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LOGICAL REASONING

OMET BASED

1 Linear Arrangement

Chapter

Learning Objectives

In this chapter, we will :

- Understand how to interpret the information/statements given in the question and get a final arrangement out of it
- Learn to make arrangement of people/objects in horizontal rows
- Gain an understanding of arrangement of people/objects in vertical columns
- Grasp the concept of arrangement of people in rows and columns
- Learn to make linear arrangement with a distribution of multiple parameters
- Acquire knowledge of linear arrangement with people facing different directions

Linear Sequencing

LineAr seqUencinG is essentially arranging the items in a sequence (in a single line). questions of this type are also referred to as **seating arrangement**. The word seating arrangement should not be misconstrued and it should not be treated as questions involving only people sitting as per specified conditions. essentially, these questions involve arranging subjects (people or things) according to the given conditions. The arrangement is done only on one axis, and hence, the position of the subjects assumes importance here in terms of order, like first position, second position, etc.

Let us look at the examples.

Solved Examples

Directions for questions 1.01 to 1.05: read the data given below carefully and answer the questions that follow.

seven people Paul, queen, rax, sam, Tom, Unif and Vali are sitting in a row. rax and sam sit next to each other. There are exactly four people between queen and Vali. sam sits to the immediate left of queen.

1.01: if Paul and Tom are separated by exactly two person, then who sits to the immediate right of Vali?

(A) Paul (B) Tom
(c) Unif (D) rax

1.02: if queen is not sitting at either ends of the row, then who among the following has as many persons on the left as on the right?

(A) sam (B) Unif
(c) rax (D) Vali

1.03: if queen sits at one end of the row, then who sits at the other end?

(A) Paul
(B) Tom
(c) Vali
(D) cannot be determined

1.04: if Tom sits to the right of queen, and Paul is separated from Tom by exactly three people, then who sits to the immediate right of Vali?
(A) sam (B) Paul
(c) Tom (D) Unif

1.05: in how many different ways can this seven people sit in a row?
(A) 3 (B) 2
(c) 10 (D) 12

Solutions for questions 1.01 to 1.05: Let us write down the conditions given in short form and then represent them pictorially. Also, let us treat the people sitting at left as 'left' and their right as 'right' for interpreting the conditions.

rax and sam sit next to each other ➔ rs or sr.
There are exactly 4 people between queen and Vali ➔ q — — — — V or V — — — — q.
sam sits to the immediate left of queen ➔ sq.

now let us analyse the data/conditions that we are given and then put the three conditions together. Let us number the seats from our left to right as seat 1 to seat 7.

since s is to the left of q and since r and s have to be next to each other, r can only be to the immediate left of s. Thus, r, s and q, will be in the order rsq. since there are four people between q and V, q can be placed in seats 1, 2, 6 or 7. But if q is in seat 1 or 2, then there are no seats for r and s. Hence, there are only two seats available for q. Let us fix the positions of r, s and V in each of these two positions of q and write them down. The directions left and right is as shown below.

◀L ▶r

Arrangement i:

1	2	3	4	5	6	7
	V			r	s	q

Arrangement ii:

1	2	3	4	5	6	7
V			r	s	q	

These are the only two arrangements possible for the four persons V, r, s and q. The other three persons Paul, Tom and Unif can sit in the three vacant seats in any order, as no information is given about them. now let us look at each of the questions.

1.01: Paul and Tom are separated by exactly two persons. Arrangement i is the only one possible as in Arrangement ii, Paul and Tom cannot have exactly two persons between them. so, we have the arrangement as follows: T/P, V, U, P/T, r, s, q so, Unif must be sitting to the immediate right of Vali.

1.02: if queen is not at the end, then only Arrangement ii mentioned above is possible. The person who has as many people seated on the left as on the right can only be the person who is sitting in the middle seat, i.e., seat 4. in this arrangement, rax is sitting in seat 4.

1.03: 'queen sits at one end' means that we should look at Arrangement i. in this arrangement, any one out of the three person Paul, Tom and Unif can be in seat 1.

1.04: if Tom and Paul are separated by exactly three people, then only Arrangement ii is possible. so, Tom and Paul have to be in seats 3 and 7. since, it is also given that Tom is to the right of queen. Tom has to be in seat 7 and Paul in seat 3. so, the arrangement must be as follows: V, U, P, r, s, q, T
The person sitting to the immediate right of Vali is Unif.

1.05: We have two possible arrangements, such as 'Arrangement i and Arrangement ii' that we have already looked at. in each arrangement, the remaining three people can sit in the remaining three seats in 6 ways. Thus, a total of 12 ways of seating the seven people is possible.

Directions for questions 1.06 to 1.10: These questions are based on the following information.

A group of eight people, namely G, H, i, J, K, L, M, and n are sitting in a row but not necessarily in the same order. some of them are facing south and the remaining are facing north. no two person is sitting adjacent to each other facing south.

- J sits two places away from H and they both face different directions.
- M sits second to the right of G.
- The number of people to the right of M is one less than the number of people to the right of K.
- K sits to the immediate right of H, who faces the same direction as i face.

- I sits to the immediate left of N and one of them sits at an end.
- G sits to the left of N, who sits to the left of L.
- K and L face the same direction which is different from the direction which M faces.

1.06: Who sits second to the right of J?
(A) K (B) M
(c) L (D) n

1.07: Three of the following are alike in a certain way, and hence form a group. Which is the one that does not belong to that group?
(A) JH (B) iH
(c) MG (D) MK

1.08: Which of the following is/are definitely true?
(A) M and G face different directions.
(B) K sits three places away from J.
(c) Two people sit between L and H.
(D) Both (A) and (B).

1.09: Who sits to the immediate right of G?
(A) K (B) L
(c) H (D) J

1.10: How many people are facing north?
(A) Five
(B) Three
(c) Two
(D) cannot be determined

Solutions for questions 1.06 to 1.10: it is given that M sits second to the right of G, who sits to the left of n. Thus, if n sits at the right end, n must face north, since i sits to the immediate left of n. As J sits two places away from H and they both face different directions and K sits to the immediate right of H, J must be sitting at the third place from the left end and H sits two places away from i. it is given that H and i face the same direction. For the above conditions to satisfy, i must face north. Thus, H also faces north and K sits adjacent to i. since H and J face different directions, J faces south. Thus, the neighbours of J must face north as no two people sitting adjacent to each other face south. it is also given that M sits second to the right of G and the number of people to the right of M is one less than the number of people to the right of K. Hence, M must be sitting to the immediate left of J and G to the immediate right of J. As K and L face the same direction which is different from the direction in which M faces, K and L must face south as M faces north and L sits at the left end. Hence, the possible final seating arrangements are as below.

L↓ G↑ J↓ M↑ H↑ K↓ i↑ n↑

or

↓n ↓i ↑K ↓H ↓M ↑J ↓G ↑L

1.06: L sits second to the right of J.

1.07: except MK, in all other options the second person sits second to the left of the first person.

1.08: K sits three places away from J.

1.09: J sits to the immediate right of G.

1.10: since there are two arrangements, we cannot determine

EXERCISE-1

Directions for questions 1 to 9: select the correct alternative from the given choices.

1. Five people L, M, n, O and P sit in a row, not necessarily in the same order. P sits exactly in between M and n. if L sits exactly in between M and O, then which of the following must be true?
(A) O sits to the immediate right of M.
(B) L and n always sit together.
(c) M sits exactly at the centre of the row.
(D) P sits between M and L.

2. six people, namely Tanmay, sanjay, Ganpat, Dhruv, nagraj and Jivan are standing in a queue at a railway ticket counter. Further it is known that
(i) Ganpat is two positions ahead Jivan.
(ii) Only nagraj is ahead Tanmay.
(iii) neither sanjay nor Jivan is standing at the end of the queue.
How many people are ahead of Dhruv but behind Tanmay?
(A) Zero (B) Two
(c) Three (D) Four

3. The Principal called five people, namely srinivas, Murali, raghu, Vijay and Krishna who are working as the Director, secretary, Treasurer, Professor and student Leader of a college, not necessarily in that order. They are seated in the five seats facing the Principal.
The Treasurer sat to the immediate left of Krishna who is one seat away from the Director.
Murali is two places away from the secretary.
Vijay, who is the student Leader, is one place to the right of Murali.
What is the position of Krishna with respect to the Professor?
(A) To the immediate right.
(B) Three places away to the left.
(c) Two places away to the left.
(D) none of the above

4. seven men, A, B, c, D, e, F and G have parked their cars in a row. The cars of e and F should be next to each other. The cars of D and G should be parked next to each other. Whereas A and B cannot park their cars next to each other. But B and D must park their cars next to each other and c's car is parked to the immediate right of G's car. if e parks his car to the left of F, then which of the following statements is false?
(A) There are two cars in between B and G's cars.
(B) B and c's cars are not parked together.
(c) G's car is the only car in between D and c's cars.
(D) A's car is at the left extreme end.

5. Five people A, B, c, D and e are sitting in a row facing the same direction. A is two places away to the right of B. c is two places away to the left of D. e is not sitting at the extreme right. Who is sitting in the middle of the row?
(A) A (B) B
(c) c (D) cannot be determined

6. Five people A through e are sitting in a row facing the same direction. A is three places away to the right of c. Two people are sitting between. B and D. who is sitting in the middle of the row?
(A) A (B) c
(c) e (D) D

7. A group of five people, namely Arnab, Ankur, Adi, Anush and Asraf are sitting in a row facing the same direction. There are at least two people sitting between Arnab and Asraf. There is at most one person sitting between Ankur and Anush. if Anush is sitting to the immediate right of Adi, who is adjacent to Arnab, then which of the following is true?
(A) Arnab is sitting at the extreme right.
(B) Asraf and Anush are adjacent to each other.
(c) Asraf is sitting between Anush and Arnab.
(D) Asraf and Ankur are adjacent to each other.

8. There are seven people, named M, n, O, P, q, r and s sitting in a row, facing the same direction.
M is five places to the right of O.
P is four places to the right of q.
r is three places to the right of s.
Who is sitting in the middle of the row?
(A) P (B) n
(c) s (D) r

9. A group of six people, namely Alpana, Brahma, chetana, Drona, ena and Fanna are sitting in a row. Alpana and Fanna are sitting adjacent to each other. chetana is two places to the right of ena and neither of them is sitting at the extreme ends. There is one person sitting between Alpana and Brahma. Who is sitting to the immediate right of ena?
(A) Alpana (B) Fanna
(c) Drona (D) Brahma

Directions for questions 10 to 12: These questions are based on the following information.

A group of five people, namely Amit, Balram, chetan, Deepak and eswar are sitting in a row facing north. The following information is known about them.

(i) Only Deepak is sitting between Amit and Balram.
(ii) neither Amit nor Balram is at the ends.
(iii) chetan is sitting to the immediate left of Balram.

10. Who is sitting at the right end of the row?
(A) Amit (B) Balaram
(c) chetan (D) eswar

11. How many people are sitting between Amit and chetan ?
(A) Zero (B) One
(c) Two (D) Three

12. What is the position of eswar with respect to Balram?
(A) immediate right (B) second to the left
(c) Third to the right (D) immediate left

Directions for questions 13 to 15: These questions are based on the following information.

six people, namely P, q, r, s, T and U are sitting in a row facing north. Further it is known that:
(i) exactly two people are sitting between P and q.
(ii) exactly one person is sitting between T and U.
(iii) q is sitting at the right end of the row.

13. if U is sitting adjacent to s, then how many people are sitting between U and r?
(A) One (B) Two
(c) Three (D) cannot be determined

14. if s is sitting to the immediate right of T, then who is sitting second to the right of r?
(A) P (B) T
(c) U (D) s

15. Who among the following cannot be adjacent to T?
(A) P (B) r
(c) s (D) none of these

Directions for questions 16 to 18: These questions are based on the following information.

eight books on different subjects, such as Biology, chemistry, Physics, Maths, english, Hindi, Zoology, and economics are stacked together. Further it is known that:
(i) economics is above Biology which is just above Hindi, which is not at the bottom.
(ii) There are only two books between the Zoology and the english books.
(iii) number of books above chemistry is less than the number of books below it.
(iv) Only Maths book is above Zoology.

16. Which book is at the bottom of the stack?
(A) Physics (B) Hindi
(c) english (D) economics

17. How many books are there between economics and Hindi?
(A) Three (B) Two
(c) Four (D) cannot be determined

18. Find the pair that does not exhibit a similar relationship as the other three pairs.
(A) Biology – Hindi
(B) economics – chemistry
(c) english – Hindi
(D) Maths – Zoology

Directions for questions 19 to 21: These questions are based on the following information.

six buildings of different colours red, yellow, white, blue, green and orange are in a row. each of these buildings belongs to a different person among Dubey, sharma, roy, sanyal, Tiwari and reddy. Following is the information known about them.
(i) Green building is three places to the right of Dubey's building.
(ii) red building is three places to the right of sharma's building.
(iii) White building is three places to the right of reddy's building.
(iv) roy's building is adjacent to the orange building.
(v) sanyal's building is not green. sharma's building is not blue.
(vi) Tiwari's building is not adjacent to roy's building but three places away from reddy's building.

19. What is the colour of Dubey's building?
(A) Blue (B) Yellow
(c) Green (D) red

20. The red building belongs to
(A) roy (B) sanyal
(c) Tiwari (D) Dubey

21. Which of the following is true?
(A) There is at least one building between the orange and green coloured building.
(B) reddy's building is to the left of sharma's building.
(c) reddy's and sharma's buildings are not adjacent
(D) sanyals' building is to the right of sharma's building.

Directions for questions 22 and 23: These questions are based on the following information.

in a school there are five classes (class i to class V) and each class has two sections A and B. each section is accommodated in a different classroom. The class rooms are in a row.
(i) The two sections, A and B of any class are not adjacent to each other.
(ii) Any four consecutive classrooms, accommodate two A sections and two B sections.
(iii) class V A is three places away from class i A and neither of these two is at any of the extreme ends.
(iv) class iii B is three places away from class iV B and neither of these is at any of the extreme ends.

(v) class ii B is not at any of the extreme ends.
(vi) class ii A is at the extreme right.
(vii) class V A is to the right of class iii B.

22. Which class is at the extreme left?
(A) i (B) V
(c) iii (D) cannot be determined

23. Which class is to the immediate right of class iii B?
(A) i A (B) ii B
(c) V A (D) i B

Directions for questions 24 to 27: These questions are based on the following information.

seven friends P, q, r, s, T, U and V sit on a bench facing north. each of them is of a different weight (in kg), their random bodily weights are 79, 83, 85, 87, 89, 92 and 96. The following information is known about them.

P sits third to the right of the heaviest person. The heaviest person sits exactly between r and the lightest person, who sits at an end. The third lightest person sits adjacent to r and that person is neither P nor adjacent to P. q sits third to the left of the person whose weight is the next higher to r. r's weight is neither 83 kg nor 87 kg. P's weight is neither 92 kg nor 79 kg. T's weight is 83 kg. s is heavier than V but is not the heaviest.

24. Who is the third lightest?
(A) P (B) q
(c) r (D) s

25. How many people sit between r and U?
(A) One (B) Two
(c) Three (D) Five

26. Who sits second to the right of the heaviest person?
(A) P
(B) s
(c) The person whose weight is 89 kg
(D) The person whose is weight is 87 kg

27. How many persons are lighter than s?
(A) Four (B) Five
(c) Three (D) Two

Directions for questions 28 to 30: These questions are based on the following information.

in a conference, five delegates A, B, c, D and e who are from different countries hailing from india, Pakistan, sri Lanka, Bangladesh and nepal are sitting in a row facing north.

(i) The delegate from Bangladesh is to the immediate left of the delegate from sri Lanka.
(ii) A is the only person sitting between c and D. D is to the immediate right of e.
(iii) B, the delegate from Pakistan is sitting at one of the extreme ends.
(iv) The delegate from nepal is sitting at the middle of the row.

28. in B is not adjacent to e, then who is the delegate from nepal?
(A) D (B) c
(c) A (D) B

29. if D is not the delegate from sri Lanka, then who is sitting at the extreme left end of the row?
(A) The delegate from sri Lanka.
(B) The delegate from Pakistan.
(c) The delegate from Bangladesh.
(D) cannot be determined

30. Which of the following is false?
(A) A is the delegate from Bangladesh.
(B) e is sitting at the extreme left end.
(c) c is the delegate from nepal.
(D) none of these

Directions for questions 31 to 33: These questions are based on the following information.

seven people, namely Akhil, Bhavya, chaitra, Dinker, eashan, Fallon and Geet are sitting in a row. The total number of people in the row is 28.

(i) Akhil is the eighth person from the left end.
(ii) Among the seven people Geet is in the right most position.
(iii) eashan and Dinker are adjacent to each other. except these two person no two among the given seven people are adjacent to each other.
(iv) There are thirteen people between Geet and Akhil.
(v) There are two people between Akhil and chaitra.
(vi) Dinker and eashan are sitting to the right of chaitra and left of Fallon.
(vii) There are four people between Fallon and Geet.

31. if fourteenth position from the left is Bhavya, then at the most, how many people are there between Dinker and chaitra?
(A) Five (B) seven
(c) six (D) Four

32. if chaitra and Fallon interchange their positions, then how many people are there between chaitra and Akhil?
(A) eight (B) Ten
(c) nine (D) cannot be determined

33. if the people in the6th, 10th and 16th positions from the left leave the row, then how many people are there between chaitra and Fallon?
(A) Five (B) nine
(c) six (D) cannot be determined

Directions for questions 34 to 36: These questions are based on the following information.

eight people, namely A, B, c, D, e, F, G, and H are sitting in a row facing north. There are exactly two people sitting between D and e. A is sitting third from the left end. B, A,

c and G are sitting in that order from left to right but no two of them are in adjacent positions. D, F and H are sitting from left to right in that order, but not necessarily in adjacent positions.

34. if H and D interchange their positions and then D and e interchange their positions, who sits second to the right of A?
(A) H (B) D
(c) e (D) cannot be determined

35. How many people sit between B and c?
(A) Three (B) Four
(c) Five (D) cannot be determined

36. Which of the following pair of people sits at the ends?
(A) B, H (B) G, D
(c) B, G (D) H, D

Directions for questions 37 to 40: These questions are based on the following information.

There are six floors in an apartment (The ground floor is named as the first floor, the floor above the ground floor is named as the second floor and so on). There are 12 rooms from A through L. each floor contains two rooms, which are adjacent to each other. These 12 rooms have two columns, with six rooms in each column.

(i) There are three floors between rooms H and G. G does not live on the top floor.
(ii) The rooms H and e are in the same floor.
(iii) rooms B and e are in consecutive floors.
(iv) room c is on the sixth floor and room D is on the first floor.
(v) The number of floors between room A and room c is equal to the number of floors between room G and room K.
(vi) room F is above room G and in the same column.
(vii) room A is in the odd numbered floor. room i is above room L and below room F.
(viii) room L is above room D in the same column and below room i in the same column.

37. Which of the following rooms are on the second floor?
(A) L, A (B) B, J
(c) L, J (D) cannot be determined

38. How many floors are there between rooms H and J?
(A) One (B) Two
(c) Three (D) cannot be determined

39. The room which is right above room J is
(A) i (B) A
(c) L (D) cannot be determined

40. Which room is exactly between rooms i and D in the same column?
(A) L (B) J
(c) G (D) cannot be determined

Exercise-2

Directions for questions 1 to 3: These questions are based on the following information.

seven flags of different colours, such as Violet, indigo, Blue, Green, Yellow, Orange and red are placed in a row from left to right, not necessarily in that order. The indigo flag and the Yellow flag have four flags between them. The Orange flag is not between the indigo flag and the Yellow flag. The Violet flag and the red flag cannot be next to the Blue flag.

1. What is the total number of possible arrangements?
(A) 12 (B) 8
(c) 4 (D) none of these

2. if the Black flag and the White flag are also to be placed in the row, such that they are adjacent to each other but neither of them is next to the Violet flag or the red flag, and also neither of them is at any of the ends, then what is the total number of possible arrangements?
(A) 24 (B) 48
(c) 96 (D) none of these

3. Which of the following statements is true?
(A) Yellow flag is at one of the ends.
(B) The indigo flag and the Orange flag are adjacent to each other.
(c) The Blue flag is adjacent to the Green flag.
(D) The Yellow flag or the indigo flag is/are adjacent to both the Orange flag and the Blue flag.

Directions for questions 4 to 6: These questions are based on the following information.

A group of seven people, namely A, B, c, D, e, F, and G are standing in a queue in front of a ticket counter. The following information is known about them.

(i) The number of people standing in front of A is same as the number of people standing behind c.
(ii) The number of people standing in front of G is same as the number of people standing behind D.
(iii) Three people are standing between B and F.
(iv) B is standing behind A, but ahead of e.

4. Who is standing in the middle of the queue?
(A) A (B) e
(c) B (D) F

5. Who is standing at the front end of the queue?
(A) A (B) B
(c) c (D) D

6. Who is standing at the rear end of the queue?
(A) B (B) F
(c) D (D) c

Directions for questions 7 to 10: These questions are based on the following information.

A group of seven friends, namely Bipul, Lalita, Mihir, naina, Deepa, sushmita and Pradeep were sitting in a row in that order facing same direction. They rearrange themselves in another order, such that in the new arrangement,

(i) For any one of them neither of the neighbours is same as in the previous arrangement.
(ii) Only Mihir and Deepa remain at their previous positions.
(iii) sushmita and Lalita do not sit adjacent to each other in the new arrangement.

7. How many people are sitting between Bipul and Pradeep?
(A) 0 (B) 1
(c) 2 (D) 3

8. The number of people sitting between sushmita and Lalita is
(A) 1 (B) 2
(c) 3 (D) 4

9. Who among the following are adjacent to each other?
(A) Pradeep and Laltia
(B) Bipul and Deepa
(c) Deepa and Pradeep
(D) sushmita and Mihir

10. Who is sitting at the right end of the row?
(A) naina (B) Lalita
(c) sushmita (D) cannot be determined

Directions for questions 11 to 13: These questions are based on the following information.

A group of seven people, namely Amol, Bimal, Komal, Tamal, Kajol, Gopal and Mrinal were standing in a queue, not necessarily in the same order.

(i) Gopal is standing in front of only one person, i.e., Mrinal.
(ii) Kajol is the only person standing infront of Tamal.
(iii) Komal is standing immediately in front of Bimal.

11. if Tamal and Komal are adjacent to each other, then what is the position of Amol in the queue?
(A) Fourth (B) Fifth
(c) Third (D) sixth

12. Who is/are definitely standing between Bimal and Tamal?
(A) Komal (B) Gopal and Amol
(c) Komal and Amol (D) Amol

13. Who is standing immediately behind Amol?
(A) Gopal (B) Bimal
(c) Komal (D) cannot be determined

Directions for questions 14 to 16: These questions are based on the following information.

A group of nine people, namely A, B, c, D, e, F, G, H and i are seated in a row, not necessarily in the same order. Following is some information regarding the seating arrangement.

(i) A is seated as many places to the left of c as D is seated to the right of B.
(ii) The only person seated between F and H is seated two places to the left of i.
(iii) neither c nor D is seated at any of the ends.
(iv) G, who is not seated at any of the ends is seated to the right of e.
(v) e and F are seated together.

14. in how many ways can these nine people be seated?
(A) Two (B) Four
(c) One (D) Three

15. Which of the following is definitely true?
(A) D and e are seated together.
(B) c is seated to the left of D.
(c) F and G are seated together.
(D) A and B are seated together.

16. Which one of the following may be a valid representation of the seating positions of the person?

(a)	B	A	D	c	e	F	G	H	i
(b)	B	D	A	c	e	F	G	H	i
(c)	A	B	c	D	e	F	G	H	i
(d)	A	c	B	D	e	F	G	H	i

(A) (a), (b), (c) and (d)
(B) (a) and (d) only
(c) (b) and (c) only
(D) (a), (b) and (d) only

Directions for questions 17 to 19: These questions are based on the following information.

A group of nine people from A to i are standing in a row. each of e and G is next to exactly one person. There are two people between c and A. F is between i and B. B is to the immediate right of e and c is to the immediate left of G.

17. Which of the following additional statements is sufficient to determine the order of the person standing in the row from left to right?
(A) i is to the immediate left of A and c is to the immediate right of H.
(B) A is to the left of D and H.

(c) There are two persons between F and D.
(D) c is sitting to the left of G.

18. if i is to the immediate right of A, then who is to the immediate left of c?
(A) D (B) F
(c) H (D) either D or H

19. How many arrangements are possible, given that, F is to the immediate right of B?
(A) Three (B) Four
(c) six (D) eight

Directions for questions 20 to 23: These questions are based on the following information.

A group of eight people from A through H sit on a bench in a multiplex and each of them has to go to a different screen among i to Viii, but not necessarily in the same order.

A sits second to the right of c, neither of them will be going to screen Viii and one of them is at an end. The person who will be going to screen Vii is adjacent to c, but not to A. c will be not going to screen iV. B will be going to screen iii and is to the immediate right of e. e is three places away from the person, who will be going to screen ii and is second to the left of the person, who will be going to screen V. D will be going to screen ii, but is not adjacent to F, who is two places away from H. H sits second to the left of the person who is going to screen i.

20. Who sits to the immediate right of D?
(A) H
(B) The person who will be going to screen V.
(c) The person who will be going to screen Vi.
(D) G

21. Who is going to screen Vi?
(A) A (B) c
(c) e (D) F

22. Who sits second from the right end?
(A) B
(B) F
(c) The person who sits to the immediate right of A
(D) The person who will be going to screen Viii

23. Three of the following four are alike in a certain way based on the given information and so form a group. Find the one which does not belong to that group.
(A) e, G
(B) H, the person who will be going to screen V
(c) The person who will be going to screen i, H
(D) F, D

Directions for questions 24 to 27: These questions are based on the following information.

Ten cars were parked in a parking lot which are of different colours among red, Black, Green, White, Yellow, Pink, Blue, Gray, Violet and Orange, but not necessarily in the same order. These ten cars were parked in two rows in such a way that five cars in each row and each car from one row is exactly opposite a car from the other row. The cars were numbered from 1 to 10 and parked in such a way that odd numbered car is not opposite another odd numbered car and no two even numbered cars are adjacent to each other. Further information related to positions of the cars is given below.

The right and left are to be considered as if the driver is sitting in the car and these directions are as per the driver's left and right.

(i) Pink coloured car is numbered eight which is not in the same row as that of the cars numbered four or six.
(ii) White and yellow coloured cars are adjacent to the car numbered six, but white car is not at an end.
(iii) Blue coloured car is numbered 5 which is not in the same row as that of the cars numbered 3 or 6.
(iv) red coloured car is neither adjacent nor opposite to Blue or Green coloured car.
(v) Pink coloured car is at the right end of the row.
(vi) The car numbered 6 is second from the right in its row.
(vii) Black coloured car is even numbered and is opposite to the car numbered 1.
(viii) Violet and Orange coloured cars are parked in the same row. The car numbered 6 is not to the left of car numbered 7.
(ix) Green coloured car is odd numbered but not 1 and is in the same row with Blue coloured car.
(x) Yellow coloured car is opposite to car numbered 2 and is numbered neither 3 nor 1.

24. Which of the following is the correct combination of cars parked in a row?
(A) 2, 3, 8, 9, 10 (B) 1, 3, 4, 6, 9
(c) 5, 7, 8, 2, 9 (D) 4, 1, 9, 7, 10

25. if Green coloured car is adjacent to Gray coloured car, then which numbered car is opposite to car number 4?
(A) 5
(B) 7
(c) 1
(D) cannot be determined

26. Which pair of cars is adjacent to Black coloured car?
(A) Pink, Black (B) Black, Gray
(c) Blue, Gray (D) Blue, Green

27. Which pair cars is parked at the middle?
(A) car numbered 10, Orange coloured car.
(B) car numbered 1, Black coloured car.
(c) car numbered 9, White coloured car.
(D) cannot be determined

Directions for questions 28 to 30: Answer these questions based on the information given below.

eight houses of eight different colours, such as red, yellow, green, blue, violet, pink, brown and white are on two sides of a road. There are four houses on each side of the road and each house is facing another house on the other side of the road. Further the following information is known about the houses.

(i) The pink coloured house is diagonally opposite to the brown coloured house.
(ii) The red coloured house is opposite to the yellow coloured house and is on the same side as the green coloured house.
(iii) The violet coloured house is opposite to the white coloured house but is not on the same side as the blue coloured house.
(iv) The blue and brown coloured houses are on the same side of the road.

28. What is the colour of the second pair of diagonally opposite houses?
(A) Yellow and green (B) Blue and red
(c) Blue and green (D) red and white

29. Which of the following mentions the colours of two houses, which are on the same side of the road?
(A) Violet and yellow (B) red and brown
(c) Brown and violet (D) Pink and green

30. How many houses are there in between the blue and brown coloured houses?
(A) none (B) One
(c) Two (D) cannot be determined

Directions for questions 31 to 34: These questions are based on the given information.

A group of eight people, namley K, L, M, n, O, P, q and r are sitting in a row (not necessarily in the same order).

Four of them are facing north and the remaining four are facing south. They belong to different professions, such as Professor, scientist, Musician, Beautician, Teacher, Lawyer, Architect and Principal.

(i) P faces north and sits at the right end.
(ii) either the Lawyer or Principal (but not both) is adjacent to Musician whose neighbours face south.
(iii) M is a Professor and sits adjacent to the scientist. Beautician sits three places away to the right of the Lawyer.
(iv) n, the Principal, sits second to the right of O.
(v) Musician faces the same direction as P and sits second to the left of P.
(vi) r is the scientist who is to the immediate left of the Architect and faces south.
(vii) K is neither a Principal nor a Lawyer. L and scientist are neighbours of the Architect.
(viii) q, the Musician, sits three places away from the Architect and is to the immediate right of K.

31. Who sits second to the left of n?
(A) The Architect (B) The Teacher
(c) O (D) K

32. Who are the neighbours of the Lawyer?
(A) n and Architect (B) O and scientist
(c) O and Principal (D) Both (A) and (c)

33. Which among the following statements is true?
(A) Teacher sits at the left end.
(B) L is a not a Beautician.
(c) O is an Architect.
(D) Both (B) and (c)

34. Three of the following are alike in a certain way, and hence form a group. Which is the one that does not belong to that group?
(A) O – Architect (B) P – Beautician
(c) n – Principal (D) r – scientist

Directions for questions 35 to 38: These questions are based on the following information.

Four boys K, L, M, and n sit in row i facing north and they are from different professions, such as engineer, Doctor, Professor and Actor. Four girls P, q, r, and s sit in row ii facing south and they are of different professions, such as Lawyer, Teacher, Director and collector. They sit in such a way that the distance between any two adjacent persons in a row is the same such that one person in one row faces the other person in the other row, but not necessarily in the same order

collector sits opposite to the person who sits third to the right of n. Doctor and Teacher sit opposite to each other. engineer sits opposite to the person who sits third to the left of r. Only one person sits between K and L. r sits second to the right of s, the Director. P does not sit opposite to engineer and K is neither an engineer nor a Doctor. Lawyer does not sit opposite to Actor.

35. Who is the Doctor?
(A) K (B) M
(c) L (D) n

36. Who sits opposite to the Director?
(A) Actor (B) Professor
(c) L (D) K

37. Which of the following 'person–profession' combination is correct?
(A) P – Director (B) s – collector
(c) M – Actor (D) n – engineer

38. What is the position of P with respect to r?
(A) immediate right
(B) immediate left
(c) second to the right
(D) second to the left

Exercise-3

Directions for questions 1 and 2: These questions are based on the following information.

Aksha, Bindu, chandana, Deeksha, Harsha and Lasya have different number of years of work experience. They worked between the years 1988 to 2000. each person has at least one-year experience. The following information is known about them.

(i) Harsha started working in 1988 and has 8 years of experience.
(ii) Aksha started working in 1991 and has 6 years of experience.
(iii) Bindu has 7 or 6 years of experience and her experience is overlapped with Harsha.
(iv) chandana started working in 1988 and stopped in the same year when Deeksha started working.
(v) Lasya started working in 1989 and has 1 year more experience than chandana.
(vi) no two persons stopped working in the same year.
(vii) Deeksha has one year less experience than chandana.

1. How many pairs of persons stopped working in the consecutive years?
(A) 5 (B) 4
(c) 3 (D) 6

2. How many years are there in which more than three persons started working?
(A) 1 (B) 2
(c) 3 (D) none of these

Directions for questions 3 to 5: These questions are based on the following information.

A group of seven friends, namely Asha, Lata, Mahesh, Madhu, Mahima, sandhya and Kavita are sitting in a row facing north. Lata is two places away to the left of sandhya. Mahima has Kavita to her left and Madhu to her right. Asha is sitting to the immediate left of Madhu but not to the immediate right of Mahima. Mahesh is not sitting adjacent to Kavita.

3. if Madhu is not sitting at any of the ends, then how many people are sitting between Mahesh and Mahima?
(A) 0 (B) 1
(c) 2 (D) 3

4. Who among the following can be the one sitting to the left of Lata?
(A) Kavita (B) Madhu
(c) Asha (D) Mahesh

5. if sandhya is sitting at the middle of the row, then who is sitting at the left end?
(A) Lata (B) Mahesh
(c) Kavita (D) Madhu

Directions for questions 6 to 8: These questions are based on the information given below.

A group of four friends, namely Aravind, Bharat, chandrapaul and Daniel went for an excursion with their wives Preeti, revati, sravani and Vanita, not necessarily in the same order. each couple hails from a different city, they are from Mumbai, chennai, Kolkata and Hyderabad, not necessarily in that order. They went to Agra to visit the Taj Mahal, where they sat in a row. each wife always sat to the immediate right of her husband.

(i) Bharat sat to the immediate right of Preeti.
(ii) Daniel is from Hyderabad and Preeti is not from Mumbai.
(iii) revati and her husband were sitting to the immediate right of the couple that hailed from chennai.
(iv) chandrapaul and his wife were sitting to the immediate left of the couple from Kolkata and chandrapaul was sitting to the immediate right of sravani.
(v) Aravind sat to the immediate right of revati, who is not from Mumbai.

6. Who is Daniel's wife?
(A) sravani (B) Preeti
(c) Vanita (D) revati

7. Which couple is from chennai?
(A) Vanita and Bharat
(B) Daniel and revati
(c) chandrapaul and Preeti
(D) Aravind and sravani

8. Which husband from the pair of couples was seated second in the row from left to right?
(A) Aravind (B) Bharat
(c) chandrapaul (D) Daniel

Directions for questions 9 to 11: These questions are based on the following information.

A group of seven people, namely A, B, c, D, e, F and G wearing seven different coloured shirts, such as red, Blue, Green, Yellow, Pink, White and Violet are sitting in a row not necessarily in the same order facing north. We know the following additional information.

(1) D is sitting as many places away to the right of the person wearing red coloured shirt as the person wearing white coloured shirt is sitting to the left of A.
(2) The person wearing pink coloured shirt is four places away to the right of G.
(3) The number of people to the left of c is same as the number of people to the right of the person wearing white coloured shirt.

(4) The person wearing blue coloured shirt is four places away to the left of the person wearing green coloured shirt.
(5) The people wearing violet coloured shirt and yellow coloured shirt are sitting at the second and seventh positions from the extreme left, respectively.
(6) F is sitting to the immediate left of e, who is adjacent to c.

9. Who is wearing green coloured shirt?
(A) A (B) c
(c) B (D) D

10. Who is wearing pink coloured shirt?
(A) B (B) F
(c) e (D) A

11. Who is sitting at the extreme right?
(A) D (B) A
(c) c (D) B

Directions for questions 12 to 14: read the information given below and then answer the questions that follow.

seven boxes of different colours, such as White, indigo, Blue, red, Yellow, Green and Violet have to be arranged in a row on a shelf in such a way that the Blue box and the indigo box have only four boxes in between them, whereas the White box is not in between the Blue and the indigo boxes and the Yellow box is to the immediate left of the indigo box.

12. if the White and the red boxes have two boxes between them, then which of these would be exactly in the middle of the row of boxes?
(A) Yellow box (B) red box
(c) Violet box (D) Green box

13. if the green box is placed to the immediate left of the violet box and next to the blue box, wherein the white box is to extreme left, then which of the following boxes will be the fourth from the right end?
(A) red box (B) Yellow box
(c) Green box (D) Violet box

14. Which of the following statements is definitely false?
(A) The violet box is exactly in the middle of the row.
(B) The white box is not at any of the extreme ends.
(c) The yellow box is in the third place from the right end.
(D) each of the white and the indigo boxes are at the extreme ends.

Directions for questions 15 to 17: read the data given below and then answer the questions that follow.

M, n, O, P, q, r, s, T, U, V and W are eleven persons in a team. O is elected as their captain. O makes them sit in a row. P and r must sit together and V and W also sit together, whereas there are exactly four seats between the two pairs P, r and V, W. T and U sit together and T is to the immediate right of s, who is next to q. M and n sit in that order only at one extreme end and no one sits to the left of P.

15. Who sits exactly at the fourth place to the right of U?
(A) n (B) M
(c) q (D) P

16. How many people sit between s and n?
(A) 4 (B) 3
(c) 5 (D) 6

17. How many ways of arrangements are possible in the row with the given conditions?
(A) 2 (B) 3
(c) 4 (D) 5

Directions for questions 18 to 20: These questions are based on the following information.

seven persons A through G sit in a row, not necessarily in the same order, some face north and the remaining face south. no two adjacent persons face the same direction. The following information is known about them.

Two persons sit between D and e, and e is at one of the ends. G is two places away to the right of e. B faces the same direction as c faces and is adjacent to both D and F. G faces north.

18. What is the position of D with respect to G?
(A) immediate right (B) immediate left
(c) second to the left (D) second to the right

19. Four of the following are alike in a certain way and so form a group. Find the one which does not belong to that group.
(A) e G (B) G c
(c) F D (D) A B

20. Which of the following is/are 'definitely true'?
(A) A sits adjacent to G
(B) e and c are not at the ends
(c) B is second to the left of c
(D) More than one of the above

Directions for questions 21 and 22: These questions are based on the following information.

Ten people are sitting in two parallel rows, which have five people each, in such a way that there is an equal distance between adjacent people. in row i, A, B, c, D, e are seated (not necessarily in the same order) and all of them are facing north. in row ii, P, q, r, s, and T are seated facing south. Therefore, each member seated in row i faces exactly one member of row ii.

r and T are not sitting at any end. s is sitting opposite to the person who is not a neighbour of A or c. c is not sitting opposite to s. neither B nor e is sitting opposite to T. Only one person is sitting between c and A. But neither of them is

sitting at the left end. T is not a neighbour of s or r. e is not sitting opposite to s. A is not sitting opposite to the person who is sitting at the left end. At least one person sits to the left of q.

21. Who is sitting opposite to the person who is not a neighbour of either s or q?

(A) D (B) c
(c) e (D) A

22. if r and T interchange their positions, then who among the following will sit opposite to T?

(A) e (B) A
(c) B (D) D

Directions for questions 23 to 25: These questions are based on the following information:

A group of eight people K, L, M, n, O, P, q and r are sitting in two rows facing each other, i.e., four people in each row not necessarily in the same order. They hail from various professions, such as Principal, Beautician, Doctor and Teacher, and they are facing south. Whereas, the other group of professionals, such as Architect, Politician, singer and scientist are facing north.

(i) The doctor is sitting opposite to the person, who is to the immediate right of q, the politician.
(ii) neither M nor O is a teacher.
(iii) either r or K is the doctor.
(iv) The teacher and the scientist are sitting opposite to each other at an end.
(v) neither q nor O sits at an end.
(vi) The politician and the architect are adjacent to each other.
(vii) L is the singer and is sitting to the immediate left of P, who is a scientist.
(viii) K is the principal and he is sitting opposite to the architect.

23. Who among the following is the teacher?

(A) n (B) O
(c) r (D) K

24. Which of the following statements is definitely true?

(A) P is the scientist and sitting at left extreme.
(B) r is the doctor and sitting opposite the singer.
(c) n is the teacher and sitting to the immediate left of r.
(D) More than one of the above.

25. if q interchanges his place with K, then who sits to the immediate left of q?

(A) Architect (B) singer
(c) Principal (D) Beautician

ANSWER KEYS

Exercise-1

1. (c)	8. (B)	15. (D)	22. (D)	29. (B)	36. (c)
2. (c)	9. (D)	16. (A)	23. (c)	30. (c)	37. (c)
3. (c)	10. (D)	17. (D)	24. (B)	31. (c)	38. (B)
4. (A)	11. (c)	18. (c)	25. (A)	32. (A)	39. (B)
5. (D)	12. (c)	19. (A)	26. (c)	33. (D)	40. (A)
6. (c)	13. (B)	20. (B)	27. (B)	34. (B)	
7. (D)	14. (A)	21. (D)	28. (c)	35. (B)	

Exercise-2

1. (D)	8. (D)	15. (c)	22. (B)	29. (D)	36. (A)
2. (D)	9. (c)	16. (A)	23. (D)	30. (c)	37. (c)
3. (c)	10. (D)	17. (A)	24. (B)	31. (D)	38. (B)
4. (B)	11. (B)	18. (D)	25. (A)	32. (D)	
5. (A)	12. (A)	19. (c)	26. (D)	33. (D)	
6. (D)	13. (D)	20. (A)	27. (B)	34. (B)	
7. (B)	14. (B)	21. (B)	28. (c)	35. (D)	

Exercise-3

1. (B)	5. (c)	9. (B)	13. (D)	17. (A)	21. (B)	24. (D)
2. (D)	6. (A)	10. (D)	14. (B)	18. (A)	22. (A)	25. (D)
3. (D)	7. (c)	11. (A)	15. (A)	19. (D)	23. (A)	
4. (A)	8. (c)	12. (B)	16. (c)	20. (D)		

SOLUTIONS

EXERCISE-1

1. Five people L, M, n, O, and P sit in a row, not necessarily in the same order.
P sits exactly between M and n which means that the following arrangements can be obtained:
M/n P M/n L/O L/O
(or)
L/O M/n P M/n L/O
(or)
L/O L/O M/n P M/n
it is also given that L sits exactly between M and O, which means that M sits at the center of the row.
n P M L O
(or)
O L M P n
'M sits exactly at the center of the row' is true.

2. From (ii), we can say that nagraj is the first person in the queue while Tanmay is the second.
now, from (i) and (iii) we can say that Ganpat is the 3rd person and Jivan is 5th.
Thus, sanjay is the 4th person and Dhruv is the last person in the queue. Hence, the queue is as follows.

nagraj
Tanmay
Ganpat
sanjay
Jivan
Dhruv

There are 3 people (Ganpat, sanjay and Jivan) ahead of Dhruv but behind Tanmay.

3. it is given that:
_____ Krishna _____
Treasurer Director
As Murali is two places away from the secretary, hence, Krishna must be the secretary, as Vijay must sit to the immediate right of Murali.
Hence, we get the following arrangement:
_____ Krishna Murali Vijay
Treasurer secretary Director Professor student Leader

4. A, B, c, D, e, F and G are seven people who parked their cars in a row. e's car and F's car should be next to each other, i.e., eF or Fe. similarly, the cars of D and G should be next to each other, i.e., DG or GD. A's car and B's car should not be next to each other, whereas the cars of B and D are parked next to each other, i.e., BD or DB. c's car is parked to the immediate right of G's, i.e., G → c. Hence, they can be parked in the following order.
(i) e F or F e
(ii) D G or G D
(iii) B D G
(iv) B D G c
As A and B are not parked together, the arrangement can be as follows.
(i) A_____B D G c
(ii) __ A__ B D G c
(iii) _____ B D G c A
(iv) __ B D G c A __
(v) __ B D G c__ A
(vi) B D G c A _____
(vii) B D G c__ A __
(viii) B D G c_____A
But as e and F must be together, the arrangement can be as follows. AFeBDGc or AeFBDGc,
FeBDGcA (or) eFBDGcA,
BDGcA (eF or Fe) or BDGc (eF or Fe) A.
if e and F park in that order only, i.e., e first and then F, then the order is eFBDGcA (or) BDGcAeF. in any case B and D have only one car between their cars. choice (A) is FALse. B and c do not park together. choice (B) is TrUe. D and c have only G's car between their cars. choice (c) is TrUe. A is at the extreme. choice (D) is partly true.

5. As A is two places to the right of B and c is two places to the left of D, the possible arrangements are as follows.
(i) B c A D __
(ii) __ B c A D
(iii) c B D A __
(iv) __ c B D A
As e is not sitting at extreme right arrangements, the options (i) and (iii) are not possible. Hence, c or B is sitting at the middle.

6. Given that, A is three places away to the right of c. The possible arrangements are as follows.
(i) c __ A __
(ii) __ c __ A
Given that, two people are sitting between B and D. By combining with the above, we get the following possible arrangements.
(i) c B/D A D/B
(ii) B/D c D/B A
in either case e is the one who is sitting in the middle of the row.

7. As Anush is to the immediate right of Adi who is adjacent to Arnab, the possibilities are as follows:
(i) Arnab Adi Anush
(ii) Arnab Adi Anush
(iii) Arnab Adi Anush
As there is at most one person between Ankur and Anush, (iii) is not possible.
in (ii), Ankur must sit at the extreme right.
∴ There cannot be at least two people between Arnab and Asraf.
∴ Only case (i) is possible.
Arnab Adi Anush Asraf/Ankur Asraf/Ankur
The only choice (D) is true.

8. From the first two statements the possibilities are as follows:
(i) O q M P
(ii) q O P M
From the third statement the possible arrangements are as follows.
(i) O s q n r M P
(ii) q O s n P r M
∴ in either case n is sitting in the middle of the row.

9. As, chetan is two places to the right of ena neither of them is sitting at the extreme ends and Alpana and Fanna are adjacent to each other, the possibilities are as follows:
(i) e c A / F A / F
(ii) A / F A/ F e c
As there is one person between Alapana and Brahma, the possibilities are as follows.
(i) D e B c A F
(ii) F A e B c D
∴in either case Brahma is sitting to the immediate right of ena.

Solutions for questions 10 to 12: From (i) and (ii), we have
A/B D B/A
From (iii), we can say that c must be at the left end of the row. Thus, we get the following arrangement.
c B D A e

10. eswar is sitting at the right end.

11. Two people are sitting between Amit and chetan.

12. eswar is third to the right of Balram.

Solutions for questions 13 to 15: From (i) and (iii), we get
P q
now, from (ii) and the above, we can say that the person sitting between T and U is P. Hence, we get 4 possible arrangements which are as follows.
r T P U s q case (a)
r U P T s q case (b)
s T P U r q -- case (c)
s U P T r q -- case (d)

13. U is adjacent to s in case (a) and (d), and in both the cases there are two people sitting between U and r.

14. s is sitting to the immediate right of T in case (b), Hence, P is sitting second to the right of r.

15. Any one of the three P, r and s, can be adjacent to T.

Solutions for questions 16 to 18: From (ii) and (iv), we can say that Maths is on the top, Zoology is 2nd from the top, and english is 5th from the top. now from (i), we can say that Hindi is 2nd from the bottom and Biology is 3rd from the bottom. now, from the above information and (iii), economics and chemistry are the 3rd and 4th from the top. Thus, Physics is the bottom one in the stack. Hence, we have the following arrangement.

Maths
Zoology
economics/chemistry
chemistry/economics
english
Biology
Hindi
Physics

16. Physics is at the bottom.

17. Position of economics book is not certain, and hence, it cannot be determined.

18. except english and Hindi all other pairs are in adjacent positions.

Solutions for questions 19 to 21:
From (i), Dubey's _____.
Green
From (ii), sharma _____.
red
From (iii), reddy _____.
White
∴ The owners of the left three buildings are Dubey, sharma and reddy and the colours of the right three buildings are green, white and red.
The colours of the left three buildings are blue, yellow and orange.
The owners of the right three buildings are roy, sanyal and Tiwari.
From (iv), roy's building is adjacent to the orange building. From the above explanation the arrangement will be as follows.
_____ _____ _____ roy _____ _____
Orange

From (vi), as Tiwari's building is three places away from reddy's building, the following arrangement is possible.

_____ _____ reddy roy sanyal Tiwari

Orange White

From (v), since sanyal's is not green, as well it is not white, it must be red.

roy's building is green.

∴ The arrangement is as follows.

Dubey	sharma	reddy	roy	sanyal	Tiwari
Blue	Yellow	Orange	Green	red	White

19. The colour of Dubey's building is blue.

20. The red building belongs to sanyal.

21. Only choice (D) is true.

Solutions for questions 22 and 23: From (ii), as any four consecutive classrooms accommodate two A sections and two B sections, the following arrangements are possible.

	1	2	3	4	5	6	7	8	9	10
Arrangement A	A	B	B	A	A	B	B	A	A	B
Arrangement B	B	A	A	B	B	A	A	B	B	A

But it is given that class ii A is at the extreme right. Hence, arrangement (a) is not possible.

From (iv): iii B/iV B iV B/iii B

But neither of iii B and iV B is at the extreme end.

∴ They have to be in positions 5 and 8 in any order.

From (vi), class ii A is in position 10.

From (v), class ii B has to be in position 4 or 9. But it is given that both sections A and B of the same are not adjacent to each other. since, ii A is in position 10, ii B cannot be in position 9.

∴ ii B is in position 4.

The arrangement obtained so far is as follows.

1	2	3	4	5	6	7	8	9	10
ii	iii/iV		iV/iii		ii				
B	A	A	B	B	A	A	B	B	A

From (vii), V A is to the right of iii B.

∴ iii B must be in position 5 and V A must be in position 6 or 7.

⇒ iV B is in position 8.

From (iii), V A is three places away from i A.

This is possible only when i A is in position 3 and V A in position 6.

The arrangement obtained so far is as follows.

1	2	3	4	5	6	7	8	9	10
i	ii	iii	V	iV	ii				
B	A	A	B	B	A	A	B	B	A

since, iV B is in position 8, iV A must be in position 2.

⇒ iii A is in position 7.

∴ i B and V B are in positions 1 and 9 in any order.

∴ The final arrangement is as follows.

1	2	3	4	5	6	7	8	9	10
i/V	iV	i	ii	iii	V	iii	iV	V/i	ii
B	A	A	B	B	A	A	B	B	A

22. i B or V B can be at the extreme left.

23. V A is to the immediate right of class iii B.

Solutions for questions 24 to 27: it is given that P sits third to the right of the person who is the heaviest. The heaviest person sits exactly between r and the lightest person, who sits at an end. P's weight is neither 92 kg nor 79 kg. Hence, the lightest person, i.e., the person who is of 79 kg should sit at the left end and r sits either third from the left end or third from the right end. Given the person whose weight is the third lowest (i.e., 85 kg) sits adjacent to r is neither P nor adjacent to P. Hence, we get the following arrangement.

__ __ __ __ r P __

79 96 85

it is given that q sits third to the left of the person whose weight is the next highest after **r**. **r**'s weight is neither 83 nor 87 and P's weight is not 92. Hence, **r**'s weight is 89, **q**'s weight is 85 and q sits to the immediate left of r. The person whose weight is 92 kg sits at the right end. As T's weight is 83 and s is heavier than V, but is not the heaviest, the final arrangement is as follows.

V	T	U	q	r	P	s
79	83	96	85	89	87	92

24. q is the third lightest.

25. Only one person.

26. The person who is 89 kg.

27. Five persons

28. Form (ii), the arrangement of A, c, D and e must be in the order of e, D, A, c …. (a)

From (iv), we get:

___ ____ ____ ___ ___

nepal

From (iii) and (a), we get the following cases.

case (i):

B e D A c

Pakistan nepal

case (ii):

e D A c B

nepal Pakistan

From (i), the final representations are as follows.

case (i):

B e D A c

Pakistan india nepal Bangladesh sri Lanka

case (ii):

e D A Bangladesh sri Lanka nepal

c B

india Pakistan

if B is not adjacent to e, then A is the delegate from nepal (case (ii)).

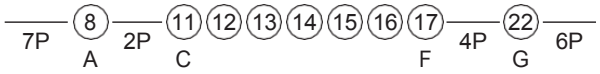
29. if D is not the delegate from sri Lanka, then the delegate from Pakistan is at the extreme left end of the row.

30. choice (c) is false.

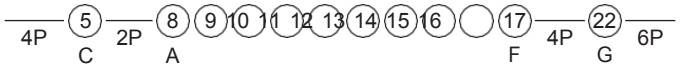
Solutions for questions 31 to 33: Let us represent the names of the seven people with their first letter.

From the given information the possible cases are,

(i)



(ii)



31. From the given information, case (i) is not possible. in case (ii), we have

∴ six people.

32. in both cases, if chaitra and Fallon interchange their positions, 8 people sit between chaitra and Akhil.

33. in case (i), there are four persons.
in case (ii), there are eight persons.

Solutions for questions 34 to 36: Given that, A is sitting third from the left end. B, A, c and G are sitting from left to right in that order but not in adjacent positions. Hence, B is sitting at the left end and the possible arrangements are as shown below.

(i) _____
(ii) _____
(iii) _____

Given that, there are exactly two people sitting between D and e. Hence, case (i) and case (ii) are eliminated, as we cannot place D and e. in case (iii), D sits to the immediate right of B and e sits to the immediate left of c.

Given that D, F and H are sitting from left to right, in that order but not necessarily in adjacent positions.

Hence, the final row arrangement is as shown below.

B D A F e c H G

34. D sits second to the right of A.

35. Four people sit between B and c.

36. B and G.

Solutions for questions 37 to 40: From (iv), (ii) and (i), we can say that rooms H and e are on the fifth floor in any order. D and G are on the first floor in any order.

From (vii), we can say that room A is on the third floor.

From (iii) and (v), we can say that B and K are on the fourth floor.

From (vi), (viii) and (ix) and above, the possible arrangements are as shown below.

Floor Number	Rooms			
	Case (i)		Case (ii)	
6	c	F	F	c
5	H/e	e/H	H/e	e/H
4	B/K	K/B	B/K	K/B
3	i	A	A	i
2	L	J	J	L
1	D	G	G	D

37. L and J are on the second floor.

38. Two floors.

39. room A.

40. room L.

EXERCISE-2

1. in each arrangement above, we get 4 possibilities. Hence, the total number of possible arrangements is 16.

2. Let us consider Black and White flags as one single unit, they are represented as X. now, X is not next to Violet or red.

(i) i/Y B G V/r r/V Y/i O
↑
X

(ii) O i/Y B G V/r r/V Y/i
↑
X

(iii) i/Y V/r r/V G B Y/i O
↑
X

(iv) O i/Y V/r r/V G B Y/i
↑
X

Hence, the total number of arrangements
= 8 × 4 = 32

3. (A) Yellow flag may or may not be at an extreme end as shown in various arrangements.
(B) similarly, as shown in the figures above, indigo and Orange flags may not be together.

(c) The Blue flag is always adjacent to the Green flag, as seen in every possible arrangement.

(D) This statement again may or may not be true, as it can be observed in the arrangements.

Solutions for questions 4 to 6: Let us indicate the positions in the queue from the front end to the rear end as follows.

1 –
2 –
3 –
4 –
5 –
6 –
7 –

From (i), the possible positions of A and c are positions (1 and 7) or (2 and 6) or (3 and 5).

From (ii), the possible positions of G and D are same as above.

From (iii), the possible positions of B and F are (1 and 5) or (2 and 6) or (3 and 7).

From the above discussion it is clear that any of A, B, c, D, F and G cannot be in position 4.

∴ e is in position 4.

if B and F are in positions 1 and 5, then A and c must be in positions 2 and 6. in such case we can find positions for G and D. similar will be the situation if B and F are in positions 3 and 7.

Hence, B and F must be in positions 2 and 6.

now, if A and c are in positions 1 and 7, then G and D must be in positions 3 and 5.

From (ii), B is standing ahead of e. since, e is in position 4, B must be in position 2. it is given that B is standing behind A. Hence, A must be in position 1.

∴ The final arrangement is as follows.

1 A
2 B
3 G/D
4 e
5 D/G
6 F
7 c

4. e is standing in the middle of the queue.

5. A is standing at the front of the queue.

6. c is the last person in the queue.

Solutions for questions 7 to 10: Let the name of any person be represented with the first letter. The initial arrangement of the persons is as given below.

B L M n D s P

From (ii), the positions of M and D remain the same as given below.

M D

since, no person retained the previous positions and neither of the neighbours of any person remain same, n has to sit at one of the ends.

if n sits at the extreme left, then L can be at any of the two right positions at the extreme right and from (iii), s must be sitting to the immediate right of n as follows:

n s M P D L B

n s M B D P L

But the first case is not possible, as Bipul and Lalita are sitting adjacent to each other. Only the second case is possible.

similarly, when n is sitting at the extreme right end, the possible arrangement is as follows:

s B M P D L n

∴The possible arrangements are:

1) s B M P D L n

2) n s M B D P L

7. There is one person between Bipul and Pradeep in both the cases.

8. Four people are sitting between sushmita and Lalitha in both the cases.

9. in both the cases Deepa and Pradeep are adjacent to each other.

10. naina or Lalita is sitting at the right end of the row.

Solutions for questions 11 to 13: From (i): Mrinal is the last person in the queue and Gopal is the last but one person in the queue.

From (ii): Kajol is the first person in the queue and Tamal is the second person in the queue.

From (iii) and the above information the possible arrangements are as follows.

Case (A)	**Case (B)**
Kajol	Kajol
Tamal	Tamal
Komal	Amol
Bimal	Komal
Amol	Bimal
Gopal	Gopal
Mrinal	Mrinal

11. The given condition is satisfied in case (a), in which Amol is the fifth person in the queue.

12. in both the cases Komal is standing between Bimal and Tamal.

13. Gopal or Komal is standing immediately behind Amol.

Solutions for questions 14 to 16:

1 2 3 4 5 6 7 8 9

(a) Position 1 ≠ c, D, G, i

Position 9 ≠ A, B, c, D, e, F, H, G

(b) F – Hi

Or

H – Fi

(c) since A, B, c, D, e, F, G, H are not seated at the extreme right ends, i must be seated there.

__	__	__	__	__	__	__	__	i

(d)

	__	__	__	__	F	__	H	i

or

__	__	__	__	__	H	__	F	i

Hence, position 1 ≠ c, D, G, H, F, e, i, L so it is either A or B.

since e and F are seated together, the following possibilities can exist.

(i)	A	c	B	D	e	F	G	H	i
(ii)	A	B	c	D	e	F	G	H	i
(iii)	B	D	A	c	e	F	G	H	i
(iv)	B	A	D	c	e	F	G	H	i

14. There are four ways.

15. choice (A): D and e are not seated together in (iii) and (iv). choice (B): c is to the right of D in (iii) and (iv). choice (c): F and G are seated together in all the cases from (i) to (iv). choice (D): A and B are not seated together in case (i) and (iii).

16. By observing the cases (i) through (iv), all the four are valid representations.

Solutions for questions 17 to 19: Both e and G are next to exactly one person.

⇒ e and G are at extreme ends of the row.

There are two persons between A and B and also between c and A.

⇒ A is at the middle place of the row.

B is to the immediate right of e.

⇒ G is at the extreme right end.

⇒ c is next to G.

1	2	3	4	5	6	7	8	9
e	B	__	__	A	__	__	c	G

F is between i and B.

⇒ F could be at 3, 4 or 6 and i could be at 4, 6 or 7.

17. From (A), we know that i is to the immediate left of A and c is to the immediate right of H, which gives us the following arrangement.

eB__ iA__ HcG

We already know that F is between i and B, which gives us the following arrangement.

eBFiADHcG

∴ choice (A) is enough to determine the order of the persons from left to right, whereas, the other choices do not lead to a fixed and definite arrangement.

18. if i is to the immediate right of A, we get the following arrangement.

eB_____Ai __ cG

1 2 3 4 5 6 7 8 9

This means that F is at either 3 or 4 which means that one of the remaining persons, i.e., D or H is at 7.

19. F is to the immediate right of B as given in the following arrangement.

e B F__ A____ c G

1 2 3 4 5 6 7 8 9

Positions 4, 6 and 7 are to be filled up by i, D and H. i can be placed at 4, 6 or 7, i.e., 3 ways. The remaining two D and H can then be placed in two ways.

∴ Total ways = 3 × 2 = 6.

Solutions for questions 20 to 23: Given, A sits second to the right of c, neither of them is going to screens Viii and one of them is at an end. The person who is going to screen Vii is adjacent to c, but not to A. c is not going to iV. Hence, A sits at the right end, c sits third from the right end and the person who is going to screen Vii sits fourth from the right end. Given, B is going to screen iii and is to the immediate right of e. e is three places away from the person, who is going to screen ii and is second to the left of the person, who is going to screen V. Hence, e sits at the left end, B sits second from the left end, the person who is going to screen V sits to the immediate right of B and the person who is going to screen ii sits second to the right of B. Given, D is going to screen ii, but is not adjacent to F, who is two places away from H. Hence, F is adjacent to c and A, H sits to the immediate left of c and G sits to the immediate left of D. Given, H sits second to the left of the person who is going to screen i. Hence, F is going to screen i, e is going to screen Viii, A is going to screen iV and c is going to screen Vi.

∴ The final arrangement is as shown below.

20. H sits to the immediate right of D.

21. c is going to screen Vi.

22. F sits second from the right end.

23. except in choice (D), in the remaining groups, there is exactly one person sitting between the first person and the second person.

Solutions for questions 24 to 27: it is given that, odd numbered cars are not opposite each other and no two even numbered cars are adjacent to each other. Hence, we can say that an odd numbered car is opposite to an even numbered car.

From (i), (ii), (v), (vi) and (x) and above, we get:

Pink	White	Yellow		
____	____	____	____	____
8	4	6	× 3, × 1	
____	____	____	____	____

From (vii), the only possibility is Black coloured car is numbered 10 and is opposite to White coloured car, which is numbered 1.

From (iii) and (ix), Blue and Green coloured cars are opposite to cars numbered 4 and 6 in any order.

From (iv), red coloured car is opposite to Pink coloured car.

From (viii), a Violet and Orange coloured cars are numbered 4 and 6 in any order.

Hence, Gray coloured car is numbered 2.

red coloured car is numbered 3.

Yellow coloured car is numbered 9 and Green coloured car is numbered 7.

The final arrangement is as shown below.

Pink	Blue/Green	Black	Green/Blue	Gray
8	5/7	10	7/5	2
red	Voilet/Orange	White	Orange/Voilet	Yellow
3	4	1	6	9

24. 1, 3, 4, 6, 9.

25. car numbered 5.

26. Blue and Green.

27. car numbered 1 and the Black coloured car.

Solutions for questions 28 to 30: From (ii), the red and yellow coloured houses are opposite to each other. The red and green coloured houses are on the same side.

From (iii), the violet and white coloured houses are opposite to each other. Blue and white colour houses are on the same side of the road.

From (i), the pink and brown coloured houses are at diagonally opposite positions, the blue, white and yellow coloured houses must be on the same side of the road.

∴ The red, green and violet are on the other side.

The red and yellow coloured houses are opposite to each other and the violet and white coloured houses are opposite to each other, the green and blue coloured houses are diagonally opposite to each other.

From (iv) we get,

blue white yellow brown/blue yellow white brown

or

pink violet red green/pink red violet green

28. The blue and green coloured houses are diagonally opposite to each other.

29. The pink and green are on the same side.

30. There are two houses between the blue and brown coloured houses.

Solutions for questions 31 to 34: it is given that, P faces the north and sits at the right end. Musician faces the same direction as P and sits second to the left of P. From (4), we come to know that q is the Musician and sits three places away from the Architect. Thus, q also faces north. From (3), (4) and (5) we come to know that, K is to the immediate right of P and he is neither the Principal nor the Lawyer. Both the neighbours of q face south.

					Qi	K	Pi
			Architect		Musician		

From (5), L and the scientist are neighbors of the Architect. suppose, scientist sits second to the left of the q, from (8), Professor sits to the immediate left of q. it is not possible because either Principal or Lawyer sits to the immediate left of q (from (3) and (5)). Hence, r who is the scientist who sits four places away from q and faces south. M is the Professor who sits to the immediate right of r, and L sits second to the left of q.

M	R			L
Professor	Scientist	Architect		
	Q	K	P	
	Musician			

From (6), n who is the Principal, sits second to the right of O. so, n sits to the immediate left of q and O is an Architect and he faces north. From (8), Beautician sits three places away to the right of the Lawyer. Thus, L is the lawyer and faces north and K is the Beautician. Hence, M has to face south and P must be the Teacher.

The final arrangement is as follows.

MJ .	RJ .	Oi	Li
Professor	Scientist	Architect	Lawyer
HJ .	Qi	KJ .	Pi
Principal	Musician	Beautician	Teacher

31. K, the Beautician, sits second to the left of n.

32. n, is the Principal and O, the Architect, are neighbours of the Lawyer.

33. L is the Lawyer and O is the Architect. Hence, both (B) and (c) are true.

34. except in option (B), in all other the options person and their profession combination is true.

Solutions for questions 35 to 38: it is given that the collector sits opposite to the person who sits third to the right of n, and the engineer sits opposite to the person who sits third to the left of r and only one person sits between K and L.

r _____ collector

n K/L M L/K engineer

r sits second to the right of s and P does not sit opposite to the engineer and s is the Director.

r P s q

n K/L M L/K

Doctor sits opposite to the Teacher and K is neither an engineer nor a Doctor. Hence, the final arrangement is as follows.

Teacher Lawyer Director collector

r P s q

K M L

Doctor Professor Actor engineer

35. n is the Doctor.

36. Actor sits opposite to the Director.

37. 'M – Actor' combination is true.

38. P sits to the immediate left of r.

EXERCISE-3

Solutions for questions 1 and 2: From (i), we can say that Harsha stopped working in the year 1996.

From (ii), we can say that Aksha stopped working in the year 1997.

From (ii) and (iii), we can say that Bindu has 7 years of experience. since each person has different number of years of experience and Bindu started working in 1988 and stopped in 1995. From (iv) and (v), we can say that, chandana and Lasya stopped working in the years 1989 and 1991 or 1990 and 1992 or 1991 and 1993 or 1992 and 1994 or 1993 and 1995 or 1998 and 2000, respectively.

chandana did not stop working in 1994 or 1995, since no two persons stopped working in the same year. From (vii) and from (v), and above we can say that Deeksha started working in 1989 or 1990 or 1991 or 1992 or 1993 or 1998.

From (vii), we can say that chandana did not have one-year experience. Hence, we can say that chandana did not stop working in 1989. since she started working in 1988 (from (iv).

if chandana stopped working in 1991 (i.e., 3 years of experience) then Deeksha has 2 years of experience, i.e., Deeksha stopped working in 1993, which is not possible since Lasya stopped working in 1993. similarly, chandana did not stop working in 1992 or 1993 or 1997.

Hence, chandana stopped working in 1990 and Lasya stopped working in 1992, and hence, Deeksha stopped working in 1991.

∴The arrangement is as shown below.

Let us represent the names with their starting letters.

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
started working	H, c, B	L	D	A									
stopped working			c	D	L			B	H	A			

1. (chandana, Deeksha), (Deeksha, Lasya), (Bindu, Harsha) and (Harsha, Aksha) stopped working in the consecutive years.

2. More than three persons started working in none of the years.

Solutions for questions 3 to 5: From the given information it is clear that Asha and Madhu are sitting adjacent to each other and Mahima is sitting to the left of Asha and at least there is one person sitting between them. Kavita is to the left of Mahima. As, it is given that Lata is two places away to the left of sandhya, there is one person between Lata and sandhya and the person can be Kavita or Mahima. As Mahesh is not sitting adjacent to Kavita.

if they are sitting adjacent to Kavita, then the possible case is:

i. Lata Kavita sandhya Mahima Mahesh Asha Madhu
if they are sitting adjacent to Mahima, then the possible cases are:

ii. Kavita Lata Mahima sandhya Asha Madhu Mahesh

iii. Kavita Lata Mahima sandhya Mahesh Asha Madhu
if they are sitting adjacent to Mahesh, then the possible case is:

iV. Kavita Mahima Lata Mahesh sandhya Asha Madhu

3. There are 3 people between Mahesh and Mahima, if Madhu is not sitting at any end (i.e., ii).

4. Kavita can sit to the left of Lata (i.e., ii, iii and iV).

5. Kavita is sitting at the extreme left end, if sandhya is at the middle of the row (ii and iii).

Solutions for questions 6 to 8: Males: Aravind, Bharat, chandrapaul and Daniel

Females: Preeti, revati, sravani and Vanita

cities: Mumbai, chennai, Kolkata and Hyderabad

With reference to the couples, the wife always sits to the immediate right of her husband.

From (i), Bharat is not the husband of Preeti.

From (ii), Daniel is from Hyderabad.

From (iii), revati is not from chennai.

From (iv), chandrapaul is not from Kolkata and he is not the husband of sravani.

From (v), Aravind is not married to revati and revati is not from Mumbai.

Let us represent the persons with the first letter in their names.

From (iv),

[Husband – s] [c – Wife] [Husband – Wife / Kolkata]

From (iii) and (v),

[Husband – Wife / chennai] [Hubsane – r / not Mumbai] [A – Wife]

By combining the above two arrangements, we obtain the following arrangement.

[Husband – s] [c – Wife / chennai] [Hubsand – r / Kolkata] [A – Wife]

From (ii), we know that Daniel is from Hyderabad. Hence, he cannot be revati's husband.

⇒ He is the husband of sravani.

From (i), we know that Bharat is to the immediate right of Preeti.

⇒ Preeti is the wife of chandrapaul and Bharat is the husband of revati.

⇒ Vanita is the wife of Aravind. Thus, we obtain the following arrangement.

[D – s / Hyderabad] [c – P / chennai] [B – r / Kolkata] [A – V / Mumbai]

6. Daniel is married to sravani.

7. chandrapaul and Preeti are from chennai.

8. chandrapaul and his wife are seated second in the row.

Solutions for questions 9 to 11: From (2), (5) and (6), we get:

____ G ____ __ _____ ____ ____

Blue Violet Green Pink Yellow

From (7), we have: F e c

From (3), we come to know that c must be wearing green coloured shirt.

∴ From (2), A is to the immediate right of c.

From (1), B is wearing blue coloured shirt and A and D are sitting adjacent to each other.

The final distribution is as follows:

B G F e c A D

Blue Violet White red Green Pink Yellow

9. c is wearing green colour shirt.

10. A is wearing pink colour shirt.

11. D is sitting at extreme right.

Solutions for questions 12 to 14: The Blue box and the indigo box have 4 boxes between them. The Yellow box is to the immediate left of the indigo box. so, the possible arrangement may be as follows.

Yellow, indigo, Blue.

(Or)

Blue, _, _, Yellow indigo, White

(Or)

White, Blue, _____, Yellow, indigo.

But the White box is not between the Blue and indigo boxes. so, the arrangement can be as follows:

Blue, _, _, _, Yellow, indigo, White

(Or)

White, Blue, _, _, _ , Yellow, indigo.

12. if the White and red boxes have two boxes between them, then the arrangement must be as follows:
White Blue – red – Yellow indigo.
The red box must be in the middle of the row.

13. if the White box is to the left extreme end, then the Green box is placed to the immediate left of the Violet box and next to the Blue box, then the order of colours is White, Blue, Green, Violet, red, Yellow, indigo. The fourth box from the right end is the Violet box.

14. The arrangement can be as follows:
Blue, –, –, –, Yellow, indigo, White
(or)
White, Blue, –, –, –, Yellow, indigo.
now, the Violet box may or may not be in the middle of the row. so, choice (A) is ruled out.
The Yellow box can be placed third from the right end. now, choice (c) is ruled out.
White and indigo boxes can be at the extreme ends. choice (D) is ruled out. But the White box must be at one of the extreme ends.
so, choice (B) is definitely false.

Solutions for questions 15 to 17: Let us analyse all the given conditions. M, n, P, q, r, s, T, U, V and W ten people sitting in a row. O is the eleventh person who makes them sit. it is also given that P and r sit together, whereas V and W sit together. There are exactly 4 seats between the two pairs P, r and V, W. q, s and T, U sit in pairs together with T to the immediate right of s. q, s, T, U must be the order of their sitting. M and n sit in that order only at one extreme end. no one sits to the left of P. so, P must be at the left extreme end.

P -------- M n

P r------ M n

P, r and V, W have exactly 4 seats between them.

P r ---- V W M n

P r---- W V M n

The four spaces should be occupied by q, s, T, U in that order only. so, the seating arrangement is, P, r, q, s, T, U [V, W or W, V] M, n.

15. The order is as follows.
P r q s T U V W M n or P r q s T U W V M n
n is exactly at the fourth place to the right of U.

16. The order of seating is as follows.
P r q s T U [V W or W V] M n
Between s and n there are 5 people and they are (T, U, V, W, M).

17. The possible arrangements of seating are as follows.
(i) P r q s T U V W M n
or
(ii) P r q s T U W V M n
Therefore, two possible arrangements can be made.

Solutions for questions 18 to 20: it is given that no two adjacent people face the same direction that means alternate people face the same direction. Two people sit in between D and e, and e sits at one of the ends. G is two places away to the right of e. We get the following cases.

case (i):

e↑ ↓ G↑ D↓ ↑ ↓ ↑

case (ii):

↓ ↑ ↓ D↑ ↓ ↑ e↓

Given that B faces the same direction as c faces and it is adjacent to both D and F.

Then the possibilities are as follows.

case (i):

e↑ A↓ G↑ D↓ B↑ F↓ c↑

case (ii):

c↓ F↑ B↓ D↑ G↓ A↑ e↓

since G faces north, case (ii) is eliminated and the final row arrangement is shown below.

e↑ A↓ G↑ D↓ B↑ F↓ c↑

18. 'D' is to the immediate right of 'G'.

19. except AB, in the remaining options both are facing the same direction.

20. A sits adjacent to G and B is second to the left of c are definitely true.
Therefore, more than one is true.

Solutions for questions 21 and 22: it is given that T and r are not sitting at any end and T is not adjacent to both s and r. Hence, we have the following possible seating arrangement.

	T/r		r/T	

s is sitting opposite to the person who is not a neighbour of both A and c. And only one person is sitting between A and c and neither of them is sitting at the left end. Hence, the arrangement is as follows.

s	r		T	
		A/c		c/A

A is not sitting opposite to the person who sits at the left end and at least one person is sitting to the left of q. neither B nor e is sitting opposite to T, hence, D has to sit opposite to T. e is not sitting opposite to s and c is not sitting opposite to s. Hence, the final seating arrangement is as follows.

s	r	q	T	P	↓ row ii
B	e	A	D	c	↑ row i

21. c is sitting opposite to P, who is not a neighbour of both s and q.

22. if r and T interchange their positions, then e will sit opposite to T.

Solutions for questions 23 to 25: From (iv) and (vii), we come to know that P is a scientist and he is sitting opposite to the teacher at an end.

L is the singer and is sitting to the immediate left of 'P'.

From (i) and (vi), we come to know that q is a politician and sits adjacent to the architect. From (v), we come to know that neither q nor O sits at ends. Hence, the arrangement is as follows:

Teacher

	q	L	P
Architect	Politician	singer	scientist

From (viii), we know that K is the principal and is sitting opposite to the architect. From (iii), either r or K is the doctor. Hence, r is the doctor.

From (ii), neither M nor O is the teacher and from (v) neither q nor O sits at ends.

From (i), the doctor is sitting opposite to the person who is to the immediate right of q.

Hence, r is the doctor and he must be sitting opposite to L.

Therefore, M is the Architect, O is the beautician and n is the teacher.

Hence, the final arrangement is as follows:

Principal	Beautician	Doctor	Teacher
K	O	r	n
M	q	L	P
Architect	Politician	singer	scientist

23. n is the teacher.

24. Both the third and the fourth options are definitely true.

25. When q interchanges his place with 'K', the beautician sits to the immediate left of q.

2 Circular Arrangement

Chapter

Learning Objectives

In this chapter, we will:

- Extend the knowledge of solving linear arrangement puzzles to circular arrangement puzzles.
- Learn how to interpret the statements given and convert them into a circular arrangement.
- Understand the arrangement of even number of people/objects sitting diametrically opposite each other, around a circle.
- Apply knowledge to understand arrangement of odd number of people/objects around a circle.
- Understand and solve circular arrangement puzzles with multiple parameters.
- Understand and solve circular arrangement puzzles where people face different directions.

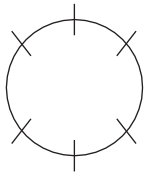
Questions on circular arrangement involve seating of people around a table or arrangement of things in a circular manner (for example, different coloured beads strung to form a necklace).

In case of people sitting around a table, the table could be of any shape, such as rectangular, square, circular or any other.

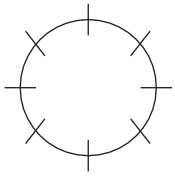
The data given in such sets of questions specify the positions of some or all of the individuals (or things) in the arrangement. The positions are specified through conditions involving specified people sitting (or not sitting) opposite to each other or a particular person sitting to the right or left of another person, etc.

Once you read the data, first draw the shape specified in the data and then draw the slots in the seating arrangement.

Six people around a circular table



Eight people around a circular table



Statements like 'A and B are sitting farthest from each other' or 'A and B sit across the table' imply that A and B sit opposite to each other.

On the other hand, you should remember that, unlike in straight-line arrangement, the words 'immediately' and 'directly' do not play any role in circular arrangement. In general, there is no left side or right side (unless we are talking of 'immediate right' or 'immediate left').

So, if it is given that C sits to right of B, then it is clear that C must be to the immediate right of B. A person's left is in clockwise direction and right is in anti-clockwise direction, when he or she sits facing the centre of a circular table.

To understand better, please go through the solved examples and try to solve them without going through the solution first.

Solved Examples

Directions for questions 1 to 5: These questions are based on the following information.

P, Q, R, S and T sit around a table.

P sits two seats to the left of R and Q sits two seats to the right of R.

2.01: If S sits in between Q and R, then who sits to the immediate right of P?

(A) T (B) S
(C) Q (D) R

2.02: Which of the following cannot be the correct seating arrangement of the five people in either the clockwise direction or the anti-clockwise direction?

(A) P, Q, R, S, T (B) P, S, R, T, Q
(C) P, Q, S, R, T (D) P, T, R, S, Q

2.03: If S is not sitting next to Q, then who is sitting between Q and S?

(A) R (B) P
(C) T (D) Both (R) and (P)

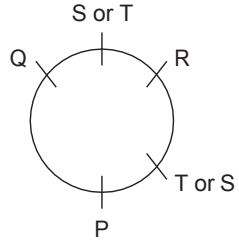
2.04: If a new person U joins the group such that the initial conditions for the seating arrangement should be observed and also a new condition that U does not sit next to R be satisfied, then which of the following statements is true?

(A) U sits to the immediate right of S.
(B) U sits to the immediate left of T.
(C) U sits to the immediate left of P.
(D) Either (A) or (B) above.

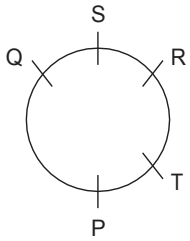
2.05: If a new person U joins the group such that the initial conditions for the seating arrangement should be observed and also a new condition that U does not sit next to P, S or T be satisfied, then who will be the neighbours of P (one on either side)?

(A) S and T (B) S and Q
(C) T and R (D) R and Q

Solutions for questions 2.01 to 2.05: P sits two seats to the left of R and Q sits two seats to the right of R. We can represent this information in the diagram below.

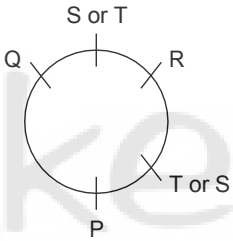


2.01: If S sits between Q and R, then the arrangement is as follows.



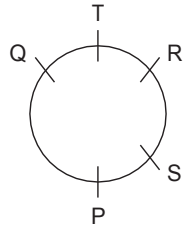
As can be seen from the diagram, T is to the immediate right of P.

2.02: We will take each choice and see whether it fits in the arrangement that we represented through a diagram in the analysis of the data (the same diagram is reproduced below).



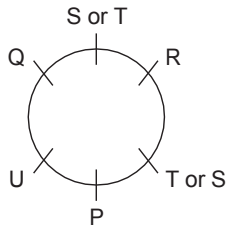
We can see that the arrangement given in choice (A) is not possible and hence, the answer choice is (A).

2.03: If S is not next to Q, then the seating arrangement is fixed as follows.



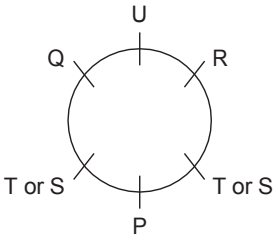
Now P is between Q and S.

2.04: On the basis of the diagram that we drew, we find that to accommodate U we have to create a new slot between P and Q.



Hence, choice (C) is the correct answer.

2.05: We create a new slot for the sixth person. But since U will not sit next to P, S or T, he will have to sit between R and Q. The arrangement will then look as follows:



As we can see from the diagram that the neighbours of P will be T and S.

Directions for questions 2.06 to 2.09: These questions are based on the following information.

There are 10 people at a round table conference, consisting of a Professor, a Lawyer, a Doctor, a Scientist, an Accountant, a Grocer, two Computer Specialists and two Marketing Executives. The Professor sits opposite to the Lawyer. The Scientist and the Doctor sits opposite to each other. The two Marketing Executives sit opposite to each other with one of them sitting to the immediate left of the scientist. The Professor sits to the immediate right of the Scientist.

2.06: If the two Computer Specialists sit opposite to each other but neither of them is immediately next to any Marketing Executive, who sits to the immediate right of the professor?
(A) Computer Specialist
(B) Marketing Executive
(C) Grocer
(D) Accountant

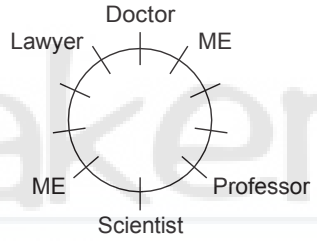
2.07: If the Grocer and Accountant do not sit opposite to each other, then which of the following must be TRUE?
(A) The Computer Specialist cannot sit beside the Lawyer.
(B) One of the Computer Specialists is next to a Marketing Executive.
(C) The Professor cannot have the Scientist and a Computer Specialist on his either side.
(D) The Computer Specialists must sit next to one another.

2.08: If a Computer Specialist is the immediate neighbour of a Marketing Executive and the Grocer is the immediate neighbour of the Lawyer, then how many different kinds of seating arrangements are possible? (Assume that the two Computer Specialists are indistinguishable from each other and the two Marketing Executives are indistinguishable from each other.)
(A) 3 (B) 6
(C) 16 (D) 8

2.09: The maximum number of persons you can count if you start counting with the Scientist and end with a Marketing Executive (excluding both) is
(A) 0 (B) 8
(C) 5 (D) 6

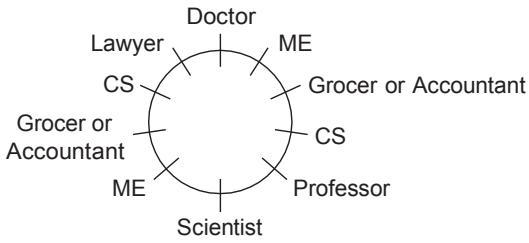
Solutions for questions 2.06 to 2.09: The Professor sits to the immediate right of the Scientist and opposite to the Lawyer. The Scientist sits opposite to the Doctor and one Marketing Executive is to the immediate left of the Scientist.

Choosing to place the Scientist in one of the 10 seats, we have the arrangement as follows.



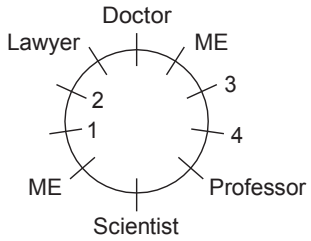
The vacant seats are one each for the two Computer Specialists, one for the Grocer and one for the Accountant.

2.06: The two Computer Specialists sit opposite to each other. Neither of them is next to any Marketing Executive. So, the arrangement must be as follows.



So, the Computer Specialist sits to the immediate right of the professor.

2.07: The Grocer and the Accountant do not sit opposite to each other. Then the arrangements can be as follows:

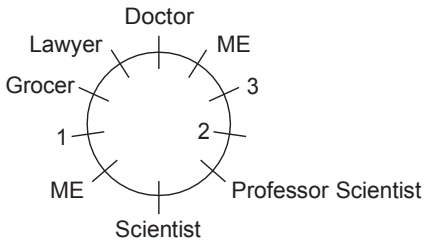


The Grocer and the Accountant can occupy the following pairs of seats: 3 and 4, 1 and 4, 1 and 2 or 2 and 3.

Then, the two computer specialists may occupy one of the pairs of seats 1 and 2, 2 and 3, 3 and 4 or 4 and 1.

We check for the choices given in the question, one by one, and find that whichever combination is taken, there is a Computer Specialist in Seat 1 or Seat 3, both of, which are next to the Marketing Executives seats. So, choice (B), which states that one of the Computer Specialists is next to a Marketing Executive is true.

2.08: Given that the Grocer is the immediate neighbour of the Lawyer, we have the three seats numbered 1, 2 and 3 (in the following diagram) free for the two Computer Specialists and the Accountant. Since a Computer Specialist has to be next to a Marketing Executive, he should be in Seat 1 or 3. By fixing the Accountant in any one of the three seats 1, 2 or 3, we can ensure that there is a Computer Specialist next to a Marketing Executive. Hence, there are three possible seating arrangements.



2.09: Based on the seating arrangement that we discussed, the number of persons between the Scientist and a Marketing Executive can be 3 or 8 (counted clockwise) or 0 or 5 (counted anti-clockwise). Maximum number that can be counted is 8.

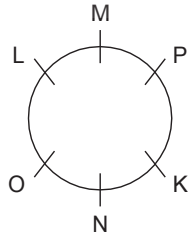
Directions for question 2.10: Select the correct alternative from the given choices.

2.10: Six people K, L, M, N, O and P are sitting around a table. K and L do not sit next to each other. O and P are opposite to each other. M is sitting to the immediate right of P. If K is not between O and M, then N is not next to P. Which of the following is not an arrangement (in clockwise direction) satisfying the conditions given above?

(A) NKOLMP (B) PKNOLM
(C) LNOKMP (D) KMPNLO

Solution for question 2.10:

2.10: O and P are opposite to each other. M is to the right of P. Then we have two possible arrangements. In one case, when K is between O and M, the other two seats can be occupied by N and L. So, we cannot uniquely determine the seats of L and N. In the second case, if K is not between O and M (then, L has to be between O and M), then N is not next to P. This means that K has to be next to P and the only seat left is for N which is to the right of O.



From the choices, we can clearly see that choice (A) is the correct answer because that arrangement is not possible.

Exercise-1

Directions for questions 1 to 9: Select the correct alternative from the given choices.

1. Six people from A through F are seated around a circular table. A is opposite to D, who is two places to the right of F. If B is adjacent to A, then who is seated between E and C?
(A) B (B) A
(C) D (D) F

2. Six delegates are seated around a rectangular table such that two delegates are seated along each of the longer sides and one along each of the shorter sides. Vaibhav is seated at one of the shorter sides. Neither Vasu nor Varun is seated at any shorter side. Only one person is seated between Vasu and Vijay. Vallabh is opposite to Vagdev. If Varun is to the immediate right of Vagdev, then who is opposite to Vasu?
(A) Vijay (B) Vaibhav
(C) Varun (D) Vallabh

3. A group of six people from P through U are seated around a circular table. Among them three are boys and three are girls. No two girls are seated in adjacent places. S is three places away to the left of U. Q is neither adjacent nor opposite to P. Which of the following may represent the group of boys?
(A) S, T, U (B) Q, P, R
(C) Q, R, T (D) S, T, R

4. At buffet, six sweets are arranged in a circular order on a table. Burfi is opposite to Kova. There is one sweet between Laddu and Kaju Katli. Gulab Jamoon is to the immediate right of Kova. Rasagulla is one of the sweets. Which sweet is two places away to the left of Gulab Jamoon?
(A) Laddu (B) Rasagulla
(C) Kaju katli (D) (A) or (B)

5. Six people from A through F are sitting around a circular table such that C is sitting to the right of E and F is to the right of A. If B is sitting to the left of D, and A and C are sitting adjacent to each other, then who is sitting opposite to D?
(A) A (B) B
(C) C (D) E

6. A group of six friends from P through U are sitting around a hexagonal table. S is sitting adjacent to T and Q. Q is sitting to the left of U and P is sitting to the right of R. Who is sitting opposite to R?
(A) T (B) Q
(C) S (D) U

7. A group of six people from A through F are sitting in a circular table such that A is sitting two places away to the left of E, who is not adjacent to C and F. D is to the right of E and A is sitting between B and F. Now, who is sitting opposite to D?
(A) A (B) B
(C) C (D) F

8. A group of eight boys, namely A, B, C, D, E, F, G and H sit around a circular table, not necessarily in the same order. B and D sit neither adjacent to C nor opposite to C. A sits in between E and D, and F sits in between B and H. Which of the following is definitely true?
(A) H sits in between C and E.
(B) B sits in between A and G.
(C) C sits opposite to G.
(D) None of these

9. P, Q, R, S, T and U are the six corners of a table which has six sides, not necessarily in the same order. A group of six people, namely A, B, C, D, E and F are sitting along the sides joining the corners, not necessarily in that order. S is to the right of P and R is to the left of T. A is sitting opposite to E and to the immediate right of F. D is sitting between the corners of P and T and is opposite to C. If F is sitting between R and U, then who sits between Q and S?
(A) A (B) E
(C) C (D) B

Directions for questions 10 to 12: These questions are based on the following information.

Sameer, Sameep, Sandeep, Sangeet, Sanskar and Saarang are sitting around a hexagonal table in a library studying a book each. The cover of the book in their hands is of different colours, such as Red, Green, Blue, Orange, White and Yellow not necessarily in that order. Further, it is known that Sameer sits opposite to Sameep, who sits to the immediate left of the person holding the Blue cover book, who sits two places away from the person holding the White cover book. Sangeet sits two places away from the person holding the Yellow cover book and sits opposite to the person holding the white cover book. Sandeep and Saarang sit next to each other.

10. What is the colour of the book with Sanskar?
(A) Yellow (B) White
(C) Blue (D) Red

11. If the person holding the Orange cover book sits opposite to the person holding the Red cover book, then which statement among the following cannot be true?
(A) Sanskar does not hold the White cover book.
(B) Sangeet is not holding a Green cover book.
(C) Saarang holds the Yellow cover book.
(D) Sandeep holds the Yellow cover book.

12. If Sandeep sits opposite to the person holding the Green cover book, then who is sitting opposite to the person holding the Red cover book?
(A) Sandeep (B) Sameer
(C) Sanskar (D) Cannot be determined

Directions for questions 13 and 14: These questions are based on the following information.

Among the seven people, namely Maggi, Cherry, Prachi, Toto, Saxena, Gaddar and Basanti, sitting around a circular table.

(i) Toto is adjacent to neither Prachi nor Basanti.
(ii) Maggi is two places away to the right of Saxena.
(iii) Cherry is adjacent to both Basanti and Saxena.
(iv) Gaddar is not adjacent to Basanti.

13. Who is sitting four places away to the left of Cherry?
(A) Gaddar (B) Maggi
(C) Toto (D) Prachi

14. In which of the following combination is the second person sitting two places away to the left of the first person?
(A) Gaddar, Cherry (B) Maggi, Prachi
(C) Saxena, Basanti (D) Both (B) and (C)

Directions for questions 15 to 17: These questions are based on the following information.

Eight people A, B, C, D, E, F, G, and H are sitting around a rectangular table not necessarily in the same order. One person sits along the shorter side and three persons sit along the longer side.

A and G are sitting diagonally opposite to each other. D and E are sitting opposite to each other.

A is sitting to the immediate left of F, who is sitting at one of the shorter sides of the table.

15. If C is sitting to the immediate right of H, then who is sitting opposite to F?
(A) B (B) C
(C) H (D) D

16. If C is sitting opposite to A, then who among the following must be sitting on the same side as C?
(A) G and E (B) G and D
(C) G (D) H or B

17. If H is not sitting at one of the shorter sides, then how many arrangements are possible?
(A) 24 (B) 8
(C) 4 (D) 16

Directions for questions 18 to 20: These questions are based on the following information.

Each of the six people, namely John, Ted, Humpty, Dumpty, Jack and Jill is from one different country among India, Japan, China, Australia, America and England and are sitting around a circular table, they may not be in the same order. John, who is from China is sitting adjacent to an American, who is not Humpty. Ted is not an Indian, and the Chinese is not sitting adjacent to the Indian. The person from England is sitting one place away to the left of the Australian. Humpty is sitting opposite to the Indian, who is adjacent to the Japanese. The Australian and Dumpty are sitting opposite to each other. Jack is not from India and Ted is not from Japan and both are not adjacent to each other.

18. Who among them is from India?
(A) Jill (B) Dumpty
(C) Humpty (D) None of these

19. If Jack is the Japanese, then who is sitting opposite to the American?
(A) Jill (B) Ted
(C) Jack (D) Dumpty

20. To which country does, Humpty belong?
(A) Japan (B) Australia
(C) America (D) England

Directions for questions 21 to 23: These questions are based on the following information.

Eight friends, A through H are sitting around a circular table, playing a game of cards. They belong to two different teams X and Y. No two persons of the same team sit in adjacent seats.

(i) A sits neither opposite to D nor to H but is sitting in between C and G.
(ii) B sits neither opposite to A nor to G but is sitting in between F and D.
(iii) B and H belong to team X and D sits opposite to E.
(iv) A scored two points more than D, who scored three points more than F, who scored four points more than E. B scored twice as that of G, who scored twice that of C, who scored twice that of H.

21. Who are the members of team X?
(A) A, D, F and E (B) B, H, C and E
(C) B, D, H and G (D) B, H, C and G

22. If E and H scored one point each, then which team wins the game, given that the team with the minimum points wins the game?
(A) Team X
(B) Team Y
(C) Both teams scored the same points
(D) Cannot be determined

23. If team Y scores 92 points and team X scores 90 points, then which among the following is definitely true?
(A) H and D scores equal points.
(B) B scores twice as many points as F.
(C) A scores three points less than G.
(D) D scores one point more than G.

Directions for questions 24 to 26: These questions are based on the following information.

Eight people from A through H are sitting around a circular table, not necessarily in the same order. The following information is known about them.

(i) If C and F interchange their places, then each of them will have only one new neighbour.
(ii) H is sitting two places away to the left of A.
(iii) Two persons are sitting between C and G.
(iv) The one, who is adjacent to both C and F is not B. B is sitting opposite to G.

24. If A is not sitting adjacent to B, then who will be sitting three places away to the right of F?
(A) E (B) B
(C) D (D) Cannot be determined

25. If C is to the immediate left of E, then who will be sitting opposite to H?
(A) C (B) D
(C) F (D) Either (B) or (C)

26. If A is sitting between G and D, then who is sitting two places away to the right of B?
(A) A (B) F
(C) E (D) D

Directions for questions 27 to 29: These questions are based on the following information.

12 erasers named A through L are placed at a different hour division of a clock. B is at 7th hour division, E is opposite to K. L is at 60° from A. K is to the immediate left of H. H is at 90° from C which is 60° from D. F is at 11th hour division which is adjacent to K and J. G is at 30° from I.

27. What is the angle between E and H?
(A) 135° (B) 150°
(C) 120° (D) 170°

28. If A is at 5th hour division, then which is placed at 3rd hour division?
(A) L (B) G
(C) I (D) Cannot be determined

29. Which is opposite to G?
(A) C (B) D
(C) B (D) Cannot be determined

Directions for questions 30 to 33: These questions are based on the following information.

Among seven people, namely Tanuja, Divya and Vasudha are females and Srikanth, Ganesh, Sateesh and Appu are males and they are sitting around a circular table, but not necessarily in the same order. The following information is known about their seating.

No two females are adjacent to each other. Ganesh and Appu are not adjacent to each other. Srikanth is sitting to the immediate left of Vasudha, who is third to the left of Appu. Tanuja is not adjacent to Sateesh. Appu and Sateesh are adjacent to each other. All are facing the centre.

30. Who is sitting second to the right of Appu?
(A) Divya (B) Tanuja
(C) Srikanth (D) Ganesh

31. Who is sitting adjacent to Vasudha?
(A) Sateesh (B) Appu
(C) Divya (D) Ganesh

32. In a certain way, Vasudha is related to Divya. Sateesh is related to whom in the same way?
(A) Srikanth (B) Ganesh
(C) Tanuja (D) Appu

33. Three out of the following four follow a particular pattern and so form a group. Find the one which does not belong to the group.
(A) Appu, Divya (B) Vasudha, Ganesh
(C) Divya, Vasudha (D) Vasudha, Tanuja

Directions for questions 34 to 37: These questions are based on the following information.

A group of 12 people, from M through X are sitting around a circular table, but not necessarily in that order.

Starting from P in clockwise direction, O, V, W, N and Q are sitting in that order. Further, starting from P in anti-clockwise direction, M, T, R, S, U and X are sitting in that order. Also, M is between P and Q, T is between Q and N, R is between N and W, S is between W and V and U is between V and O.

34. Who is sitting adjacent to both V and W?
(A) U (B) R
(C) S (D) Cannot be determined

35. Who is sitting opposite to R?
(A) O (B) P
(C) X (D) Cannot be determined

36. How many people sit between T and V when counted from the clockwise direction with respect to T?
(A) Five (B) Six
(C) Four (D) Cannot be determined

37. If all the persons are facing away from the centre, then who sits third to the left of R?
(A) V (B) Q
(C) U (D) Cannot be determined

Directions for questions 38 to 40: These questions are based on the following information.

There are two circular tables in a room. Six Russians, namely A, B, C, D, E and F are sitting at one table and six Frenchmen, such as M, N, O, P, Q and R are sitting at the other table. A and D are sitting opposite to each other. B and

E are sitting opposite to each other. C sits to the right of D. B is the only person who can translate Russian to French; C is the only person who can translate French to Russian, and none of them does the vice-versa, unless so stated. E and F sit adjacent to each other. Also, M sits opposite to P; Q sits to the right of R and R sits opposite to O. N and P sit adjacent to O. On the table, any person can talk to another person, only as stated below. The only conversations that took place are as given below:

A spoke to B; B to R; R to C; R to Q; Q to P; P to O; O to N; N to M; C to D; D to E; F to A; M to R; and E to F.

The conversations are one-sided, i.e., A spoke to B implies that A is the speaker and B is the listener and not vice-versa.

38. If C wants to send a message to M, then how many people must the message pass through? (excluding the first and the last)

(A) 1 (B) 6
(C) 10 (D) None of these

39. If the order of conveying messages is reversed at both the tables (i.e., 'A speaks to B' now becomes 'B speaks to A' and so on) and also B and C exchange their interpretory skills, then which of the following will be true?

(A) A can send a message to Q involving only 2 people.
(B) The person sitting to the right of F can send a message to the person sitting to the left of N, by involving only five people.
(C) The person sitting to the right of C, on the same table, can translate Russian into French.
(D) The maximum number of people involved in the longest message in this new arrangement is more than that in the previous arrangement.

40. If the person sitting to the right of B wants to send a message to the person sitting two places to the left of D, then what is the maximum possible number of people involved between them? (excluding the two people)

(A) 11 (B) 10
(C) 4 (D) None of these

Exercise-2

Directions for questions 1 to 5: These questions are based on the following information:

Six sofas of different colours are arranged in a circular order. On each sofa, a boy among O, P, Q, R, S and T and a girl among U, V, W, X, Y and Z are sitting.

(i) The red coloured sofa is in between the yellow coloured sofa and blue coloured sofa.
(ii) X is sitting on white sofa, which is opposite to the sofa where Z is sitting.
(iii) The orange coloured sofa is adjacent to the sofa where both O and V are sitting.
(iv) The sofa, where W is sitting is adjacent to the blue and pink coloured sofas.
(v) P is to the left of S, who is opposite to Y.

1. Who among the following is sitting on the sofa which is opposite to the pink coloured sofa?

(A) S (B) X
(C) Y (D) U

2. Who are sitting on the blue coloured sofa?

(A) Z, P (B) W, S
(C) O, V (D) T, Z

3. What is the colour of the sofa which is opposite to the sofa where Y is sitting?

(A) Yellow (B) Orange
(C) White (D) Blue

4. Which of the following represents the people sitting on the same sofa?

(A) Z, Q (B) W, P
(C) X, T (D) W, S

5. Which of the following represents the correct order of the colours of the sofas?

(A) Pink, Orange, Blue, Red, White, Yellow
(B) Pink, Blue, Red, Yellow, Orange, White
(C) Red, Blue, Orange, Pink, White, Yellow
(D) Pink, Orange, Yellow, Red, Blue, White

Directions for questions 6 to 9: These questions are based on the following information.

Seven children of a family are seated around a circular table to have their lunch. No two children finish their lunch at the same time and no two adjacent children finish their lunch immediately one after the other.

(i) Sujatha finishes her lunch immediately before Bhuvan finishes his lunch. Bhuvan is to the immediate left of Srilatha.
(ii) Pranav is three places away to the left of Anand but finishes his lunch after Anand finishes his lunch.
(iii) Krupa is to the immediate left of the child who finishes his/her lunch before two children.
(iv) Kruti finishes her lunch immediately after Bhuvan finished his lunch but not after Pranav finished his lunch.
(v) The number of children who finish their lunch before Srilatha finishes her lunch is same as the numbers of children who finish their lunch after.

6. How many children finish their lunch before Pranav finishes his lunch?
(A) 1 (B) 2
(C) 4 (D) 5

7. Who finishes his/her lunch immediately after Kruti finishes his lunch?
(A) Bhuvan (B) Krupa
(C) Sujatha (D) Srilatha

8. Who is to the immediate right of Pranav?
(A) Sujatha (B) Kruti
(C) Krupa (D) Srilatha

9. Which of the following represents the seating order?
(A) Anand, Sujatha, Pranav, Srilatha, Bhuvan, Kruti, Krupa
(B) Anand, Kruti, Sujatha, Pranav, Krupa, Srilatha, Bhuvan
(C) Anand, Krupa, Kruti, Pranav, Sujatha, Srilatha, Bhuvan
(D) Anand, Krupa, Bhuvan, Srilatha, Pranav, Sujatha, Kruti

Directions for questions 10 to 12: These questions are based on the following information.

A group of six boys, namely Prasad, Prakash, Prashant, Pranay, Praveen and Prabhat each wearing a T-shirt of a different colour, such as Indigo, Green, Blue, Orange, Violet and Yellow are sitting around a table in six equi-spaced chairs. Prakash is opposite to the boy wearing the Orange T-Shirt. Prabhat is opposite to the boy wearing the Green T-Shirt. Prashant is to the right of the boy wearing the Indigo T-Shirt and opposite to the boy wearing the Violet T-Shirt. Praveen is between the boys wearing Orange and Yellow T-Shirts and is not wearing the Violet T-Shirt. Pranay is opposite to the boy who is wearing the Yellow T-Shirt.

10. Which of the following statements is true?
I. The boys wearing Green and Orange T-Shirts are either next to each other or opposite to each other.
II. The boys wearing Indigo and Orange T-Shirts are either next to each other or opposite to each other.
III. The boys wearing Blue and Violet T-Shirts are always next to each other.
IV. The boys wearing Blue and Indigo T-Shirts are either opposite to each other or are next to each other.
(A) Only I and II (B) Only III
(C) Only III and IV (D) I, II, III and IV

11. If Prabhat is wearing the Orange T-Shirt, then who is wearing the Green T-Shirt?
(A) Prasad (B) Prakash
(C) Praveen (D) Pranay

12. If Prashant is wearing the Orange T-Shirt, then who is between Praveen and Pranay?
(A) Prashant (B) Prasad
(C) Prakash (D) Prabhat

Directions for questions 13 to 15: These questions are based on the following information.

Eight people, namely Ram, Ramesh, Mohan, Sohan, Seema, Saroj, Sakshi and Saloni are sitting around a circular table. Each of them is from different professions, such as Doctor, Engineer, Dancer, Singer, Teacher, Lawyer, Accountant and Pilot, not necessarily in the given order. Further it is known that
I. Pilot is sitting opposite to Ramesh, who is adjacent to the Accountant.
II. Dancer is sitting opposite to the Lawyer and is not adjacent to Sakshi who is not sitting adjacent to the Lawyer.
III. Saloni is sitting opposite to the Engineer, Ramesh is not a Lawyer or Doctor or Engineer.
IV. Sakshi, the Singer, is sitting one place away to the right of Saroj.
V. Seema is sitting opposite to the Lawyer and Ram is sitting opposite to the Dancer.
VI. Ramesh is sitting three places to the right of Singer. Mohan is neither the Accountant nor adjacent to the Dancer.

13. Who is the Doctor?
(A) Ramesh (B) Saloni
(C) Saroj (D) Cannot be determined

14. What is the profession of Mohan?
(A) Accountant (B) Pilot
(C) Engineer (D) Cannot be determined

15. Who is sitting opposite to Ramesh?
(A) Seema (B) Sakshi
(C) Saroj (D) None of these

Directions for questions 16 to 18: These questions are based on the following information.

Each of the eight boys from A through H has a different fruit with them and are seated around a square table such that two boys are seated along each side. The following information is known about the seating arrangement.
(i) G, who has Watermelon is four places away to the right of B. F is opposite to the boy who has Banana.
(ii) The boy who has Grapes and the boy who has Kiwi are on the same side of the table. C is to the immediate left of B but is not along the same side.
(iii) The boy who has Orange and the boy who has Guava are seated at opposite sides.
(iv) E has Litchi and H has Grapes. There are three boys between E and H.

(v) The boy who has Watermelon is to the immediate right of the boy who has Mango and is to the immediate left of F.

16. If A has Orange, then who will be sitting at the side which is opposite to the side where C is sitting?
(A) D (B) A
(C) H (D) F

17. Who is three places away to the left of F?
(A) A (B) E
(C) G (D) B

18. Which of the following is a correct combination of boy and the fruit that he has?
(A) C-Kiwi (B) G-Mango
(C) F-Orange (D) B-Watermelon

Directions for questions 19 to 21: These questions are based on the following information.

Eight people A, B, C, D, E, F, G and H are sitting around a square table, but not necessarily in that order. The people who are sitting at the corners, face the centre and the people who are sitting at the sides face away from the centre. Each of them likes a different colour among red, blue, green, yellow, pink, black, white and violet. The following information is known about their seating.

(i) B sits second to the left of the person who likes blue.
(ii) The person who likes violet sits at the corner, who is adjacent to both G and the person who likes blue.
(iii) A sit second to the right of the person who likes yellow and is not adjacent to G.
(iv) C sits adjacent to the person who likes yellow.
(v) C likes neither violet nor blue. The person who likes pink is adjacent to neither A nor B.
(vi) E sits to the immediate right of the person who likes pink.
(vii) F is not adjacent to the person who likes black.
(viii) The person who likes black sits at one of the sides.
(ix) D likes white.
(x) H does not like black.

19. Who likes red?
(A) C (B) E
(C) F (D) Cannot be determined

20. Who sits third to the right of F?
(A) H (B) C
(C) G (D) Cannot be determined

21. Three of the following four are alike in a certain way, based on the given information and so form a group. Find the one which does not belong to that group.
(A) The person who likes green.
(B) The person who likes violet.
(C) The person who likes yellow.
(D) The person who likes red.

Directions for questions 22 to 24: These questions are based on the following information.

Eight people, namely Anand, Brijesh, Chandak, Dweepesh, Sayan, Jagat Rupak and Palak are sitting around a square table such that two people are sitting along each side. The following information is known about them.

(i) Jagat, who is sitting to the immediate right of Rupak is sitting opposite to Chandak who is sitting to the immediate right of Brijesh.
(ii) Sayan is sitting opposite to Dweepesh, who sits along the same side as Brijesh.
(iii) Palak is not sitting along the same side as Sayan.

22. Who is sitting along the same side as Chandak?
(A) Anand (B) Palak
(C) Sayan (D) Rupak

23. Who is sitting opposite to Rupak?
(A) Palak (B) Anand
(C) Brijesh (D) Data inadequate

24. Who is sitting to the immediate right of Sayan?
(A) Anand (B) Rupak
(C) Chandak (D) Data inadequate

Directions for questions 25 to 27: These questions are based on the following information.

Eight people from P through W are sitting around a rectangular table, each of them facing the centre but not necessarily in that order. Three people sit along each of the longer sides of the table and one person sits along each of the shorter sides.

(i) If Q and S interchange their positions, then V sits to the immediate left of S.
(ii) If P and T interchange their positions, then R sits opposite to T.
(iii) If Q and U interchange their positions, then W sits third to the right of U.
(iv) P sits third to the left of Q, who sits at the longer side of the table.
(v) If W and S interchange their positions, then S sits third to the left of T.
(vi) U and S sit opposite to each other.

25. Who sits opposite to V?
(A) S (B) W
(C) N (D) Cannot be determined

26. Who among the following sit along the longer side of the table?
(A) Q, R, V (B) S, U, P
(C) Q, R, W (D) Cannot be determined

27. Who sits second to the left of S?
(A) Q (B) T
(C) U (D) Cannot be determined

Directions for questions 28 to 32: These questions are based on the following information.

Eight members of a family A through H are sitting around a circular table.

The following information is known about them:

(i) There are three married couples in the family.
(ii) One of A's sons is sitting opposite him while the other is adjacent to him.
(iii) H's sister-in-law is B, who is sitting to the immediate right of H's father-in-law.
(iv) The number of females in the family is less than the number of males in the family.
(v) Two of the married couples have two children each.
(vi) C, who is the eldest male in the family is sitting third to the left of his wife.
(vii) F, the youngest is not G's son and is sitting adjacent to H.
(viii) H is the aunt of E, who is sitting three places away from G.

28. Who is C's son?
(A) A (B) E
(C) D (D) None of the above

29. How is A's brother-in-law's nephew's grandmother related to B?
(A) Mother (B) Sister
(C) Niece (D) Aunt

30. What is the position of E's father with respect to C's daughter-in-law?
(A) Immediate left (B) Opposite to each other
(C) Second to the right (D) Second to the left

31. Based on information given three of the following four are similar in a certain way and, hence, form a group. Find the one that does not belong to the group.
(A) E (B) G
(C) F (D) B

32. How is F related to the person sitting third to the left of him?
(A) Son (B) Father
(C) Brother (D) Grandson

Directions for questions 33 to 36: These questions are based on the following information.

Eight people from A through H sit around a circular table, but not necessarily in that order. Some are facing the centre and the remaining are facing away from the centre. The following information is known about their seating.

(i) B sits third to the right of G.
(ii) There are two people sitting between G and A.
(iii) C sits second to the left of A.
(iv) C and G face the same direction.
(v) D sits third to the left of the person who is adjacent to C.
(vi) E sits third to the right of D, both of them face the same direction.
(vii) F faces E.
(viii) B and H face different directions.

33. How many people face the centre?
(A) 4 (B) 3
(C) 5 (D) Cannot be determined

34. If B faces the centre, then who sits third to the left of H?
(A) D (B) C
(C) G (D) E

35. If H and A face the same direction, then who sits second to the right of B?
(A) D (B) A
(C) G (D) H

36. Who sits to the immediate right of B?
(A) F (B) H
(C) D (D) Cannot be determined

Directions for questions 37 to 40: The following questions are based on the information given below:

Eight people, namely G, H, I, J, K, L, M and N are sitting around a square table. Some of them are facing the centre and others are facing away from the centre.

(i) I is sitting at one of the corners and is facing away from the centre.
(ii) Neither J nor M is a neighbour of I.
(iii) The neighbours of I face the same direction as I.
(iv) L and M face the same direction and sit opposite to each other.
(v) H is to the immediate right of M and G is to the immediate left of I.
(vi) J and K are neighbours of N and face different directions.
(vii) N sits opposite to I and faces the centre.
(viii) M and K are facing different directions and K is to the immediate right of N.

37. How many people are facing away from the centre?
(A) Five (B) Four
(C) Two (D) Three

38. Three of the four are alike in a certain way and so form a group. Which is the one that does not belong to that group?
(A) JH (B) NI
(C) MK (D) MN

39. Who is sitting to the immediate right of H?
(A) M (B) G
(C) I (D) K

40. Who is sitting in the opposite position of G?
(A) H (B) M
(C) K (D) J

Exercise-3

Directions for questions 1 to 3: These questions are based on the following information.

A group of eight people, namely A, B, C, D, E, F, G and H from eight cities, such as P, Q, R, S, T, U, V and W not necessarily in the same order are sitting around a circular table. We know the following additional information.

(1) Among A, E, G and F, no two people are adjacent to each other.
(2) Among the people from P, T, V and W, no two people are opposite to each other.
(3) A is to the immediate left of B, who is two places away to the right of the person from Q.
(4) The person from S is opposite to D, who is adjacent to E.
(5) The person from P is to the immediate left of G, who is from T.
(6) C, who is from W, is adjacent to the people from R and V.

1. Who is from R?
(A) A (B) B
(C) E (D) F

2. Who is to the immediate right of H?
(A) G (B) E
(C) A (D) Cannot be determined

3. Who is opposite to the person from V?
(A) A (B) G
(C) F (D) Cannot be determined

Directions for questions 4 to 6: These questions are based on the following data.

Eight chairs are arranged in a room. Four of them are exactly at the four corners while the remaining four are placed against the walls on the four sides in between each pair of chairs. In the corners P, Q, R and S are four boys and A, B, C and D are four girls who occupy the chairs all of which are facing the centre of the room. Q is in a corner chair and R is in a chair which is not along the same wall as either of the walls are adjoining Q. A and C are seated at corners, which is diagonally opposite to each other. B does not sit along any wall which is adjacent to the corner where A sits and is opposite to P. C sits to the immediate right of R, who is between C and D.

4. S must be seated between
(A) C and Q (B) A and D
(C) A and Q (D) C and A

5. If S and P interchange their seats, then who is to the immediate left of D?
(A) A (B) P
(C) R or C (D) S

6. Which of the following is not one of the correct arrangements of the corner seat occupants, either in clockwise direction or in anti-clockwise direction consecutively?
(A) Q, A, D and C (B) A, Q, C and D
(C) D, A, Q and C (D) D, Q, A and C

Directions for questions 7 to 9: These questions are based on the following data.

Four teachers Ranjan, Rajan, Raman and Raj, and four doctors Puneet, Piyush, Pratham and Pratima are sitting around a table. No two teachers sit adjacent to each other. Raj is two places to the right of Ranjan and adjacent to Pratima, who is two places to the left of Puneet, who is adjacent to Rajan.

7. If Raman is not opposite Ranjan, then who is seated two places to the left of Ranjan?
(A) Raman (B) Rajan
(C) Raj (D) Cannot be determined

8. If Pratima is adjacent to Raman, then who is seated opposite to Raj?
(A) Pratima (B) Raman
(C) Rajan (D) Ranjan

9. If Pratham is not opposite to Puneet, then who is seated opposite to Pratima?
(A) Puneet (B) Pratham
(C) Raman (D) Cannot be determined

Directions for questions 10 to 12: These questions are based on the following data.

A group of six people, namely Amit, Amitabh, Arnold, Aakash, Abhinav and Atul, each from a different profession, such as Doctor, Lawyer, Teacher, Manager, Business Analyst and Accountant, are seated around a table in six equi-spaced chairs. Atul is opposite to the Lawyer. Arnold is to the right of the Doctor and is opposite to the person who is the Business Analyst. Aakash is opposite to the Accountant. Abhinav is between the Manager and the Accountant and is not the Business Analyst. Amitabh is opposite to the Manager, who is to the left of Aakash.

10. Who is between the Lawyer and the Business Analyst?
(A) Amit (B) Amitabh
(C) Aakash (D) Cannot be determined

11. If Atul is not the Teacher, then who is the Doctor?
(A) Abhinav (B) Amitabh
(C) Akash (D) Amit

12. If Amitabh is the Business Analyst, then who is opposite to Amitabh?
(A) Amit (B) Atul
(C) Arnold (D) Cannot be determined

Directions for questions 13 to 15: These questions are based on the following data.

A librarian wishes to sit at the centre of his circular library hall with eight shelves arranged around him in a circle. There are books on eight subjects English, Physics, Sociology, Chemistry, Mathematics, French, German and History which are placed in the shelves, the books of one subject is only in one shelf. The books on French, German and English should be in three shelves placed side by side. The books on History should be in a shelf opposite to the shelf containing French books. The books on Physics and those on Chemistry should be in the shelves opposite to each other.

13. If the books on German are opposite to the shelf which has Mathematics books, and between the shelves containing books on Physics and French, then which of the following should be opposite to each other?
(A) English and Sociology shelves
(B) English and Physics books
(C) English and History books
(D) Sociology and Mathematics books

14. If the books on Sociology are between the shelves with Physics and History books, then the books on Mathematics would be between the shelves containing books on
(A) History and French
(B) History and Chemistry
(C) French and Chemistry
(D) French and Physics

15. If the English books are to the immediate left of the shelf with Physics books, then the shelf with German books is to the immediate right of shelf containing books of which subject?
(A) Only Physics (B) Chemistry or French
(C) Only French (D) French or German

Directions for questions 16 to 18: These questions are based on the following information.

A group of eight people, namely K, L, M, N, O, P, Q, and R sit around a circular table not necessarily in the same order. Some of them are facing the centre and the remaining are facing away from the centre.

(i) P sits to the immediate left of K.
(ii) M and R are sitting in the opposite places.
(iii) Either 'Q' or 'O' sits next to L but not both.
(iv) No two people are sitting next to each other facing the same direction.
(v) R is the neighbour of both N and Q.
(vi) L sits opposite to K and faces away from the centre.

16. Three of the following are alike in a certain way and so form a group. Which is the one that does not belong to that group?
(A) KM (B) ML
(C) NO (D) PO

17. Which among the following is 'definitely true'?
(A) P is facing away from the centre.
(B) O and N are opposite to each other.
(C) K sits to the immediate right of P.
(D) L sits to the immediate right of O.

18. If M and N interchange their places, then who among the following sits to the immediate left of M?
(A) O (B) P
(C) L (D) None of these

Directions for questions 19 to 21: These questions are based on the following information.

A group of eight people from the same family sit around a rectangular table in such a way that four people, namely A, B, C and D sit along one of the longer sides of the table, facing north and the other four people, namely P, Q, R and S sit along the other longer side of the table facing south, not necessarily in that order. Each person faces exactly one person who sits on the opposite side. The following information is known about them.

P is the brother of Q, who is not adjacent to either P or S. A is the daughter of P and sits to the immediate right of B's husband. D is opposite to neither P nor S. C is the niece of P but is not opposite to either P or S. B is not opposite to S but to opposite her brother. D has only one child who is a male. Q is the daughter of C's grandfather, who is not R.

19. Who is to the immediate right of P?
(A) R's father (B) P's sister
(C) D's father-in-law (D) R

20. Which of the following person sits at an end?
(A) A (B) R
(C) Q's daughter (D) B's father

21. Which of the following statements is true?
(A) Q is at the left end (B) B is at the right end
(C) R is the brother of A (D) All the above

Directions for questions 22 to 25: These questions are based on the following information.

A group of eight people, namely P, Q, R, S, T, U, V, and W belong to the same family and they sit around a circular table facing the centre (not necessarily in the same order). The following information is known about them.

(1) P sits second to the right of his nephew, whose neighbours are females.
(2) V is the wife of P and sits to the immediate right of her daughter T.
(3) U sits second to the right of his brother-in-law and opposite to his son Q.
(4) S sits third to the right of her sister-in-law and second to the left of her father R.
(5) W is the mother-in-law of U and is adjacent to her grandson.

22. Who among the following is the wife of U?
(A) S
(B) The one who is opposite to T.
(C) The one who sits second to the right of R.
(D) Both (A) and (B)

23. Who among the following is the niece of S?
(A) The one who sits opposite to S.
(B) The one who sits to the immediate right of S's husband.
(C) T
(D) All the above

24. Which among the following is 'definitely true'?
(A) R and V sit adjacent to each other.
(B) T and her mother sit opposite to each other.
(C) W sits third to the right of her son.
(D) None of these

25. Four of the following are alike in a certain way, and hence form a group. Which is the one that does not belong to that group?
(A) TU (B) RS
(C) VW (D) QT

ANSWER KEYS

Exercise-1

1. (C)	8. (D)	15. (C)	22. (A)	29. (D)	36. (B)
2. (C)	9. (B)	16. (C)	23. (D)	30. (A)	37. (A)
3. (D)	10. (C)	17. (B)	24. (B)	31. (D)	38. (C)
4. (B)	11. (B)	18. (B)	25. (A)	32. (C)	39. (B)
5. (A)	12. (D)	19. (A)	26. (D)	33. (B)	40. (B)
6. (C)	13. (B)	20. (B)	27. (B)	34. (C)	
7. (A)	14. (C)	21. (D)	28. (A)	35. (C)	

Exercise-2

1. (D)	8. (B)	15. (C)	22. (B)	29. (A)	36. (D)
2. (A)	9. (C)	16. (A)	23. (A)	30. (C)	37. (B)
3. (B)	10. (D)	17. (B)	24. (B)	31. (D)	38. (D)
4. (D)	11. (B)	18. (A)	25. (B)	32. (C)	39. (A)
5. (C)	12. (A)	19. (D)	26. (B)	33. (C)	40. (C)
6. (D)	13. (B)	20. (B)	27. (D)	34. (A)	
7. (D)	14. (C)	21. (C)	28. (D)	35. (B)	

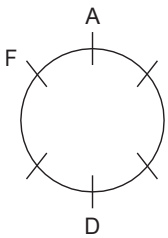
Exercise-3

1. (D)	5. (D)	9. (B)	13. (A)	17. (D)	21. (B)	25. (C)
2. (C)	6. (D)	10. (A)	14. (B)	18. (C)	22. (D)	
3. (A)	7. (A)	11. (A)	15. (B)	19. (C)	23. (D)	
4. (C)	8. (C)	12. (C)	16. (D)	20. (C)	24. (D)	

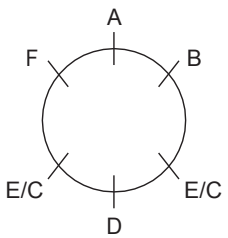
SOLUTIONS

EXERCISE-1

1. A is opposite to D, who is two places away to the right of F.

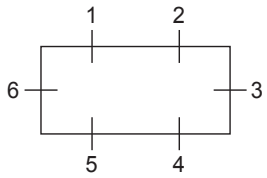


B is adjacent to A. The arrangement will be as follows.

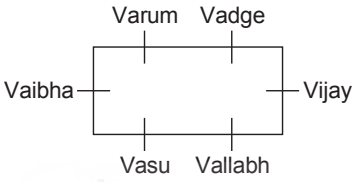


. D is in between E and C.

2. The group of six people are seated as follows:

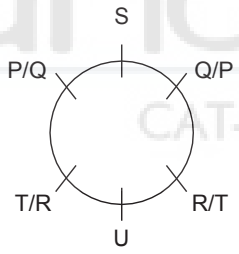


Let Vaibhav be seated at 6. Neither Vasu nor Varun is placed at 3.
Vallabh is opposite Vagdev.
. Neither Vagdev nor Vallabh is placed at 3. Vinay is at 3.
Varun is to the immediate right of Vagdev. So, the arrangement will be as follows.

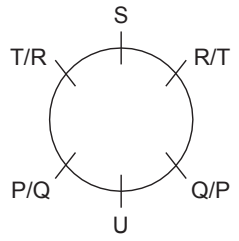


. Varun is opposite to Vasu.

3. As, S is 3 places away to the left of U,
S and U are opposite to each other. Given that Q is neither adjacent nor opposite to P.
. The following arrangements are possible.
Case – (i):

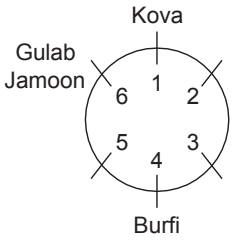


Case – (ii):



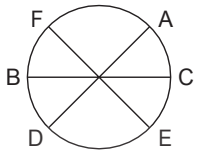
Case-(i):
. P, Q and U are of the same gender.
S, R and T are of the same gender.
Case-(ii):
S, P and Q are of the same gender.
U, R and T are of the same gender.

4. Burfi is opposite to Kova, which is to the immediate left of Gulab Jamoon. Hence, the following arrangement is possible.



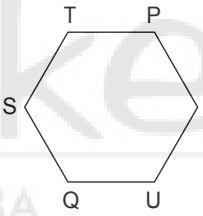
There is one sweet between Laddu and Kaju Katli.
. Laddu and KajuKatli are at 3 and 5 in any order and Rasagulla is at 2.
Rasagulla is two places away to the left of Gulab Jamoon.

5. According to the given information, the possible arrangement is as follows.



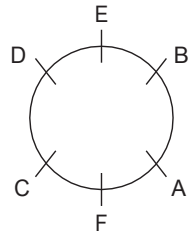
. A is sitting opposite to D.

6. The final arrangement is as follows.



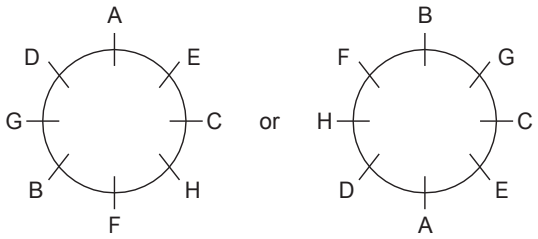
. S is sitting opposite to R.

7. It is given that A is two places away to the left of E, who is adjacent to B and D. D is to the right of E and A is setting between B and F. These conditions give us the following arrangement.



. A is sitting opposite to D.

8. It is given that A sits in between E and D, and F sits in between B and H.
It is also given that B and D sit neither adjacent to C nor opposite to C.



Hence, none of the choices is definitely true.

9. Given:

(i) Six corners (of a hexagonal table) P, Q, R, S, T and U.

(ii) Six people – A, B, C, D, E and F

(iii) $\underset{P}{\overset{\text{Right}}{\longrightarrow}}$ S; R $\underset{P}{\overset{\text{Left of}}{\longrightarrow}}$

(iv) E

∴ opp

F ⟷ A

(A is to the immediate right of F)

(v) D is sitting between the corners of P and T.

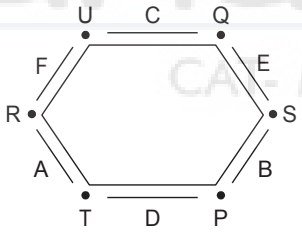
T/P_D_T/P

(vi) D $\xrightarrow{\text{opp}}$ C

(vii) R/U_F_U/R

Now, let us try to make an arrangement with the given information.

Clearly, E sits between the corners of Q and S.



Solutions for questions 10 to 12: Let us write the data as shown below:

(i) 6 people – Sameer (Smr), Sameep (Smp), Sandeep (Snd), Sangeet (Sgt), Sanskar (Skr) and Saarang (Srg) are sitting around a hexagonal table.

(ii) Colour of the books in their hands – Red, Green, Blue, Orange, White and Yellow.

(iii) Sameer $\xrightarrow{\text{opp}}$ Sameep

(iv) Sameep $\xrightarrow{\text{Immediate Left}}$ Blue

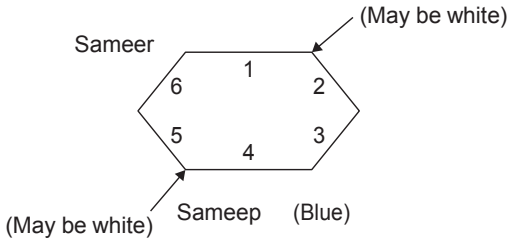
(v) Blue ____ ____ White (2 places away)

(vi) Sangeet ____ ____ Yellow (2 places away)

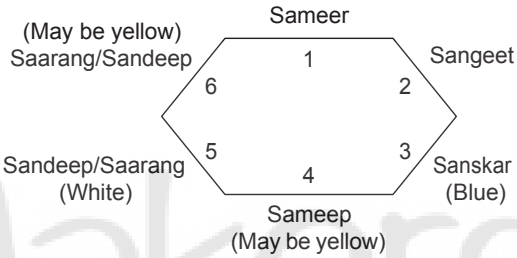
(vii) Sangeet is opposite to White.

(viii) Sandeep is adjacent to Saarang.

Based on (iii), (iv) and (v), we get the following arrangements:

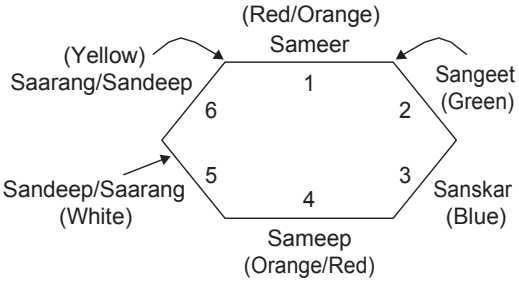


But from (vii), we get that Sangeet is opposite to White; in that case Sameer cannot have White coloured book in his hand, as he is opposite to Sandeep, not Sangeet. Hence, the person holding White coloured book must be to the immediate left of Sameep, i.e., at 5. Then Sangeet is opposite to White and to the left of Sameer, at 2. Now as Sandeep and Saarang are adjacent, hence, they must be accommodated at seat numbers 5 and 6, in any order. Then the only seat left for Sanskar is 3. Now, we get the following arrangement:



10. Hence, Sanskar holds the Blue cover book in his hand.

11. In the above figure, if the person sitting at 4 (i.e., Sameep) holds Yellow cover book, then the Red and Orange coloured books cannot be opposite to each other. Hence, the person sitting at 6 (i.e., either Saarang or Sandeep) must have Yellow cover book and Sameer and Sameep will have Red cover and Orange cover book in any order. Then, we get the following arrangement.

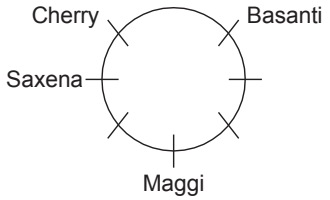


Hence, Sangeet must have Green book.

. Choice (B) is the only one that is definitely false.

12. Sandeep is sitting opposite to the person holding the Green cover book which implies that Sandeep is sitting opposite to Sangeet. Thus, either Sameer or Sandeep holds the Red cover book. Hence, it cannot be determined.

Solutions for questions 13 and 14: From (ii) and (iii), the arrangement of the persons can be represented as follows.

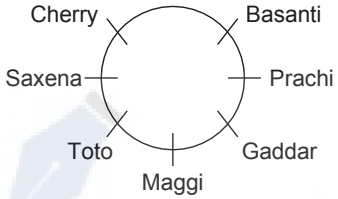


From (i) and (iv), neither Toto nor Gaddar is adjacent to Basanti.

. Prachi must be adjacent to Basanti.

As Toto is not adjacent to Prachi, Gaddar must be adjacent to Prachi.

The final arrangement of the person can be represented as follows.

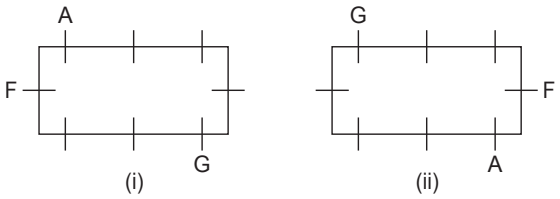


13. Maggi is sitting four places away to the left of Cherry.

14. Choice (C) is the correct representation.

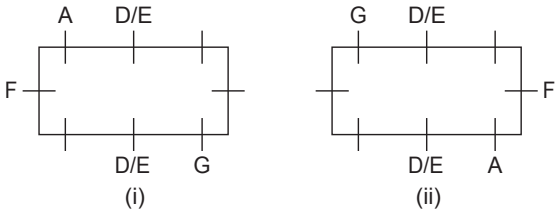
Solutions for questions 15 to 17: It is given that eight people, namely A, B, C, D, E, F, G and H are sitting around a rectangular table. One sits along the shorter side and three sits along the longer side.

A and G are sitting diagonally opposite to each other and A is sitting to the immediate left of F.

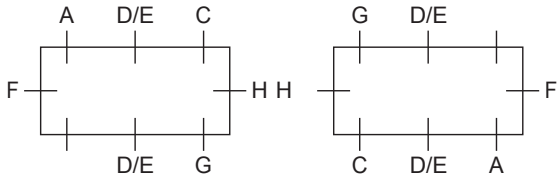


F is sitting along the shorter side.

D and E are sitting opposite each other, which is as follows.

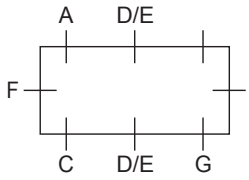


15. If C is sitting to the immediate right of H:



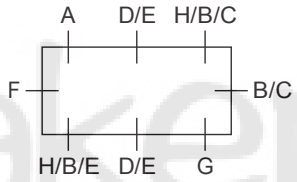
H sits opposite to F.

16. If C is sitting opposite to A, then the arrangement is as follows:



So, G sits on the same side as C.

17. If H is not sitting at one of the shorter sides, then the arrangement is as follows:



H is seated in two ways. B and C are seated in two ways.

D and E are seated in two ways.

Total ways = $2 \times 2 \times 2 = 8$

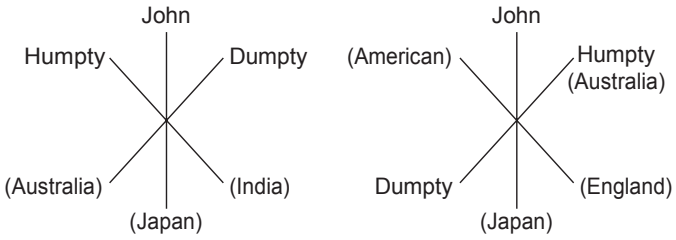
Solutions for questions 18 to 20: From the given information, John is from china and is adjacent to American who is not Humpty. But Humpty is opposite to the Indian who is not adjacent to Chinese but adjacent to Japanese, thus the following two arrangements are possible.

The English man is left to Australian thus in Case (i) Humpty can be from England and in Case (ii) Humpty can be from England and in Case (iii) Humpty can be from Australia. As Australian is opposite to the Dumpty.

Case (i), Dumpty is the Amercian and

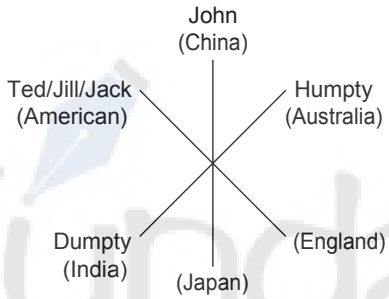
Case (ii), Dumpty is the Indian.

Thus, the arrangements are as follows.



Case (i): Now among the remaining people, i.e., Ted, Jill and Jack, as Ted and Jack are not from India Jill is the Indian. Ted and Jack are Australian and Japanese, respectively and are sitting adjacent to each other thus case (i) is not possible.
Case (ii): Either Jack or Jill is from the Japan. If Jack is from Japan, then Ted is the American and Jill is the English.

If Jill is the Japanese, then Ted is either from England or American and jack is either from England or America.



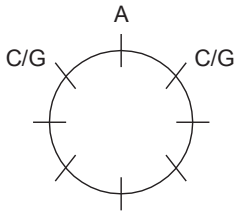
18. Dumpty is from India.

19. Jill is sitting opposite to the American.

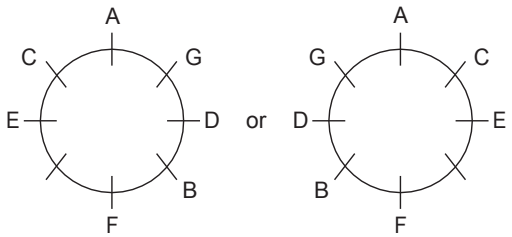
20. Humpty belongs to Australia.

Solutions for questions 21 to 23: It is given that eight friends, A through H are playing a game of cards and they belong to two different teams X and Y. No two persons of the same team sit adjacent to each other.

From (1), A sits between C and G but not opposite D or H.



From (1), (2) and (3), we get



Let the points scored by E = x, F = $x + 4$, D = $x + 7$ and A = $x + 9$.

Similarly, let the points scored by H = y, C = $2y$, G = $4y$ and B = $8y$.

21. B, H, C and G are the members of team X.

22. If E scores 1 point, then F scores 5 points, D scores 8 points and A scores 10 points.
A, D, E and F belong to team Y and their total points is 1 + 5 + 8 + 10 = 24 points.
Similarly, H scores 1, C scores 2, G scores 4 and B scores 8.
B, C, G and H belong to team X and the total sum of their points is 1 + 2 + 4 + 8 = 15 points. Hence, team X wins the game.

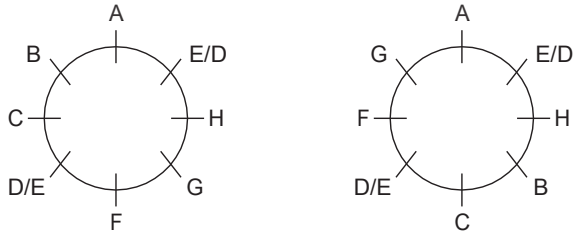
23. If team Y scores 92 points means E + F + D + A = 92.
$\Rightarrow x + (x + 4) + (x + 7) + (x + 9) = 92$
$\Rightarrow 4x + 20 = 92 \Rightarrow x = 18$.
E scores 18, F scores 22, D scores 25 and A scores 27. If team X scores 90 points, then
$y + 2y + 4y + 8y = 90$
$\Rightarrow 15y = 90 \Rightarrow y = 6$
H scores 6, C scores 12, G scores 24 and B scores 48. D scores one point more than G is definitely true.

Solutions for questions 24 to 26: From (i), it can be said that there is exactly one person sitting between C and F.

From (ii), Two people are sitting between C and G, the remaining people E and D are sitting opposite to each other.

From (iii), the representation of people sitting is as follows.

From (iv), B and G are opposite to each other and B is not sitting between C and F.

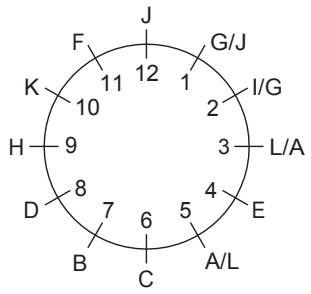


24. B will be sitting two places away to the right of F.

25. C will be sitting opposite to H.

26. D will be sitting two places away to the right of B.

Solutions for questions 27 to 29: It is given that, B is at 7th hour division and F is at 11th hour division. Given F is adjacent to K and J. K is to the immediate left of H. Hence, K is to the immediate right of F and J is to the immediate left of F. H is at 9th hour division. Given E is opposite to K. H is at 90° from C, which is 60° from D. Hence, C is at 6th hour division and D is at 8th hour division. Given L is at 60° from A. G is at 30° from I. Hence, the possible arrangements are as follows.

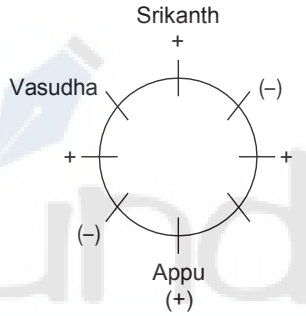


27. 150°

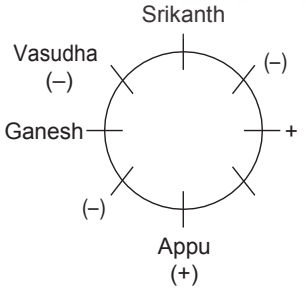
28. L is at 3rd hour division.

29. B or D is opposite to G.

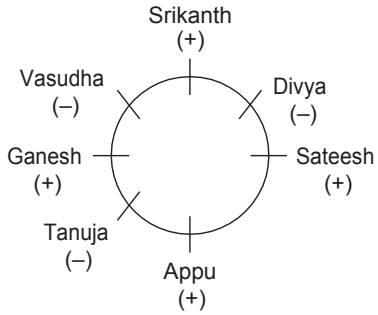
Solutions for questions 30 to 33: It is given that no two females are adjacent to each other. Vasudha (female) is third to the left of Appu (male) and Srikanth is to the immediate left of Vasudha.



Ganesh and Appu are not adjacent to each other. Hence, the arrangement will be as follows.



Appu and Sateesh are adjacent to each other, but Tanuja is not adjacent to Sateesh. Hence, the final arrangement will be as follows.



30. Divya is second to the right of Appu.

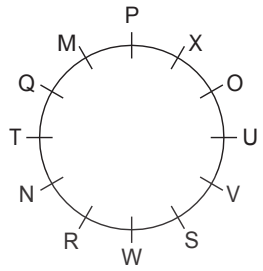
31. Ganesh is sitting adjacent to Vasudha.

32. Vasudha is sitting second to the right of Divya. Similarly, Sateesh is sitting second to the right of Tanuja.

33. Except Vasudha and Ganesh in all other options, the second person is sitting second to the right of first person.

Solutions for questions 34 to 37: From the given information, we can say that P, O, V, W, N and Q are sitting in alternate positions, starting from P in clockwise direction and M, T, R, S, U and X are sitting in alternate positions in anticlockwise direction and M is sitting adjacent to P.

The final circular arrangement is as shown below.



34. S is sitting adjacent to both V and W.

35. X is sitting opposite to R.

36. Six people.

37. V sits third to the left of R.

Solutions for questions 38 to 40: Let us take down the data as below;

(i) Six Russians, namely A, B, C, D, E and F and six French men M, N, O, P, Q and R.

(ii) A □ opp ↓ D

(iii) B □ opp ↓ E

(iv) D □ right ↓ C

(v) B = Russian to French;
C = French to Russian.

(vi) E adj F

(vii) M □ opp ↓ P

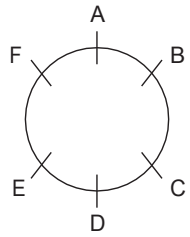
(viii) R □ right ↓ Q

(ix) R □ opp ↓ O

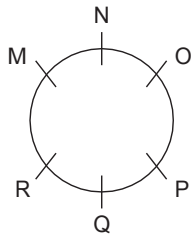
(x) (N and P) adj O

First of all, lets make the seating arrangement for the above data:

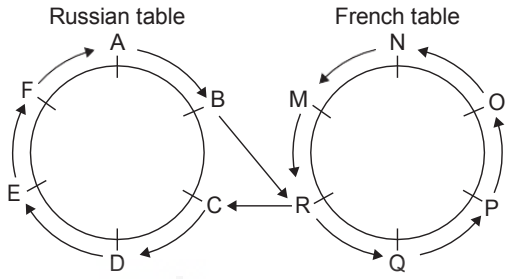
(A) Russian Table:



(B) French Table:



Also, it is given that:



38. C to M is:

(C) ➔ D ➔ E ➔ F ➔ A ➔ B ➔ R ➔ Q ➔ P ➔ O ➔ N ➔ (M)

= Total of 10 people

39. (A) The order of sending message will be as shown below:
A ➔ F ➔ E ➔ D ➔ C ➔ R ➔ M ➔ N ➔ O ➔ P ➔ Q
As the number of people involved is more than 2, hence, this statement is false.

(B) To the right of F is E and to the left of N is O. The route will be as shown:
(E) ➔ D ➔ C ➔ R ➔ M ➔ N ➔ (O)
As there are 5 people between E and O involved in passing the message. Hence, this statement is true.

(C) B sits to the right of C, who now translates French to Russian. Hence, this statement is false.

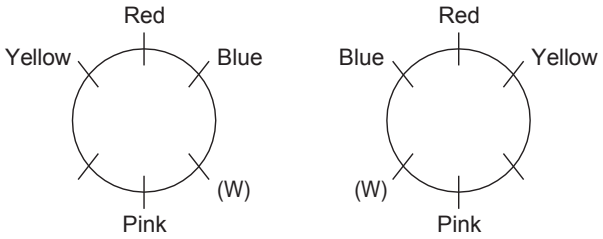
(D) The maximum number of people involved in sending message will remain the same in the new as well as the old arrangement. Hence, (D) is false.

40. A is sitting to the right of B and F is sitting two places to the left of D. The message from A to F can be sent in the following ways:
[A] , B, R, Q, P, O, N, M, R, C, D, E, [F]
So, all the 12 people are covered, subtract 2 from 12 (for A and F) and we get 10 people involved in between A and F. Also, in the route shown above, R is repeated twice, still the count is 10.

EXERCISE-2

Solutions for questions 1 to 5: From (A), we incur that red sofa is between blue and yellow sofas.

From (D), we incur that the sofa where W is sitting is adjacent to the blue and pink sofa. The pink sofa should be opposite to the red sofa. The partial arrangement will be as follows:



From (B), X is sitting on the white sofa and Z is opposite to X.

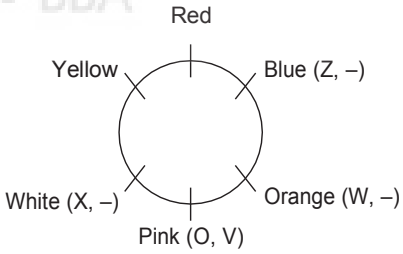
So, Z is either on yellow or blue sofa.

From (B) and (D), we incur that

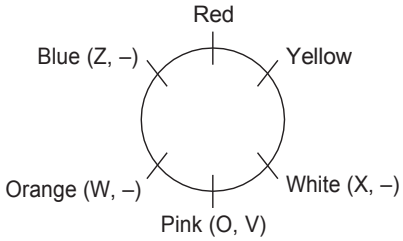
as X and W cannot be seated on the same sofa and X is on white sofa, W is on orange sofa.

From (C), O and V are in pink sofa.

. The possible arrangements are as follows:
Case – (i):

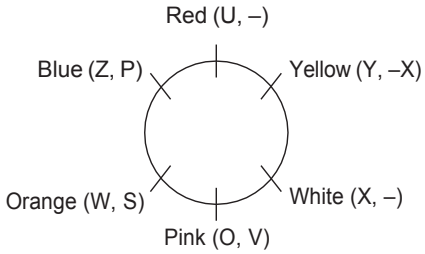


Case – (ii):



From (E), Y is opposite to S.

. Y is in yellow sofa and S is in the orange sofa. But in case (A) V is to the left of S, which contradicts (5). Hence, the following arrangement is possible.



1. U is sitting on red sofa.

2. Z and P are sitting on blue sofa.

3. Orange sofa is opposite the sofa where Y is sitting.

4. W and S are sitting on orange sofa.

5. Red, blue, orange, pink, white and yellow is the correct order.

Solutions for questions 6 to 9: The children are Sujatha, Bhuvan, Srilatha, Pranav, Krupa, Kruti and Anand.

From (v), Srilatha is the 4th person to finish her lunch.

From (i) and (iv), Sujatha, Bhuvan and Kruti finished their lunch immediately one after the other in that order. Hence, they can be either 1st, 2nd and 3rd children (or) 5th, 6th and 7th children to finish lunch.

From (iv), Pranav finished his lunch after Kruti. Hence, Sujatha, Bhuvan and Kruti are the first three people to finish their lunch.

From (iii), as Krupa is adjacent to the child who is the fifth to finish his/her lunch. Hence, Krupa cannot be the sixth person to finish her lunch. Hence, Krupa is the 7th child to finish her lunch.

From (ii), Pranav and Anand are the 6th and the 5th to finish their lunch.

The order of children from the child who finished his/her lunch first to that who finished his/her last is Sujatha, Bhuvan, Kruti, Srilatha, Anand, Pranav, Krupa.

The possible seating arrangement is as follows:

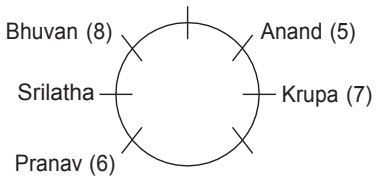
From (ii) and (iii), we incur that

Pranav is three places away to the left of Anand. Krupa is to the immediate left of the child who finished his/her lunch at the 5th place, which is Anand.

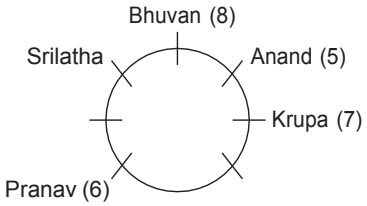
From (i), Bhuvan is to the left of Srilatha and both finished their lunch at the 3rd and the 2nd positions, respectively.

The possible arrangements are as follows:

Case (i):



Case (ii):

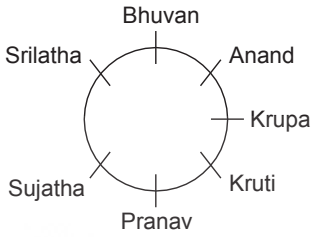


Let us consider case (i).

Here, neither Kruti nor Sujata can be adjacent to Bhuvan, because Kruti and Sujata are the 3rd and the 1st children to finish their lunch.

So, only case (ii) is possible.

Kruti cannot be adjacent to Srilatha, so Sujata is adjacent to Srilatha.



6. Five children finish their lunch before Pranav finishes his lunch.

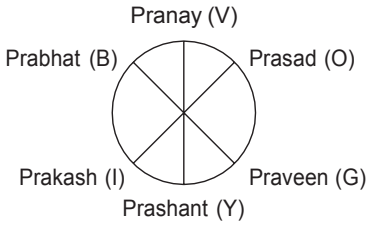
7. Srilatha finished her lunch after Kruti finished his lunch.

8. Kruti is to the immediate right of Pranav.

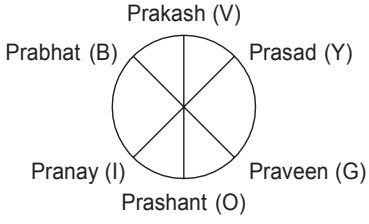
9. Anand, Krupa, Kruti, Pranav, Sujata, Srilatha, Bhuvan.

Solutions for questions 10 to 12: By taking the data given in the problem, we get the following four different arrangements. The first letters of the names of the colours are used to denote the colours.

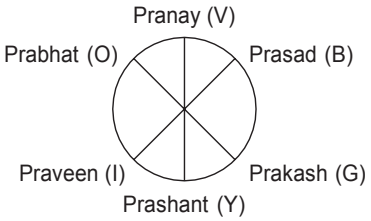
Case 1:



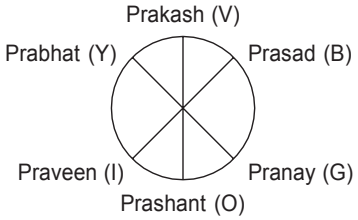
Case 2:



Case 3:



Case 4:



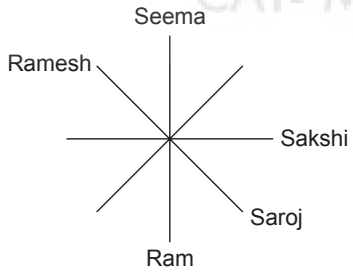
10. All the statements are true.

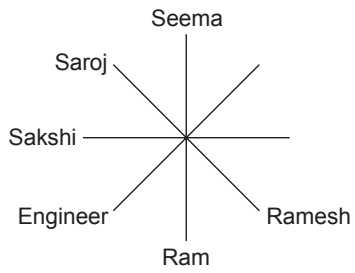
11. This question is referring to Case 3. In this case, it is Prakash who is wearing the Green T-shirt.

12. This question is referring to Cases 2 and 4. In both the cases it is Prashant who is between Praveen and Pranay.

Solutions for questions 13 to 15: From (II) and (V), we know that Seema, the Dancer is opposite to Ram, who is the Lawyer and Sakshi is not adjacent to anyone of these two.

From (IV) Sakshi, who is the Singer is at one place to the right of Saroj. And from (VI), Ramesh is sitting three places to the right of Singer.





From (I), Pilot is sitting opposite to Ramesh, thus Saroj is the Pilot and from (III), Saloni is opposite to the Engineer.

From (III) and above arrangement, Ramesh cannot be any one except Teacher. Saloni is the Doctor, Mohan is the Engineer and Sohan is the Accountant.

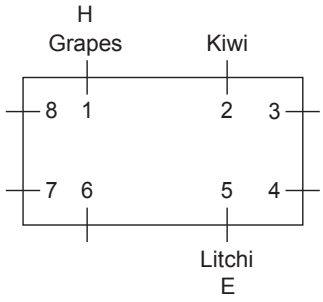
13. Saloni is the Doctor.

14. Mohan is the Engineer.

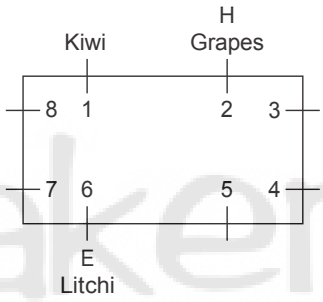
15. Saroj is sitting opposite to Ramesh.

Solutions for questions 16 to 18: From (ii) and (iv), we have two possibilities.

Case (i):



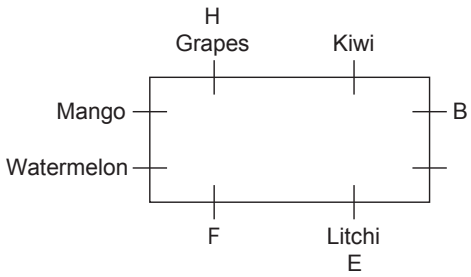
Case (ii):



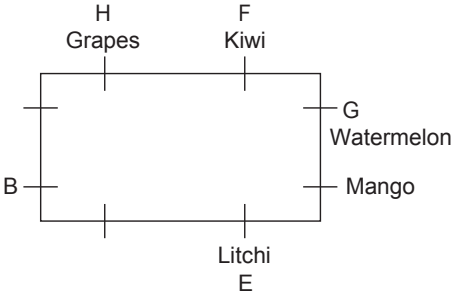
From (i), G has Watermelon and there are three boys between B and G.

From (v), the boys having Mango, Watermelon and F are seated one after the other in anticlockwise direction.

From case (i), the following arrangements are possible.



Or



But in either cases condition (iii) cannot be satisfied.

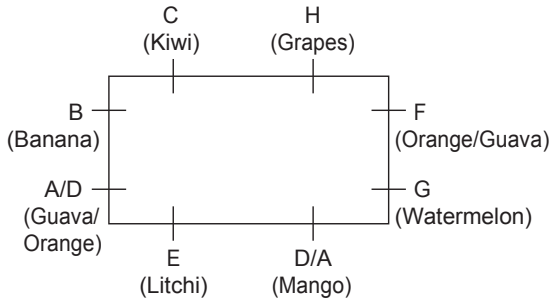
The possible arrangement from Case (ii), we incur the following:

From (iii), F has either Orange or Guava (As G has Watermelon and one boy on that side should have either Orange or Guava).

From (i), B has Banana (As, B is opposite to F).

Boy at position 7 has either Orange or Guava.

The final arrangement is as follows.



16. If A has Orange, then C will be opposite to D.

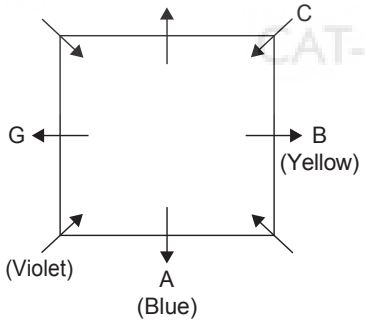
17. E is three places away to the left of F.

18. C – Kiwi is the correct combination.

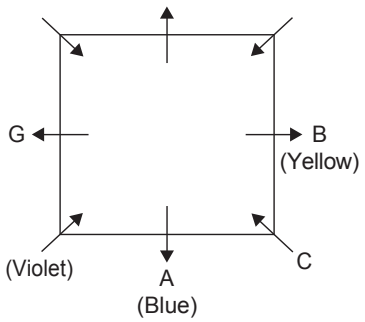
Solutions for questions 19 to 21: From (i) and (ii), G sits to the immediate left of the person who likes violet who sits to the immediate right of the person who likes blue.

From (iii), (iv) and (v), the possible cases are as follows.

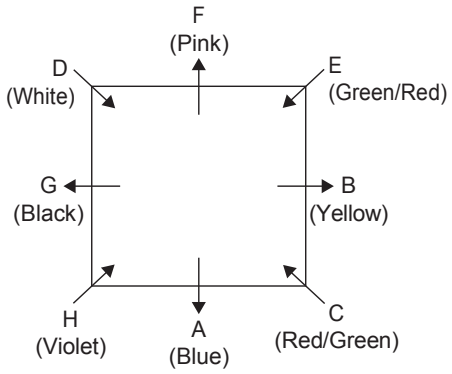
(i)



(ii)



From (vi), (vii), (viii), (ix) and (x), the possible arrangements are as shown below.



19. C or E

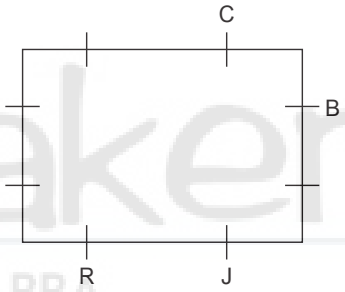
20. C

21. Except (C) remaining all sit at the corners.

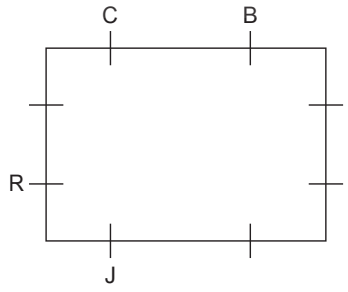
Solutions for questions 22 to 24: Let us represent the people by the first letters of each name.

From (i), we get the following possibilities.

Case (a):

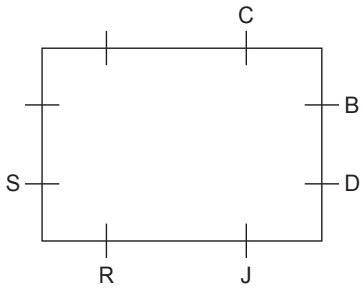


Case (b):

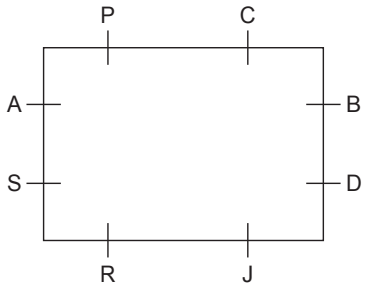


From (ii), as Brijesh and Dweepesh are sitting along the same side, Case (b) is not possible.

From (ii), we get



From (iii), the possibility is as follows.



22. Palak is sitting along the same side as Chandak.

23. Palak is sitting opposite to Rupak.

24. Rupak is sitting to the immediate right of Sayan.

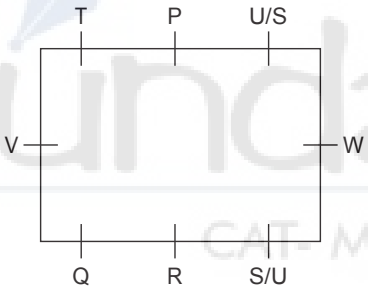
Solutions for questions 25 to 27: From (i), V sits to the immediate left of Q.

From (ii), R sits opposite to P.

From (iii), W sits third to the right of Q.

From (v), W sits third to the left of T.

From (iv), (vi) and above, the possible arrangements is as follows.



25. W sits opposite to V.

26. S, U and P.

27. Q or U.

Solutions for questions 28 to 32: As there are three married couples and two of them have two children each, the eight-member family is possible only with the following structure.

( ) Couple ( )

( ) Couple ( ) Sibling ( ) Couple ( )

( ) Sibling ( )

From (iv), we can say that there are 3 females and 5 males in the family.

From (iii), we can say that H is from the second generation, as H has a sister-in-law as well as father-in-law. From (viii), we know that H is a female. Thus, one of the siblings in the second generation is male and the other is a female. Now from (ii), A is male and has two sons.

As H is the aunt of E,

A cannot be H's husband as only one of the two couples in the second generation has children.

As F is the youngest and he is not G's son, he must be A's son.

Thus, from (ii), (iii), (vi) and (viii), we have the following.

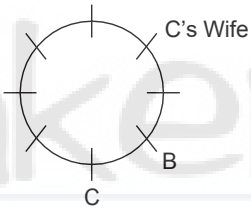
m f
C—(D/G)

m f m f
A—B Sibling (G/D)—H

m m
E Sibling F

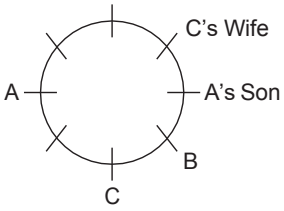
We do not have any information about D and G so let us leave it here.

Now, from (iii) and (vi), we get the following arrangement.

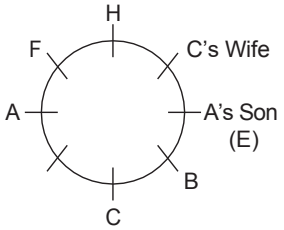


Now, only two seats that are opposite to each other are vacant. Thus, from (ii), A cannot be to the immediate right of B.

Thus, we get the following arrangement.

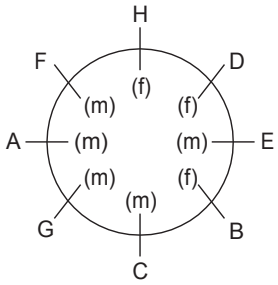


Since F is A's son and F is adjacent to both H. From (vii), (ii) and A, we get the following arrangement.



From (viii), E is three places away from G.

So, we get the following arrangement.



Thus, D is C's wife and G is H's husband.

28. G is C's son.

29. A's brother-in-law is G. G's nephew is E whose grandmother is D.
D is B's mother.

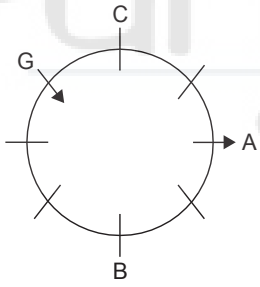
30. E's father is A. C's daughter-in-law is H. A is second to the right of H.

31. E, G and F are males while B is a female.

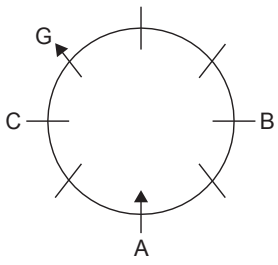
32. F is E's brother.

Solutions for questions 33 to 36: From (i), (ii) and (iii), the possible arrangements are as follows.

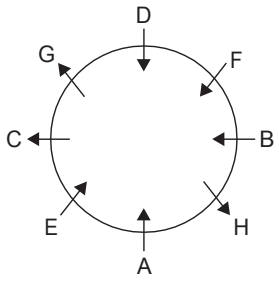
(i)

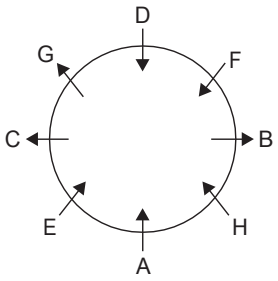


(ii)



From (iv), in case (i), C faces the centre.
In case (ii), C faces away from the centre.
From (v), in both the cases D sits to the immediate right of G.
From (vi) and (vii) and above, the possible arrangement is as follows.





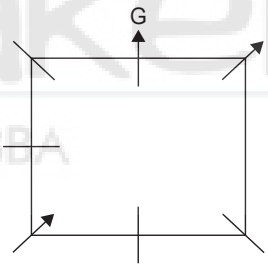
33. 5 people

34. D (From case (i)).

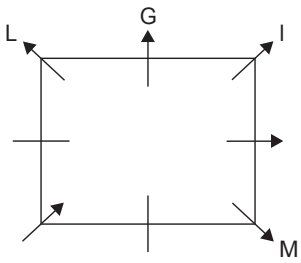
35. A (From case (ii)).

36. H or F

Solutions for questions 37 to 40: From (i), I is sitting at one of the corners and facing away from the centre.
(ii) The neighbour of I faces the same direction as I faces, hence, they face away from the centre.
From (ix), the one who sits opposite to I faces a different direction from which I faces, hence, he/she faces the centre.
From (iv), L and M face the same direction and sits opposite to each other.
From (vii), 'G' is to the immediate left of I.
From (ii), neither J nor M is a neighbour of I.

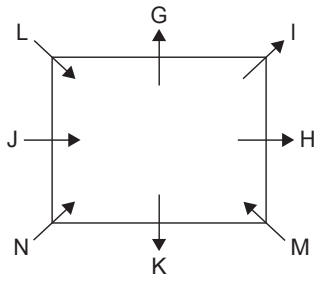


Let us assume that L and M face away from the centre and L is to the immediate left of G.



H is to the immediate right of M. If we place 'H' there we cannot place J and K, since from (viii), J and K are neighbours of N.
Hence, L and M must be facing the centre.
From (x), K must be facing away from the centre.
From (viii), J must be facing the centre.

Hence, the final arrangement is as follows:



37. Four people are facing away from the centre.

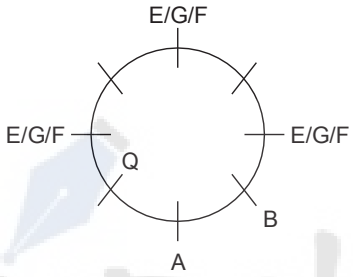
38. Except MN, in all other pairs JH, NI and MK and KN both are facing different directions.

39. M is sitting to the immediate right of H.

40. K is sitting opposite to G.

EXERCISE-3

Solutions for questions 1 to 3: From (1) and (3), we have:



From (2), no two people among P, T, V and W are opposite to each other and no two people from Q, R, S and U are opposite to each other.

From (4), the people from S cannot be opposite to the person from Q.

. The person from S must be B.

From (6), C is from W and H is from Q.

Also, C and H are opposite to each other.

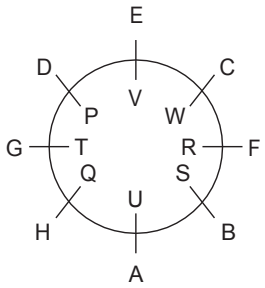
From (5), G must be to the immediate left of H.

. E is to the immediate left of D.

From (6) and (2), E must be from V.

F is from R and A is from U.

. The final arrangement will be as follows:



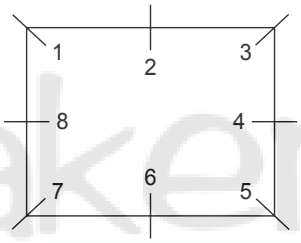
1. F is from R.

2. A is to the immediate right of H.

3. A is opposite to the person from V.

Solutions for questions 4 to 6: It is very clear from the given statements that the room (say table) has eight positions, of which four are at the corners and other four are at the four centres of the four sides of the table, which looks like the arrangement as follows.

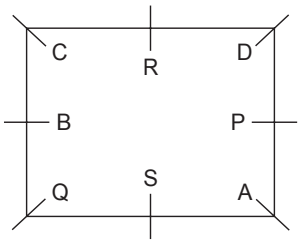
Let us number the chairs 1 to 8.



PQRS, four girls and ABCD, four boys are occupying these eight chairs. Let us analyse all the conditions.

Q is at the corner seat, so it can be anywhere either at 1 or 3 or 5 or 7. Let us say that Q is at seat 7, but as it is given that R is not along the same wall as Q, hence R must be at seat 2 or 3 or 4 whereas A and C are diagonally opposite. So, A and C must be at seat 1 and 5 not necessarily in that order. As B does not sit along any wall adjacent to the corner where A sits, but B is opposite to P. So, if A is at seat 1, then B is at 4 or 5 or 6. If so P must be at 8 or 1 or 2. Finally, as it is given that C is to the immediate right of R who is between C and D, the diagram must be as follows.

Table I



4. S is sitting between Q and A. Refer the table (I).

5. If S and P interchange their positions, then the arrangement will be as follows.

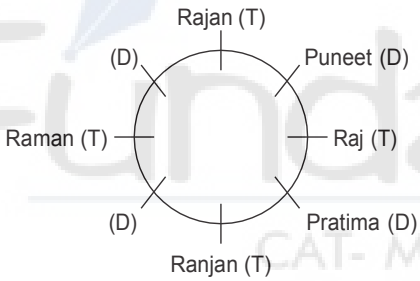
C	R	D
B		S
Q	P	A

S is to the immediate left of D.

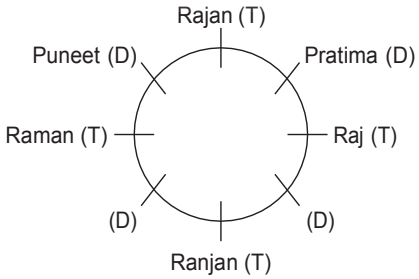
6. The corner seat arrangement clockwise is ⇒ Q, C, D, A(or) C, D, A, Q (OR) D, A, Q, C (OR) A, Q, C, D.
The anti-clockwise arrangement is:
A, D, C Q (OR) D, C, Q, A (OR)
C, Q, A, D (OR) Q, A, D, C.
Choice (A) in Q, A, D, C – Correct.
Choice (B) in A, Q, C, D – Correct.
Choice (C) in D, A, Q, C – Correct.
Choice (D) in D, Q, A, C – Incorrect.

Solutions for questions 7 to 9: The arrangements which can be made based on the data given.

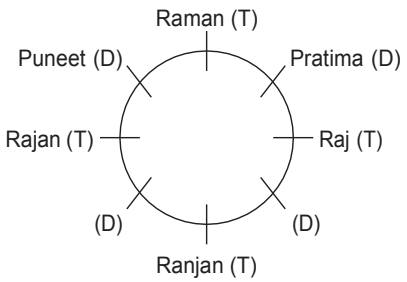
I



II



III



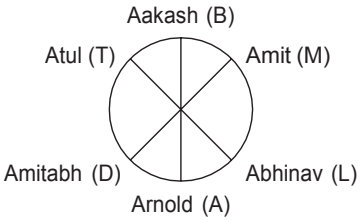
7. Here, cases I and II prevail and it is evident that Raman is two places to the left of Ranjan.

8. If Pratima is adjacent to Raman, then case III prevails and Rajan is opposite to Raj.

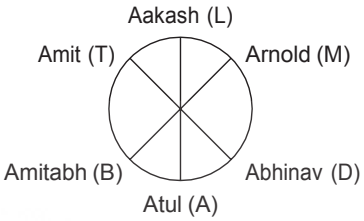
9. If Pratham is not opposite to Puneet, then in any of the two cases Pratham has to be opposite Pratima.

Solutions for questions 10 to 12: We arrive at the following two different arrangements. The first letters of the names of the professions are used to denote the profession.

Case 1:



Case 2:



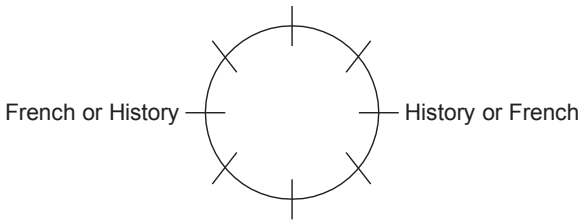
10. In all the cases, it can be observed that Amit is between the Lawyer and the Business Analyst.

11. This question refers to case (2), in which Abhinav is the Doctor.

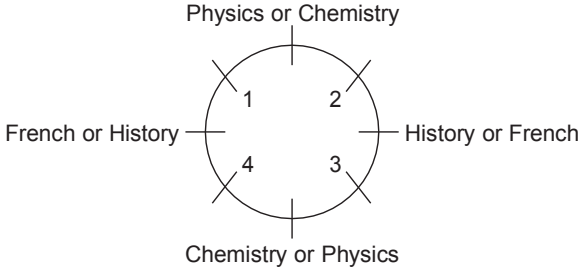
12. This question refers to case (2), where Arnold is sitting opposite Amitabh.

Solutions for questions 13 to 15: Let us analyse all the conditions. A person has eight shelves around him.

French books and History books are on opposite shelves. French, German and English books are in side by side shelves. Physics and Chemistry books are in opposite shelves.

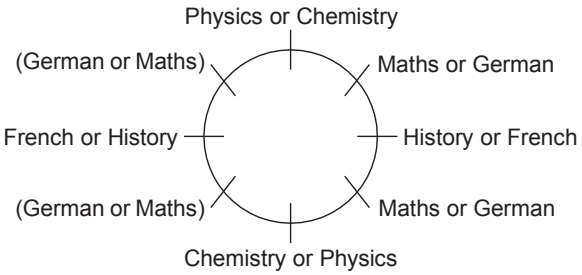


Physics and Chemistry should be on the perpendicular diagonal shelves. The final arrangement is



As French books must have English and German books on either side, these can be 1 and 4 or 2 and 3.

13. If the books on German are opposite to the shelf of Maths books, the arrangement will be as follows.

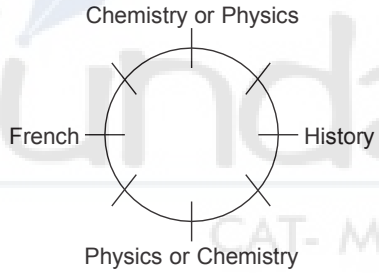


As German is between Physics and French, it can be at any of the two places as shown.

Then, Mathematics books may be between History and Chemistry shelves.

Then, English and Sociology shelves would be opposite to each other.

14. The shelf of Sociology is between the shelves with Physics and History books. Then the arrangement is

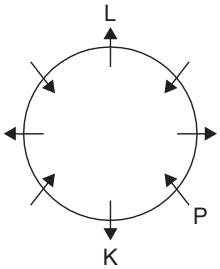


Hence, the books on Mathematics should be between books on History and Chemistry.

15. English books are to the immediate left of Physics books, so that the shelf must be between the shelves with French and Physics books. So, German books would be between the shelves of Chemistry and English. So, they are to the immediate right of Chemistry or French books.

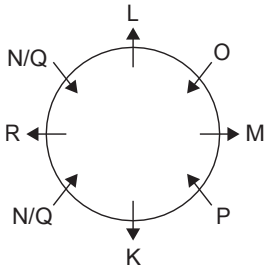
Solutions for questions 16 to 18: From (vi), L sits opposite to K and faces away from the centre. From (iv), no two people sitting next to each other face the same direction and from (i), P sits to the immediate left of K.

From the above points we get the following arrangement.



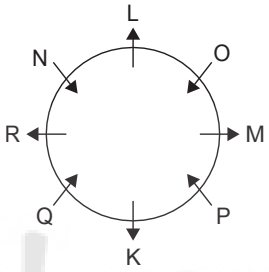
And from (ii), M and R are sitting opposite to each other. From (v), R is the neighbour of both N and Q.

Hence, the arrangement is



From (iii), either Q or O sits next to L.

Hence, the final arrangement is



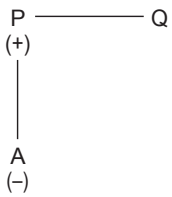
16. Among KM, ML, and NO, the second person sits second to the left of the first person.
In PO, the second person is second to the right of the first person.

17. L sits to the immediate right of 'O' and is definitely true.

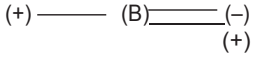
18. If M and N interchange their places, then L sits to the immediate left of M.

Solutions for questions 19 to 21: It is given that:

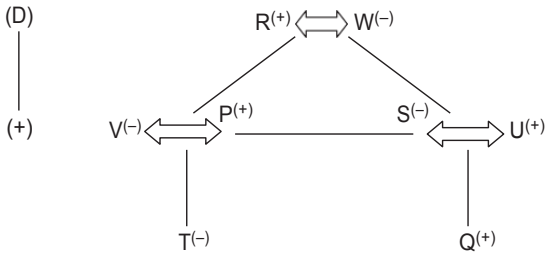
(i)



(ii)



(iii)

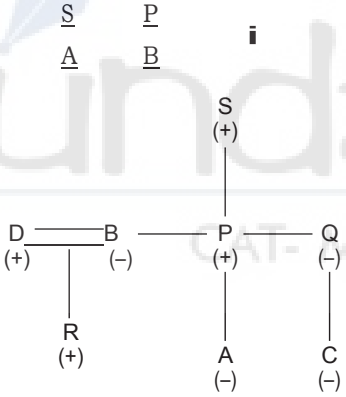


Given, P is the brother of Q, who is not adjacent to either P or S. Hence, Q sits either at the left end or right end and R sits adjacent to Q. Also given, A is the daughter of P and sits to the immediate right of B's husband. C is the niece of P. Hence, D is the husband of B and as D is not opposite to either P or S, we get the following cases.

(i)	P/S	S/P	R	Q
	__	__	D	A
(ii)	Q	R	S/R	P/S
	D	A	__	__
(iii)	Q	R	S/P	P/S
	__	D	A	__

Given, C does not sit opposite either P or S, hence, case (i) and (ii) can be eliminated. In case (iii), C sits at the left end, B sits at the right end. Given, B is not opposite to S, but is opposite to her brother. Hence, B is opposite to P, who is the brother of B. As, D has only one child who is a male, it is either R or S and C is the daughter of Q but, given Q is the daughter of C's grandfather who is not R. Hence, R should be the son of D and S is the grandfather of C. Therefore, the final arrangement and the family tree are as follows.

Q	R	S	P
C	D	A	B



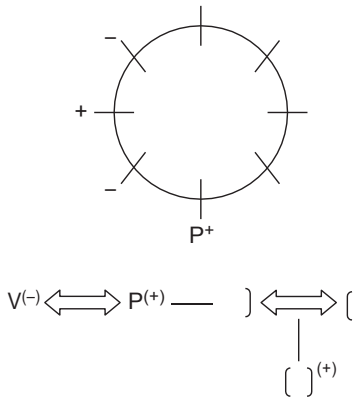
19. D's father-in-law (S) is to the immediate right of P.

20. Q's daughter sits at an end.

21. Choice (B) is true.

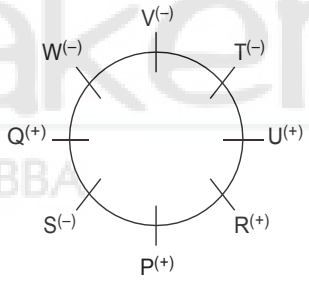
Solutions for questions 22 to 25: It is given that, P sits second to the right of his nephew whose neighbours are females.

V is the wife of P and sits to the immediate right of her daughter T.



U sits second to the right of his brother-in-law and opposite his son Q. Hence, Q must be the nephew of P who is the brother-in-law of U. From (2), we come to know that V sits to the immediate right of her daughter T. We can place T only to the immediate right of U. From (4), we can say that S is the daughter of R and wife of U. From (5), we can say that W is the wife of R, and P and S are their children. Finally, the positions are, W sits to the immediate right of V, R sits to the immediate left of U, and S sits to the immediate right of P.

The final arrangement of the given family members is as follows.



22. Both the options (A) and (B) say about the wife of U.

23. All the options (A), (B) and (C) are saying about the niece of S.

24. None of the given options is true.

25. Except option (C), in all other options the opposite genders are given.

3 Distributions

Chapter

Learning Objectives

In this chapter, you will:

- Learn how to interpret the statements given and fill a table.
- Learn how to arrive at the final distribution of parameters among people/objects from the partially filled table.
- Apply knowledge of distributions to linear and circular arrangements.
- Understand and learn to solve puzzles that involve multiple parameters.

In this type of problems, you have to match two or more variables [Variable means a 'subject' as used in the discussion of linear arrangement]. In double line-up, the data given may talk of four people living in four houses each of a different colour. What we need to find out is the colour of the house of each of the four persons. There is no first position or second position of the houses.

Sometimes, double line-up is also known as distribution.

An example of data given for this variety of questions is:

Each of the four people A, B, C and D wears a different coloured shirt, such as red, pink, blue and white. A has a red shirt and D does not have a pink shirt. From the above statement, it becomes clear that no person among A, B, C and D can have shirts of two different colours among red, pink, blue and white.

As discussed in the questions on single line-up, questions can be solved easily by representing the given data pictorially. In case of double line-up, it will help us if we represent the data in the form of a matrix or a table.

Let us see how to draw a matrix for the data given above.

	Colours			
Names	**Red**	**Pink**	**Blue**	**White**
A	✓			
B				
C				
D		×		

As it is given that A has red colour shirt, it is clear that he does not have any other colour shirt. Similarly, B, C, D do not have red colour shirt. So, in all the other cells in the row belonging to A, we put a cross ('×'). Then, the table will look as follows:

	Colours			
Names	**Red**	**Pink**	**Blue**	**White**
A	✓	×	×	×
B	×			
C	×			
D	×	×		

In this manner, we can fill up the cells on the basis of the data given to us. Once, we use up all the data, we will draw any conclusions that can be drawn and then answer the questions given in the set. You will understand this better by going through the solved example section below, please try to solve them first without looking at the solution.

Solved Examples

Directions for questions 3.01 to 3.05: These questions are based on the following information.

P, Q, R, S, T, U, V and W are eight employees of a concern. Each of them is allotted a different locker, out of eight lockers numbered from 1 to 8 in a cupboard. The lockers are arranged in four rows with two lockers in each row.

Lockers 1 and 2 are in the top row from left to right, respectively while lockers 7 and 8 are in the bottom row arranged from left to right, respectively. Lockers 3 and 4 are in the second row from the top, arranged from right to left, respectively. So are lockers 5 and 6 arranged from right to left, respectively in the second row from the bottom. P has been allotted locker 1 while V has been allotted locker 8. T's locker is just above that of Q which is just above that of R, whereas W's locker is in the bottom row.

3.01: Which of the following cannot be the correct locker number–occupant pair?
(A) 3-Q (B) 7-W
(C) 4-U (D) 6-R

3.02: If U's locker is not beside Q's locker, whose locker is just above that of W?
(A) U (B) S
(C) R (D) Q

3.03: Which of these pairs cannot have lockers that are diagonally placed?
(A) P-Q (B) S-R
(C) U-R (D) Either (B) or (C)

3.04: Which of the following groups consists only occupants of odd numbered lockers?
(A) Q, R, W (B) R, V, W
(C) T, R, Q (D) P, T, Q

3.05: If U's locker is in the same row as that of R, and S exchanges his locker with V, then who is the new neighbour of V in the same row? (Assume that nothing else is disturbed from the original arrangement)
(A) P (B) Q
(C) R (D) U

Solutions for questions 3.01 to 3.05: Let us first try to locate the lockers in the cupboard as per the conditions given. Then, we will do the allotment to the people.

Lockers 1 and 2 are in the top row and lockers 7 and 8 are in the bottom-most row. In these two rows, the lockers are numbered from left to right. In the other two rows, the lockers are numbered from right to left.

L	R	
1	2	Top Row
4	3	
6	5	
7	8	Bottom Row

Now let us look at the conditions given for the allotment of the lockers.

P has locker 1. V has locker 8.

1-P	2
4	3
6	5
7	8-V

Locker of W is in the bottom row ➔ W's locker must be 7.

1-P	2
4	3
6	5
7-W	8-V

T's locker is just above that of Q, which is just above that of R ➔ The lockers of T, Q and R must be 2, 3 and 5, respectively (there are no other group of lockers which satisfy this condition).

1-P	2-T
4	3-Q
6	5-R
7-W	8-V

S and U have lockers 4 and 6 left for them.

Thus, on the basis of the data given to us, we can show the final arrangement of lockers as below:

1-P	2-T
4-S/U	3-Q
6-U/S	5-R
7-W	8-V

Now we can answer the questions easily on the basis of the above table.

3.01: By looking at the final arrangement of lockers above, we find that choice (D) does not represent the correct combination of locker number-occupant pair.

3.02: If U's locker is not beside Q's locker, then U's locker must be locker 6. So, it is U's locker that will be immediately above W's.

3.03: R's locker is in the same row as that of exactly one of S or U and diagonally placed to the other one. Hence, 'either S-R or U-R' is the answer.

3.04: The odd-numbered lockers 1, 3, 5 and 7 belong to P, Q, R and W, respectively. Of the choices, we find that Q, R, W appear in choice (A). Hence, this is the correct choice.

3.05: U's locker is in the same row as that of R which means that locker 6 belongs to U. So, locker 4 belongs to S. Now V and S exchange lockers. Then the new neighbour of V is Q.

Directions for questions 3.06 to 3.09: These questions are based on the following information.

There are four variety of trees, such as Lemon, Coconut, Mango and Neem each at a different corner of a rectangular plot. A Well is located at one corner and a Cabin at another corner. Lemon and Coconut trees are on either side of the Gate which is located at the centre of the side opposite to the side at whose extremes, the Well and the Cabin are located. The Mango tree is not at the corner where the Cabin is located.

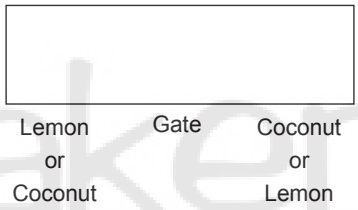
3.06 : Which of the following pairs can be diagonally opposite to each other in the plot?
(A) Neem tree and Lemon tree
(B) Cabin and Neem tree
(C) Mango tree and Well
(D) Coconut tree and Lemon tree

3.07 : If the Lemon Tree is diagonally opposite to the Well, then the Coconut tree is diagonally opposite to the
(A) Mango tree (B) Well
(C) Cabin (D) Gate

3.08: If the Coconut tree and the Neem tree cannot be at adjacent corners of the plot, then which of the following will necessarily have to be at diagonally opposite corners of the plot?
(A) Coconut tree and Well
(B) Lemon tree and Cabin
(C) Lemon tree and Coconut tree
(D) Lemon tree and Well

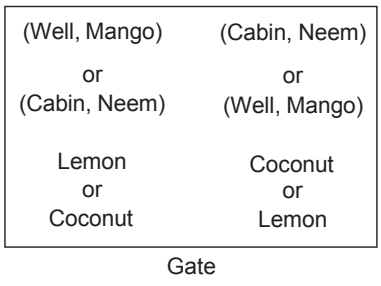
3.09: Which of the following is definitely false?
(A) Mango tree is adjacent to the Well at one corner.
(B) Neem tree is adjacent to the Cabin at one corner.
(C) Coconut tree is at the corner adjacent to the Well.
(D) Lemon tree is not on the same side of the plot as the Gate.

Solutions for questions 3.06 to 3.09: Lemon and Coconut are on either side of the gate.



The Well and the Cabin are at either end of the Well opposite to the Gate.

Mango tree and Cabin are not at the same corner. So, Neem tree and Well are not at the same corner. This means that Mango tree and the Well are at the same corner and Neem tree and the Cabin are at the same corner.



3.06: Let us take each choice and check with the above diagram to see if it is possible or not.
Neem and Lemon can be diagonally opposite to each other. Hence, this is the correct answer choice. (In an exam, you do not need to check the other choices since the first choice is correct. But, for the sake of clarity and proper understanding, we will check all the choices).

From the diagram given above, we can see that Cabin and Neem cannot be located diagonally opposite to each other.
Mango and Well cannot be located diagonally opposite to each other.
Coconut and Lemon cannot be located diagonally opposite to each other.

3.07: If Lemon tree is diagonally opposite to the Well, then we can have the following two possible arrangements.

Neem	Well
Cabin	Mango

OR

Well	Cabin
Mango	Neem

The Coconut tree is diagonally opposite to the Cabin and Neem.

3.08: Since Coconut and Neem trees cannot be at adjacent corners, the following arrangements are possible.

(Well, Mango)	(Cabin, Neem)
Coconut	Lemon

OR

(Cabin, Neem)	(Well, Mango)

From the above diagrams, we find that choice (D) is the correct answer.

3.09: We check each statement with the diagram that we drew initially to find out which of the statements has to be false.
We find that choice (D) has to be false.

Directions for question 3.10: Select the correct answer from the given choices.

3.10: A, B, C and D play four different games among Baseball, Cricket, Kabaddi and Volleyball. A does not play Baseball or Cricket. B does not play Kabaddi or Volleyball. C plays Volleyball and D plays either Baseball or Volleyball. Who plays Cricket?

(A) A (B) B
(C) C (D) D

Solution for question 3.10:

3.10: C plays Volleyball. A does not play Cricket and D does not play Cricket as he plays either Baseball or Volleyball.
∴ B should play Cricket.

Exercise-1

Directions for questions 1 to 9: Select the correct alternative from the given choices.

1. Each of the five people, namely Bhanu, Lalit, Modi, Ravindra and Kamal is wearing a different coloured shirt among white, black, brown, indigo and yellow. Bhanu is wearing neither a yellow nor a black coloured shirt. Lalit is wearing neither an indigo nor a white coloured shirt. Modi is wearing neither indigo nor a yellow coloured shirt. If Ravindra and Kamal are wearing black and indigo coloured shirts, then which coloured shirt is Lalit wearing?

(A) Brown (B) Yellow
(C) White (D) Cannot be determined

2. Rama, Bhima and Bond have to take two articles each from the available six articles, such as Gun, Bow, Arrow, Mace, Sword and Dagger. Bhima will not take the Gun or the Bow, and Bond will not take any of the Sword, the Bow or the Dagger.
If one of the three people takes the Sword and the Mace, then what is the other item selected by the person who selects the Gun?

(A) Bow (B) Arrow
(C) Dagger (D) Cannot be determined

3. A group of four students, namely Sagar, Swaroop, Sachin and Suman went to four different cities, such as Mumbai, Vijayawada, Hyderabad and Nagpur to take 4 different tests XAT, JMET, CET, CAT. The following data is also known.

1. Suman did not take JMET.
2. Swaroop did not go to Hyderabad and he did not take CET and XAT.
3. CET was conducted in Nagpur.
4. Sagar did not go to Nagpur and he did not take CAT.
5. Sachin had gone to Mumbai.

If Sagar did not take XAT, then which of the following is the correct combination of the city visited and the test written by Swaroop?

(A) Vijayawada and JMET
(B) Nagpur and JMET
(C) Hyderabad and CAT
(D) Vijayawada and CAT

4. Five trains, such as GT Express, AP Express, Rajdhani Express, Goa Express and Bangalore Express travel to five different cities, like Delhi, Goa, Chennai, Bangalore and Hyderabad, not necessarily in the same order. No two trains travel to the same city and no two cities can be visited through the same train. GT Express travels to neither Delhi nor Chennai. Neither AP Express nor Goa Express pass through Hyderabad Bangalore can be visited by either Goa Express or AP Express. Rajdhani Express travels to Chennai. Either Goa Express goes to Hyderabad or the Bangalore Express goes to Delhi.
Which one of the following statements would help in completing the arrangement?

(A) Either Chennai is visited through Rajdhani Express or Goa is visited through AP Express.
(B) Only if Bangalore is visited through Bangalore Express, is Goa then visited through Goa Express.
(C) If Goa Express goes to Bangalore, then AP Express goes to Goa.
(D) If Bangalore is visited through AP Express, then Delhi is visited through the Bangalore Express.

5. Each of five men, such as A, B, C, D and E is married to a different female among P, Q, R, S and T, not necessarily in the given order. S is the wife of B and D is not the husband of P, who is not the wife of A. E is the husband of T. Who is the wife of C?

(A) D (B) P
(C) R (D) Cannot be determined

6. Each of the four people, namely Ramesh, Rajesh, Ramani and Ravan work for four different companies among TCS, CTS, Wipro and Accenture. Each of them belongs to a different city among Delhi, Kolkata, Mumbai and Chennai. The following information is known about them.

(1) Rajesh is from Kolkata but does not work in Wipro and the person who works in Wipro is not from Chennai.
(2) Ravan works neither in Wipro nor in Mumbai.
(3) Ramani works neither in Mumbai nor in Accenture.
(4) Ramesh works neither in TCS nor in Wipro and the person from Kolkata works neither in TCS nor in CTS.

Who is working in CTS?

(A) Ramesh (B) Rajesh
(C) Ramani (D) Ravan

7. Shiva brought 4 boxes, each of a different colour. Each of these boxes contains chocolates of a different brand. He distributed one box to each of his four friends. Manju received a red coloured box but not Eclairs. Either blue or orange coloured box is received by Sanju. Tanooj received Kit Kat. One of them received Bar One while Pooja received neither yellow coloured box nor Dairy Milk. If the orange coloured box contains Diary Milk, then which of the following is true?

(A) Sanju received Bar One.
(B) Bar One is in red coloured box.
(C) Eclairs is in yellow coloured box.
(D) Tanooj received blue coloured box.

8. The teacher in-charge of a class summarized the analysis of number of students who took tests in three different subjects, such asMaths, Physics and Chemistry. No student has appeared for more than one test. Half of the students who took the test in Chemistry passed it. The number of students who passed the Physics test is equal to the number of students who passed the Maths test. The number of students who failed the Maths test and the number of students who failed the Chemistry test are equal. 30% of the students who took the Physics test failed it. 100 students failed the Maths test. If the total number of students who took the tests is 470, then which of the following is true?

(A) Among the students who took tests in different subjects, the number of students who took the test in Physics is the minimum.

(B) The number of students who failed the Maths test is not the least.

(C) The number of students who passed the Maths test is more than those who passed the Chemistry test.

(D) More than one of the above.

9. In a campus recruitment each of the four friends studying in VIT College of Engineering were recruited for a different city and each of them is from any one of the two departments Electronics and Civil. Tinku is recruited for Kolkata. One of the Electronics students is recruited in Bhopal. Pinku belongs to Electronics but is not recruited for Hyderabad. Chinku is not recruited for Chennai and is not from Electronics department. Minku and Tinku belong to the same department. If Pinku is not recruited for Bhopal, then which of the following is true?

(A) Pinku is recruited for Chennai.

(B) Chinku is recruited for Hyderabad.

(C) Minku is recruited for Bhopal.

(D) All the above

Directions for questions 10 and 11: These questions are based on the following information.

A group of three people Karan, Manohar and Jamal own one of the cars from Zen, Alto and Indica. Each of these cars are parked in different parking spaces P1, P2 and P3. It is known that Alto is parked in P2 and it does not belong to Manohar. Jamal owns Indica and Zen is not parked in P1.

10. Which car does Karan owns?

(A) Zen (B) Alto

(C) Indica (D) Either Zen or Indica

11. In which parking space did Jamal park his car?

(A) P1 (B) P2

(C) P3 (D) Either P1 or P3

Directions for questions 12 and 13: These questions are based on the following information.

Each of the four people Ramesh, Rajesh, Ramani and Ravan work for four different companies among TCS, CTS, Wipro and Accenture. Each of them belongs to a different city among Delhi, Kolkata, Mumbai and Chennai. The following information is known about them.

(1) Rajesh is from Kolkata but does not work in Wipro and the person who works in Wipro is not from Chennai.

(2) Ravan works neither in Wipro nor in Mumbai.

(3) Ramani works neither in Mumbai nor in Accenture.

(4) Ramesh works neither in TCS nor in Wipro and the person from Kolkata works neither in TCS nor in CTS.

12. Who is from Chennai?

(A) Ramesh (B) Rajesh

(C) Ramani (D) Ravan

13. Who is working in CTS?

(A) Ramesh (B) Rajesh

(C) Ramani (D) Ravan

Directions for questions 14 to 16: These questions are based on the following information.

Ten monkeys from A through J visit a garden which has tree bearing fruits, such as Mango, Guava, Banana and Berry.

Further it is known that:

(i) Only one monkey visited all the trees.

(ii) Every tree is visited by six monkeys.

(iii) A, D, E, G, I, J visited the Guava tree.

(iv) D, F, G did not visit the Berry tree.

(v) B, C, D, G, I, J visited the Banana tree.

(vi) J, A, H did not visit the Mango tree.

(vii) Every monkey visited at least one tree and exactly two monkeys visited one tree only.

14. Which of the following monkeys visited all the trees?

(A) D (B) G

(C) I (D) J

15. How many monkeys visited exactly three trees?

(A) 3 (B) 4

(C) 5 (D) 2

16. Which of the following monkeys have visited the Berry tree?

(A) B (B) C

(C) A (D) F

Directions for questions 17 to 19: These questions are based on the following information.

Six people P, Q, R, S, T and U carry an umbrella and a bag of six different colours while going to school. The colours of each of the umbrellas and each of the bags are one among red, yellow, green, blue, pink and black. None among them carries an umbrella and a bag of the same colour. Further the following information is known.

(i) S carries a blue coloured umbrella but not a black coloured bag.

(ii) The person who carries a pink coloured umbrella carries a green coloured bag.
(iii) P carries a red coloured bag but not a yellow coloured umbrella.
(iv) R carries a black coloured umbrella and T carries a yellow coloured bag.
(v) Q does not carry a black coloured bag.

17. Who carries a red coloured umbrella?
(A) T (B) U
(C) Q (D) Data inadequate

18. Which colour bag is carried by the person who carries a yellow coloured umbrella?
(A) Blue (B) Black
(C) Pink (D) Either (A) or (C)

19. Which of the following is the correct combination of the person, colour of umbrella and bag he/she carries, respectively?
(A) Q – Red – Blue (B) Q – Red – Black
(C) U – Red – Black (D) T – Red – Yellow

Directions for questions 20 to 22: These questions are based on the following information.

Eight boys from A through H gathered at a picnic. Each of them brought a different dish among P through W to the picnic. The following information is known about them.
(1) Neither A nor D brought S. Either B or E brought R.
(2) Either C or D brought P.
(3) Either G or F brought U.
(4) C brought neither S nor V. E brought W.
(5) Either H or D brought Q.
(6) Either A or F brought T. Neither G nor H brought S.

20. Which dish is brought by A?
(A) T (B) U
(C) W (D) V

21. Which of the following is a correct combination of the boy and the dish he brought?
(A) C – T (B) B – S
(C) C – Q (D) F – S

22. Who brought the dish V?
(A) A (B) B
(C) D (D) Cannot be determined

Directions for questions 23 to 26: These questions are based on the following information.

Each of the five people, namely Suman, Tarun, Uday, Yadav and Gopal is the owner of a field in a different city among A through E. Each of them planted different kinds of plants, such as guava, mango, apple, banana, and water-melon.

The following is known about them.
(1) Mango plants are not planted in the city A. Uday planted apple.
(2) One among banana and guava plants is planted by one among Tarun and Gopal in city E.
(3) Tarun planted watermelon and Suman does not own a field in the city C.
(4) Neither apple nor mango plants are planted either in city C or city D.
(5) Tarun does not have a field in D.

23. If Yadav planted guava, then who owns a field in city B?
(A) Uday (B) Yadav
(C) Suman (D) Tarun

24. Who owns a field in the city A?
(A) Uday (B) Yadav
(C) Tarun (D) Suman

25. Who owns a field in the city C?
(A) Yadav (B) Bhopal
(C) Tarun (D) Uday

26. If Suman planted mango plants, then which among the following is planted in the city D?
(A) Banana (B) Guava
(C) Water melon (D) Cannot be determined

Directions for questions 27 to 29: These questions are based on the following information.

A group of five friends Dweep, Manyata, Jagat, Poulami and Hemant, has at least one of the following items, such as pen, pencil, bag, ruler, calculator and eraser. Hemant has pen, pencil and calculator only. Jagat has calculator and pen only. Dweep has eraser and bag only. Poulami has eraser, bag and pencil only. Manyata has only one item. Each item is with at least one person.

27. Who has the ruler?
(A) Hemant (B) Poulami
(C) Manyata (D) Data inadequate

28. Which of the following gives the complete list of the people who have pencils?
(A) Hemant
(B) Poulami
(C) Hemant and Poulami
(D) Hemant, Dweep and Poulami

29. Which of the items is there with more than two friends?
(A) Pencil (B) Calculator
(C) Bag (D) None of these

Directions for questions 30 to 33: These questions are based on the following information.

A team of six professors, namely–Govind, Manoj, Prasad, Aravind, Bharath and Raman are scheduled to train newly appointed faculty members.

Each of the professors train the faculty members in a different subject, such as from Arithmetic, Logical Reasoning, Pure Maths, English, Currents Affairs and Communication

Skills on a different day among Monday, Tuesday, Wednesday, Thursday, Friday and Saturday of a week.

The following information is available about the schedule.

(1) Training in Pure Maths is scheduled on Tuesday but it is not by Aravind.
(2) Govind's session is scheduled on Wednesday but not in Logical Reasoning.
(3) The session on Current Affairs and Communication Skills are scheduled on two consecutive days.
(4) Aravind's session is scheduled on the day immediately after the day on which Manoj's session is scheduled.
(5) Prasad's session is on English but it is scheduled neither on Monday nor on Saturday.

30. Whose session is scheduled on Friday?
(A) Bharath (B) Raman
(C) Aravind (D) Manoj

31. Which subject is scheduled on Monday?
(A) Logical Reasoning
(B) Pure Maths
(C) Communication Skills
(D) English

32. If Aravind's session is on Current Affairs, then on which day of the week is the session on Communication Skills scheduled?
(A) Monday (B) Wednesday
(C) Thursday (D) Friday

33. On which day of the week is Prasad's session scheduled?
(A) Tuesday (B) Friday
(C) Thursday (D) Wednesday

Directions for questions 34 to 37: These questions are based on the following information.

In a garden there are seven different flower pots A, B, C, D, E, F and G, each of which is having a different flower among Buttercup, Carnation, Columbine, Crocus, Clover, Dahlia and Foxglove.

Each of the seven butterflies, such as P, Q, R, S, T, U and V feed on a different flower among the given but not necessarily in the same order.

(i) P feeds on the flower, which is in E.
(ii) Dahlia is not in pot F. S feeds on Crocus.
(iii) Columbine is in A, but neither U nor S feeds on that.
(iv) V and Q feed on Clover and Dahlia, which are in B and F.
(v) P and T feed on Carnation and Foxglove, but neither feeds on the flowers which is either in pot C or D.
(vi) If T feeds on Columbine, then Columbine is not in A.
(vii) E contains either Foxglove or Carnation.

34. Which butterfly feeds on Buttercup?
(A) P (B) R
(C) U (D) Cannot be determined

35. Foxglove is in which flower pot?
(A) B (B) E
(C) G (D) Cannot be determined

36. If Crocus is in C, then which flower is in D?
(A) Clover (B) Dahlia
(C) Foxglove (D) Buttercup

37. If V feeds on Dahlia, then Q feeds on
(A) Buttercup (B) Foxglove
(C) Clover (D) None of these

Directions for questions 38 to 40: These questions are based on the following information.

Twelve disciples Aman, Arjun, Arhan, Amith Akhil, Ajay, Bhuvan, Bharath, Balu, Bharani, Dharani and Danush were sent to different countries across the world to India, US, Bangladesh, Nepal, Bhutan and UK to spread the teachings of their Guru.

Exactly two disciples were sent to each country.

(i) Bharath and Dharani were sent to the same country, which is neither Bhutan nor the US.
(ii) Aman and Ajay were sent to a different country among UK and Bangladesh. Bhuvan was neither sent to Bhutan nor was he sent along with Ajay.
(iii) Aman and Balu were sent to the same country. Danush and Ajay were sent to different countries. Danush was not sent to the US.
(iv) One among Bharani, Balu and Akhil was sent to the US. The remaining two disciples were sent to different countries.
(v) The disciples having the same first letter in their names and also the same ending letters in their names were sent to Nepal.
(vi) The disciples who were sent to the same country, except Nepal, do not have the same starting letter of their names.

38. Which group of disciples were sent to India?
(A) Akhil, Bhuvan (B) Ajay, Bharani
(C) Bhuvan, Amith (D) Bharath, Dharani

39. If Aman was sent to Bangladesh, then Bharani was sent to
(A) India (B) UK
(C) US (D) None of these

40. Amith was sent to which country?
(A) India (B) Bangladesh
(C) Bhutan (D) UK

Exercise-2

Directions for questions 1 to 3: These questions are based on the following information.

A group of six friends A, B, C, D, E and F hailing from six different professions, such as engineer, doctor, professor, architect, lawyer and painter and they belongs to six different cities Kolkata, Bangalore, Hyderabad, Mumbai, Chennai and Delhi, may not be in the same order.

(i) The person from Bangalore is a doctor, who is not B.
(ii) A is an architect and C who is from Chennai, is an engineer.
(iii) The person from Delhi is a professor.
(iv) D is neither a professor nor the person from Bangalore is.
(v) E is from Mumbai and the person from Kolkata is neither an architect nor a lawyer.

1. What is the profession of F?
(A) Painter (B) Lawyer
(C) Professor (D) Doctor

2. What is the profession of the person from Kolkata?
(A) Architect (B) Doctor
(C) Painter (D) Lawyer

3. What is the profession of E?
(A) Professor (B) Lawyer
(C) Doctor (D) Painter

Directions for questions 4 to 7: These questions are based on the following information.

A group of five publishers, namely Prinston, Johnson, Holy Faith, Reprographics and Penguin published a book for competitive examinations. Each book contains three subjects, like Geography, Science, History, Polity and Mental ability. These books are arranged one over the other, three of these are second editions and two of these are first editions. The book published by Reprographic is the first edition and contains Geography. Only one book on science is the first edition. The three books containing science are stacked one over the other and both the first editions are stacked one over the other. All the second editions contain History. Neither of the first editions contains History. The book published by Holy Faith publishers contains Polity and Mental ability. The book published by Prinston publishers is at the top of the stack and the book published by Penguin publishers contains Mental ability and Geography. There is no book which contains both Science and Geography.

4. Which of the following is true?
(A) The 2nd book from the top is the 1st edition.
(B) The 3rd book from the top is the 2nd edition.
(C) The 2nd book from the bottom is the 1st edition.
(D) The bottommost book is the 1st edition.

5. Which of the following is definitely a correct combination of publishers of a book and its related subject?
(A) Penguin – History
(B) Holy Faith – History
(C) Reprographic – Science
(D) Johnson – Polity

6. Books of which publishers are on Polity?
(A) Prinston and Holy Faith
(B) Prinston and Reprographic
(C) Holy Faith and Reprographic
(D) Either (A) or (B)

7. Which among the following subjects can be contained in the least number of books?
(A) History (B) Science
(C) Polity (D) Geography

Directions for questions 8 to 10: These questions are based on the following information.

In a horse racing each of the six Jockeys, such as H, I, J, K, L and M is riding a different horse among Honey, Nunny, Pony, Rony, Tony and Sony but not necessarily in the same order. Each of the six gamblers Kamal, Krish, Kundan, Lohith, Rahul and Rohan bet on exactly one among the given horses. These horses were made to participate exactly in one race among the following races, such as Endurance race, Harness race, Flat race and Hunt race and finished the race in the top three positions only. No two of them got the same position in the same type of racing.

(i) Only Honey participates in Endurance race and its jockey is K. Only Tony finished the race in the 3rd position.
(ii) Kundan bets on the horse which participates in Harness race but did not finish the race in the 3rd position.
(iii) Lohith bets on the horse, whose jockey is M and finished the race either in the 1st or in the 2nd position.
(iv) Pony's jockey is H and participates in flat race. Nunny finished the race in the 1st position but its jockey neither I nor L.
(v) Among the given horses only two horses participate in Harness race. Neither of whose jockey is I.
(vi) Nunny, Honey and the horse whose jockey M finished the race in the same position.
(vii) I finished the race in the 2nd position. Rahul bets on a horse which finished the race in the 2nd position, but its jockey is not I.
(viii) Kamal bets on Sony, which participates with Rony in the same race. Rohan does not bet on Honey.

8. Which of the following statements is/are true?
(i) Sony participates in Hunt race.
(ii) Krish bets on Honey.
(iii) Sony finished the race in the 1st position.
(A) Only (i) (B) All the three
(C) Only (ii) (D) Only (i) and (ii)

9. Which jockey finished the race in the 1st position in Harness race?
(A) H (B) I
(C) J (D) M

10. Who bets on Rony?
(A) Kundan (B) Rahul
(C) Lohith (D) Cannot be determined

Directions for questions 11 to 14: These questions are based on the following information.

There are three students and three teachers, namely A, B, C, D, E and F. Each of these has taken three tests among the tests 1 through 6. Among which, two tests are only for students, two tests are only for teachers and two tests can be taken by both teachers and students. No two of them has taken the same set of tests.

(1) No test is taken by both A and D. Only test 6 is taken by both E and F.
(2) Test 5 is only for teachers while test 4 is only for students.
(3) E took the tests 1, 4 and 6 while A did not take test 5.
(4) Only test 3 is taken by both A and B.

11. What are the tests taken by D?
(A) 2, 5, 3 (B) 2, 5, 6
(C) 4, 1, 6 (D) 5, 1, 6

12. Which of the following tests are only for students?
(A) 1, 2 (B) 4, 1
(C) 5, 6 (D) 2, 5

13. How many people took the test 6?
(A) 3 (B) 2
(C) 4 (D) Cannot be determined

14. Which of the following tests is taken by C?
(A) 4 (B) 5
(C) 2 (D) 3

Directions for questions 15 to 17: These questions are based on the following information.

A group of three friends, namely Anand, Bhuvan and Chander have to select and buy some different music cassettes out of the six cassettes of six different singers, namely UB40, Vanessa, Williams, Xavier, Yellows and Zoloto.

Out of these three friends, one chooses five cassettes, another chooses four cassettes and the remaining person chooses three cassettes. There are exactly two different singers' cassettes, out of the six singers, which are bought by all the three people. No person has more than one cassette of the same singer. It is known that Bhuvan does not have UB40, Anand does not have Zoloto and Chander does not have Williams. The number of cassettes that Anand buys is more than the number of cassettes bought by Chander. Also, any person must have either UB40 or Zoloto, but not both. If a person has Vanessa, then he must have Yellows also. If a person has Yellows, then he must have Xavier also. Vanessa is bought by exactly one person. Also, each cassette is bought by at least one person.

15. Who has the least number of cassettes?
(A) Anand (B) Bhuvan
(C) Chander (D) Cannot be determined

16. Which among the following could be the group of cassettes belonging to only two owners?
(A) Xavier and Yellows (B) Zoloto and Williams
(C) UB40 and Zoloto (D) None of these

17. How many different arrangements are possible for the number of cassettes with the three friends?
(A) 6 (B) 3
(C) 2 (D) None of these

Directions for questions 18 to 20: These questions are based on the following information.

Eight students A, B, C, D, E, F, G, H went to four different places, such as Resort, Beach, Hotel and Cinema, such that each place was visited by two students each.

Each student visited exactly one place. After their return, their teacher asked them about the place visited by each of them. The following were their answers:

(i) A said 'I did not go with C or D and went to the Resort or the Cinema'.
(ii) B said 'I did not go with E or G and went to the Hotel or the Cinema'.
(iii) C said 'I did not go with D or F and went to the Beach or the Resort'.
(iv) D said 'I did not go with B or H and went to the Beach or the Hotel'.
(v) E said 'I went with B or C or D or F or H and went to the Cinema or the Beach'.
(vi) F said 'I did not go with A or G and went to the Resort or the Cinema'.
(vii) G said 'I went with B or D or E or F or H and went to the Beach or the Hotel'.
(viii) H said 'I did not go with C or A and went to the Resort or the Beach'.

18. Who went with A?
(A) E (B) B
(C) G (D) H

19. E went with_____and visited the_____.
(A) C, Beach (B) F, Cinema
(C) D, Beach (D) G, Beach

20. If only D and H lied about the places visited by them, then with whom did D visit the place of his choice?
(A) H (B) F
(C) G (D) Cannot be determined

Directions for questions 21 to 24: These questions are based on the following information.

A journalist organization which publishes secret information leaks information about the black money of seven people J, K, L, M, N, P and Q who have black money in various branches of Swiss Bank. Each of them has a different amount of black money among `19,898, `2436, `4537, `6734, `28,116, `3624 and `8697 (in crores), but not necessarily in the same order.

Each person kept his/her black money in one of the branches among Geneva, London and Switzerland.

Atleast two people kept their black money in each branch.

(i) L's black money is not kept in Geneva branch. M's black money is not `3624.
(ii) Either P's or J's black money is `19,898 and both of them kept their black money in London branch.
(iii) Neither L's nor P's black money is the highest.
(iv) K's black money is more than N's black money and they kept their black money in the same branch. No other person kept his/her money in this branch.
(v) K's black money is the third highest. Only those persons whose black money is the least and the second least kept their black money in Geneva.

21. Whose black money is 4537 crores (in `)?
(A) M (B) L
(C) N (D) Cannot be determined

22. Whose black money is the fourth highest?
(A) L (B) N
(C) Q (D) Cannot be determined

23. Which of the following statements is/are true?
(i) M's black money is the least.
(ii) Q's black money is the highest.
(iii) L's black money is in London.
(A) Only (i) (B) Only (ii)
(C) Only (i) and (iii) (D) All the three

24. Three of the following four pairs are alike in a certain way based on the given information and hence, form a group. Find the one that does not belong to the group.
(A) K, M (B) M, N
(C) P, Q (D) P, K

Directions for questions 25 to 27: These questions are based on the following information.

Six people A, B, C, D, E and F are wearing a different coloured dress among red, green, blue, yellow, violet and white. Following is the information known about them.

(i) Neither C nor F is wearing either a red or a yellow coloured dress.
(ii) Neither of D and E is wearing the dress coloured as white, red or blue.
(iii) B is wearing either a green or a blue coloured dress.
(iv) Neither D nor F is wearing a violet coloured dress.
(v) E is not wearing either a green or a violet coloured dress.

25. Who is wearing the green coloured dress?
(A) B (B) C
(C) D (D) F

26. What colour dress is A wearing?
(A) Green (B) Blue
(C) Red (D) White

27. Who is wearing the white coloured dress?
(A) A (B) F
(C) C (D) Data inadequate

Directions for questions 28 to 31: These questions are based on the following information.

Four channels W through Z telecast six films in three slots 8 to 10, 10 to 12 and 12 to 2. The films are categorized as comedy, horror and action. The number of films in any category is not the same and no channel telecast movies in two consecutive slots. No channel telecast the movies of same category. Kumphu and Tom are telecasted by the same channel while the movies Micky and Karate are telecasted in the same slot. Karate is the only film telecasted by the channel W in the slot 10 to 12, but it is not an action movie.

Micky is the only comedy film. The films Hanuman and Tom are not telecast in the same slot. Vali the horror film is not telecasted in the slot 8 to 10 and not in the channel Z or Y.

28. Which of the following is/are the correct combinations of film and the slot in which it was telecasted?
(A) Hanuman – (8 to 10)
(B) Hanuman – (10 to 12)
(C) Vali – (10 to 12)
(D) Micky – (12 to 2)

29. Which films are telecasted in the slot 12 to 2?
(A) Hanuman – Kumphu
(B) Vali – Tom
(C) Kumphu – Karate
(D) Vali – Micky

30. Which of the following is true?
(A) The film Micky is telecasted by X.
(B) The film Vali is telecasted by Y.
(C) The film Tom is telecasted by Z.
(D) The film Hanuman is telecasted by channel X.

31. Films of which category are maximum in number?
(A) Comedy (B) Horror
(C) Action (D) Either (B) and (C)

Directions for questions 32 to 34: These questions are based on the following information.

Six people Anju, Sanju, Raju, Manju, Billa and Sruthi went to a play station to play a different game among Gothic 2, Max Payne, Mirror's Edge, Mount & Blade, Star Craft and The Last Express. The owner of the play station allotted a different cabin among 1 to 6 to each of these six people. Each of the above-mentioned games were released in a different year among 1997, 1998, 2001, 2002, 2008 and 2009.

(i) The game played by Raju was released in 2001. He played the game in an odd numbered cabin.
(ii) Sanju played the game in Cabin 2. Gothic 2 was released immediately after Max Payne.
(iii) Billa played the game in Cabin 1. The game played by Sruthi was released after the game, The Last Express was released and was allotted Cabin 6.
(iv) The names of the games played by Raju and Manju start with the same alphabet. Mount and Blade was released in 2008.
(v) Mirror's Edge was released recently and was played by Anju in an even numbered cabin.
(vi) Neither 'The Last Express' nor 'Star Craft' was played in Cabin 2.

32. Who played Star Craft?
(A) Sanju (B) Billa
(C) Sruthi (D) None of these

33. In which year was 'The Last Express' released?
(A) 2002 (B) 1998
(C) 1997 (D) 2001

34. In which cabin did Manju play the game?
(A) 6 (B) 5
(C) 3 (D) Cannot be determined

Directions for questions 35 to 37: These questions are based on the following information.

Eight employees from P through W of a company went for a tour to different cities, such as Bangalore, Hyderabad, Mumbai and Delhi in different months during April, September, October and December in a year. Those employees who went to the same place did not go in the same month. Exactly two employees went in the same month and exactly two employees went to the same place.

T went to Delhi in either October or April. V went in September to neither Hyderabad nor Mumbai. One of the employees who went to Bangalore went in December. S went in December. U and R went to the same place, R and W went in the same month. P, R and Q went to different places, but not to Mumbai and they went in different months, but not in April. P did not go in September.

35. Who went to Delhi?
(A) P (B) Q
(C) R (D) V

36. Who went in October?
(A) P (B) Q
(C) R (D) T

37. Which among the following group of employees went to the same place?
(A) P, S (B) Q, T
(C) V, Q (D) S, T

Directions for questions 38 to 40: These questions are based on the following information.

In a horse racing, each of the six Jockeys named as H, I, J, K, L and M is riding a different horse Honey, Nunny, Pony, Rony, Tony and Sony but not necessarily in the same order. Each of the six gamblers Kamal, Krish, Kundan, Lohith, Rahul and Rohan bet on exactly one among the given horses. These horses were made to participate exactly in one race, they were Endurance race, Harness race, Flat race and Hunt race and finished the race in the top three positions only. No two of them got the same position in the same type of racing.

(i) Only Honey participates in Endurance race and its jockey is K. Only Tony finished the race in the 3rd position.
(ii) Kundan bets on the horse which participates in Harness race but did not finish the race in the 3rd position.
(iii) Lohith bets on the horse, whose jockey is M and finished the race either in the 1st or in the 2nd position.
(iv) Pony's jockey is H and participates in Flat race. Nunny finished the race in the 1st position but its jockey neither I nor L.
(v) Among the given horses only two horses participated in Harness race. Neither of whose jockey is I.
(vi) Nunny, Honey and the horse whose jockey M finished the race in the same position.
(vii) I finished the race in the 2nd position. Rahul bets on a horse which finished the race in the 2nd position, but its jockey is not I.
(viii) Kamal bets on Sony, which participates with Rony in the same race. Rohan does not bet on Honey.

38. Which of the following statements is/are true?
(i) Sony participates in Hunt race.
(ii) Krish bets on Honey.
(iii) Sony finished the race in the 1st position.
(A) Only (i) (B) All the three
(C) Only (ii) (D) Only (i) and (ii)

39. Which jockey finished the race in the 1st position in Harness race?
(A) H (B) I
(C) J (D) M

40. Who bets on Rony?
(A) Kundan (B) Rahul
(C) Lohith (D) Cannot be determined

Exercise-3

Directions for questions 1 to 4: These questions are based on the following data.

Each of five people A, B, C, D and E owns a different car among Maruti, Mercedes, Sierra, Fiat and Audi and the colours of these cars are black, green, blue, white and red, not necessarily in that order. No two cars are of the same colour. It is also known that:

(i) A's car is not black and it is not a Mercedes.
(ii) B's car is green and it is not a Sierra.
(iii) E's car is not white and it is not an Audi.
(iv) C's car is a Mercedes and it is not blue.
(v) D's car is not red and it is a Fiat.

1. If A owns a blue Sierra, then E's car can be a
(A) Red Maruti (B) White Maruti
(C) Black Audi (D) Red Audi

2. If A owns a white Audi, then E's car can be a
(A) Red Maruti (B) Blue Maruti
(C) Green Audi (D) Black Sierra

3. If A's car is a red Maruti and D's car is white, then E owns a
(A) Black Audi (B) Blue Sierra
(C) Black Sierra (D) Blue Audi

4. If E owns a red Maruti and A's car is white, then D owns a
(A) Green Fiat (B) Black Fiat
(C) Blue Fiat (D) Red Fiat

Directions for questions 5 and 6: These questions are based on the following data.

In a college, there are ten lecturers enrolled in a lecture program. These lecturers have been grouped in any one of the four subjects, such as Physics, Chemistry, Biology and Maths. One professor is assigned to each of these four subject groups. Kunal, Kapil and Kamal will give lectures on the same subject. Kapil and Karishma belong to the same subject group. Karan and Kamini belong to the same subject group. Kusum cannot be with Kamal and Kiran cannot be with Karan. Kapil will deliver a lecture on Maths and Kiran delivers a lecture on the same subject as Kate. Each of Kapil, Karan, Kusum and Kiran delivers lecture on a different subject. Kamal and Kiran are lecturers for Chemistry and Kusum is not a lecturer of Physics. Amar, Beena, Chander and Deepak are professors of subject groups with number of lecturers as 4, 3, 2 and 1, respectively.

5. Which of the following statements must be true?
(A) Amar is the subject group professor of Kamal for Chemistry.
(B) Deepak is the subject group professor of Kusum for Biology.
(C) Beena is the subject group professor of Karan for Maths.
(D) Chander is the subject group professor of Karishma for Physics.

6. Who among the following is a lecturer in Maths?
(A) Karan (B) Kiran
(C) Kamini (D) None of these

Directions for questions 7 to 10: These questions are based on the following information.

A group of eight people, namely P, Q, R, S, T, U, V and W are travelling by the following cars, such as Honda city, BMW and Honda Brio. Each of them belongs to a different city and they are from Hyderabad, Chennai, Kolkatta, Pune, Bengaluru, Cochin, Baroda and Noida but not necessarily in the same order. The number of people travelling by any car is minimum two and maximum three.

Only two people, P and the one from Pune are travelling by BMW. R and T are travelling by different cars but they are neither from Bengaluru nor from Baroda. V is from Kolkata but not travelling by Honda Brio. R and W are travelling by same car. R is not from Cochin, W is not from Bengaluru. T is not from Pune and S is from Hyderabad. U is from Chennai and travelling by Honda City.

7. Who is from Noida?
(A) P (B) W
(C) Q (D) R

8. Which of the following group of people are travelling by Honda Brio?
(A) RUW (B) RVW
(C) QRW (D) SRW

9. In which car is the person from Baroda travelling?
(A) BMW
(B) Honda Brio
(C) Honda City
(D) Either BMW or Honda Brio

10. Which of the following is true regarding the given information?
(A) P is from Noida.
(B) W is from Pune.
(C) T is from Cochin.
(D) R is travelling by Honda city.

Directions for questions 11 to 13: These questions are based on the following information.

Eight people A, C, E, G, H, K, M and P have eight different animals, such as camel, lion, monkey, horse, elephant, cat, dog and tiger. They went to three different Zoos, namely

Zoo – I, Zoo – II and Zoo – III. At least two people and at most three people went to each zoo. The following information is known about them.

Only G and M went to Zoo – III and one of them has a dog. E has a monkey and went to Zoo – I. The person, who went to Zoo – II has a tiger but is not C. C and the person, who has a cat went to Zoo – II. Neither A nor K has a tiger, but one of them went to Zoo – II. A and H went to the same Zoo. H has an elephant. The person, who has a camel did not go to either Zoo – II or Zoo – III. The person who went to Zoo – III does not have a lion. One among G and C has a horse.

11. Who went to Zoo – I?

(A) G, H, E (B) A, H, C
(C) A, K, M (D) A, H, E

12. Who has a lion?

(A) K (B) A
(C) C (D) G

13. Who has a tiger?

(A) G (B) C
(C) P (D) None of these

Directions for questions 14 to 16: These questions are based on the following information.

A group of eight people, namely A, B, C, D, E, F, G and H belong to different colonies named as P, Q and R and three different streets I, II and III, but not necessarily in the same order. No two people who belong to the same colony belong to the same street. At least two and at most three people belong to each colony and each street.

A belongs to street I and C belongs to colony R. A and E belong to neither the same colony nor the same street. D and F belong to the same colony. G and C belong to the same street. F belongs to colony P and G belongs to neither street I nor street II. E and C do not belong to the same street. B and C do not belong to the same colony. H belongs to neither colony P nor colony Q. C, D and E belong to different colonies and different streets. A and B belong to neither the same colony nor colony P. B and G belong to the same street. G does not belong to colony Q.

14. To which colony does G belong?

(A) Q (B) R
(C) P (D) P or R

15. Which of the following is the correct combination of person, colony and street respectively?

(A) F – P – II (B) G – P – II
(C) G – II – P (D) F – II – P

16. Which group of persons belong to the same colony?

(A) D, F, G (B) F, G, H
(C) D, E, F (D) None of these

Directions for questions 17 to 19: These questions are based on the following data.

A group of five men, namely Kambli, Kumble, Kamlesh, Kareem and Kishan are working in the same company but are earning different salaries. They are married to five women, namely Kunti, Kirti, Kamini, Kareena and Karishma not necessarily in that order.

(1) The person who is married to Kirti is neither earning the maximum nor the minimum salary.
(2) The husband of Kamini is earning `5 lakh/annum.
(3) Kishan earns `6 lakh / annum.
(4) Kumble, the husband of Karishma, is earning `1 lakh/annum more than Kamlesh, who earns less than Kishan.
(5) Kambli, who is not married to Kamini is earning `4 lakh/annum more than Kareem.
(6) Each of the five men earns at least 1 lakh/annum. Each man's earnings is a natural number.

17. Who earns `5 lakh per annum?

(A) Kareem (B) Kamlesh
(C) Kambli (D) Kishan

18. Who is married to Kirti?

(A) Kamlesh (B) Kambli
(C) Kishan (D) Kareem

19. If Kambli is not married to Kunti, then whose husband is earning the minimum salary?

(A) Kunti (B) Kareena
(C) Karishma (D) Kamini

Directions for questions 20 to 22: These questions are based on the following information.

Six people A, B, C, D, E, and F belong to six different professions, each of them being Accountant, Doctor, Engineer, Editor, Painter, Teacher and they are sitting around a circular table not necessarily in the same order. The following information is known about their professions and seating arrangement.

The Doctor and the Teacher are adjacent to each other. B is either the Engineer or the Editor. Neither A nor D is a Doctor but one of them is an Accountant. The Engineer is sitting second to the right of A. The Doctor is sitting opposite to F. Either F or E is the Painter. C is either the Editor or the Accountant. The Editor is not sitting opposite to the Engineer.

20. Who is sitting opposite to the Engineer?

(A) A (B) B
(C) D (D) C

21. If the doctor is to the immediate left of B, then who is sitting to the immediate left of the Accountant?

(A) Painter (B) Editor
(C) Engineer (D) Cannot be determined

22. Which of the following statements is definitely true?

(A) The Teacher is sitting second to the left of the doctor.

(B) D is an Accountant.

(C) A is the Teacher.

(D) A is sitting opposite to the Editor.

Directions for questions 23 to 25: These questions are based on the following information:

Seven people A, B, C, D, E, F and G live on seven floors (ground floor is considered the first floor and the floor just above the first floor is considered the second floor and so on.) of an apartment building. Each person takes an exam on each of the days Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday, not necessarily in the same order. The following information is known about them:

(i) There are three floors between C's floor and D's floor from top to bottom in that order.

(ii) Either B or E lives on the top floor. The person who lives on the top floor takes an exam on Wednesday.

(iii) Neither F nor G takes an exam on Tuesday and there is one person between F's floor and G's floor who takes an exam on Saturday.

(iv) The person who takes an exam on Tuesday does not live on an even-numbered floor.

(v) There are only two floors below A's floor.

(vi) C takes an exam either on Sunday or on Wednesday. Only two people live between B and G and one of them takes an exam on Monday.

(vii) The person who takes an exam on Thursday is adjacent to the person who takes an exam on either Saturday or Monday.

23. Who lives on the sixth floor?

(A) A (B) B

(C) C (D) E

24. A takes an exam on which day?

(A) Friday (B) Saturday

(C) Monday (D) Wednesday

25. How many people live between E and F?

(A) None (B) One

(C) Two (D) Three

ANSWER KEYS

Exercise-1

1. (B)	8. (D)	15. (B)	22. (D)	29. (D)	36. (D)
2. (B)	9. (D)	16. (C)	23. (C)	30. (D)	37. (C)
3. (D)	10. (B)	17. (A)	24. (A)	31. (A)	38. (D)
4. (B)	11. (A)	18. (B)	25. (C)	32. (D)	39. (B)
5. (B)	12. (D)	19. (D)	26. (D)	33. (C)	40. (C)
6. (A)	13. (A)	20. (A)	27. (C)	34. (C)	
7. (B)	14. (C)	21. (D)	28. (C)	35. (D)	

Exercise-2

1. (D)	8. (D)	15. (C)	22. (D)	29. (B)	36. (C)
2. (C)	9. (C)	16. (D)	23. (C)	30. (D)	37. (B)
3. (B)	10. (C)	17. (C)	24. (B)	31. (B)	38. (D)
4. (C)	11. (B)	18. (B)	25. (C)	32. (C)	39. (C)
5. (A)	12. (B)	19. (A)	26. (C)	33. (C)	40. (C)
6. (C)	13. (D)	20. (B)	27. (B)	34. (D)	
7. (D)	14. (D)	21. (D)	28. (A)	35. (B)	

Exercise-3

1. (A)	5. (B)	9. (B)	13. (C)	17. (A)	21. (A)	24. (B)
2. (D)	6. (D)	10. (C)	14. (C)	18. (C)	22. (D)	25. (D)
3. (B)	7. (D)	11. (D)	15. (A)	19. (A)	23. (D)	
4. (C)	8. (D)	12. (C)	16. (A)	20. (C)		

SOLUTIONS

EXERCISE-1

Solutions for questions 1 to 9:

1. The given information can be represented as follows:

Name	Colours
Bhanu	x yellow x black
Modi	x yellow x indigo
Ravindra	Black/indigo
Kamal	Indigo/black
Lalit	x indigo x white

Since neither Bhanu nor Modi is wearing a yellow coloured shirt, Lalit must be wearing a yellow coloured shirt.

2. Bond will not take a Sword or a Bow or Dagger. Bhima will not take a Gun or a Bow.
∴ Bow must be taken by Rama.
Sword and Mace can be taken by Bhima only and Rama has to take the Dagger, as Bond will not take the Dagger.
∴ Gun and Arrow is taken by Bond.

3. From 1, we know that Suman did not write JMET. From 2 and 3, we know that Swaroop did not go to Hyderabad or Nagpur (as he did not write CET which was conducted in Nagpur). From 5, we know that Sachin went to Mumbai which means Swaroop did not go to Mumbai, which implies that she must have gone to Vijayawada and written either JMET or CAT.
From 4, we know that Sagar did not write CAT or CET (as he did not go to Nagpur) and from the last statement we also know that Sagar did not write XAT, which means that he must have written JMET. This implies that Swaroop wrote CAT.
∴ Swaroop goes to Vijayawada and writes CAT.

4. Forming a grid between the trains and the cities, we get the following arrangement:

(i) $GT_{XP} \neq$ Delhi, Chennai

(ii) Hyd $\neq AP_{XP}$, Goa_{XP}

(iii) Bangalore = Goa_{XP} or AP_{XP}
$\Rightarrow$ Bangalore $\neq Raj_{XP}$, GT_{XP}, $Bangalore_{XP}$

(iv) Raj_{XP} = Chennai

(v) Either Goa_{XP} = Hyd
or $Bangalore_{XP}$ = Delhi
As $Goa_{XP} \neq$ Hyd, $\Rightarrow Bangalore_{XP}$ = Delhi
$\Rightarrow GT_{XP}$ = Hyd
Now, let us analyse the choices:

	Delhi	Goa	Chennai	Bangalore	Hyd
GT_{XP}	× (i)	× (v)	× (i)	× (iii)	✓ (v)
AP_{XP}	× (v)	•	× (iv)	•	× (ii)
Raj_{XP}	× (iv)	× (iv)	✓ (iv)	× (iii)	× (iv)
Goa_{XP}	× (v)	•	× (iv)	•	× (v)
$B'lore_{XP}$	✓ (v)	× (v)	× (iv)	× (iv)	× (v)

(A) **Either p or q:**
Implications: ~p ⇒ q and ~q ⇒ p.
But p is true (i.e., Chennai is visited by Raj_{XP}), hence, q may or may not be true (i.e., Goa may or may not be visited by AP_{XP}). Hence, (A) will not help in completing the arrangement.

(B) **Only if p, then q:**
Implications: q ⇒ p; ~p ⇒ ~q
Here, Bangalore is not visited by the $Bangalore_{XP}$ (~p), which implies that Goa is not visited by the Goa_{XP} (~p ⇒ ~q). Hence, this statement helps in completing the arrangement.

(C) **If p, then q:**
Implications: p ⇒ q; ~q ⇒ ~p
Both p and q are not decided here, as it is not known whether Goa_{XP} visits Bangalore or not, and AP_{XP} visits Goa or not.

(D) **If p, then q:**
Here, Delhi is visited by $Bangalore_{XP}$, means that q is true, but can't say whether p is true or not (since p ⇒ q).
Hence, it is only (B) which helps in completing the arrangement.

5. Given S is the wife of B, D is not the husband of P, P is not the wife of A, E is the husband of T. Since P's husband is neither D nor A, P's husband should be C. So, P is the wife of C.

6. From clues (A) and (D), Rajesh is from Kolkata and is working in Accenture. From (B) and (C), Ravan and Ramani are not from Mumbai. So, Ramesh is from Mumbai. From (D) we can say Ramesh is from CTS. Hence, Ramani is from Wipro. Since the person from Wipro is not from Chennai, Ravan is from Chennai.
∴ The final arrangement is as follows.

Name	Company	Place
Ramesh	CTS	Mumbai
Rajesh	Accenture	Kolkata
Ramani	Wipro	Delhi
Ravan	TCS	Chennai

Ramesh is working in CTS.

7. The given information can be tabulated as follows.

Name	Chocolate	Colour
Manju		Red
Sanju		Blue/Orange
Tanooj	Kit Kat	
Pooja		

Orange coloured box contains Dairy milk, it is possible only when Sanju received Orange coloured box. The complete distribution is as follows.

Name	Chocolate	Colour
Manju	Bar one	Red
Sanju	Dairy milk	Orange
Tanooj	Kit Kat	Yellow
Pooja	Eclairs	Blue

Choice (B) is true statement.

8. Let the analysis be as follows.

	Number of student		
Subject	**Passed**	**Failed**	**Total**
Physics	a	b	g
Maths	c	d	h
Chemistry	e	f	i
Total			

From the given information, we derive:

$e = \frac{i}{2}$, $f = \frac{i}{2}$, $a = c$, $d = f$, $b = \frac{3g}{10}$, $g + h + i = 40$

$d = 100$, $f = 100$, $i = 200$, $e = 100$,

$b = \frac{3g}{10} \Rightarrow a = \frac{7g}{10} \Rightarrow c = \frac{7g}{10}$

$h = c + d = \frac{7g}{10} + 100$

$\therefore g + h + i = g + \frac{7g}{10} + 100 + 200 = 470$

$\frac{17g}{10} = 170$

$g = 100$

$\therefore a = 70$, $b = 30$, $c = 70$, $h = 170$

$\therefore$ (A), (B) and (C) are true.

9. The given information can be tabulated as follows.

Name	City	Department
Minku		
Tinku	Kolkata	
Pinku		Electronics
Chinku		

From the given information Chinku does not belong to Electronics, hence, she / he is from Civil, and Chinku is not from Bhopal. Minku is from Bhopal and is an Electronic student. Chinku is from Hyderabad while Pinku is from Chennai.

$\therefore$ All the given statements are true.

Solutions for questions 10 and 11: Given that the Alto is parked in P2 and it does not belong to Manohar and Jamal owns an Indica. Since Jamal owns an Indica, the Alto should be owned by Karan. So, Manohar owns a Zen and it is parked in P3.

The final arrangement is as follows.

Name	Car	Parking Space
Karan	Alto	P2
Manohar	Zen	P3
Jamal	Indica	P1

10. Karan owns an Alto.

11. Jamal parked his car in P1.

Solutions for questions 12 and 13: From clues (A) and (D) Rajesh is from Kolkata and is working in Accenture. From (B) and (C), Ravan and Ramani are not from Mumbai. So, Ramesh is from Mumbai. From (D), we can say that Ramesh is from CTS. Hence, Ramani is from Wipro. Since the person from Wipro is not from Chennai, Ravan is from Chennai.

$\therefore$ The final arrangement is as follows.

Name	Company	Place
Ramesh	CTS	Mumbai
Rajesh	Accenture	Kolkata
Ramani	Wipro	Delhi
Ravan	TCS	Chennai

12. Ravan is from Chennai.

13. Ramesh is working in CTS.

Solutions for questions 14 to 16: Given, every tree is visited by 6 monkeys, total sum of the number of trees visited by all the monkeys is 24, i.e., 4 × 6.

14. The monkey that visited all the trees cannot be D as it did not visit the Berry tree, it cannot be G as it did not visit the Berry tree, it cannot be J as it did not visit the Mango tree.
∴ The monkey that visited all the trees is I.

15. It is known that the number of monkeys that visited all the trees is 1 and those that visited only one tree is 2. Let the number of monkeys that visited 3 trees be x and those that visited 2 trees be y.
$1(4) + x(3) + y(2) + 2(1) = 24$
$\Rightarrow 3x + 2y = 18$
and we know that $x + y = 7$
$\therefore x = 4$.

16. From the given data, the monkeys that visited only one tree must be F and H as F did not visit Guava, Berry and Banana trees and H did not visit Guava, Banana and Mango trees.
∴ A must visit at least two trees as it did not visit the Banana and Mango tree, means it should visit the Berry and Guava trees. We cannot say anything about the remaining monkeys.

Solutions for questions 17 to 19: The given information is represented in the following table.

Name	Umbrella	Bag
P	× Yellow	Red
Q		× black
R	Black	× black
S	Blue	× black
T		Yellow
U		

From the above table it is clear that U carries a black coloured bag.
From (ii) and the above table, S does not carry a blue, black, red, green or yellow coloured bag.
∴ S carries a pink coloured bag.
From (ii) the pink coloured umbrella and green coloured bag are carried by Q.
∴ R carries a blue coloured umbrella.
As P is not carrying a yellow coloured umbrella, P is carrying the green coloured umbrella.
∴ T cannot carry a yellow coloured umbrella.
U is carrying a yellow coloured umbrella.
T is carrying the red coloured umbrella
The final table is as follows.

Name	Umbrella	Bag
P	Green	Red
Q	Pink	Green
R	Black	Blue
S	Blue	Pink
T	Red	Yellow
U	Yellow	Black

17. T is carrying a red coloured umbrella.

18. U is carrying a yellow coloured umbrella and the colour of his bag is black.

19. T – Red – Yellow is the correct combination.

Solutions for questions 20 to 22: From (1) and (4), E brought W, B brought R.
From (3), C did not bring U.
From (4), C brought neither S nor V.
From (5) and (6), C did not bring Q or T.
C did not bring S, Q, V, U, R, W or T.
∴ C brought dish P.
From (1) and (6), none among A, D, G and H brought S.
∴ F brought S and A brought T. G brought U and D and H brought Q and V in any order.

Boy	Dish
A	T
B	R
C	P
D	Q/V
E	W
F	S
G	U
H	Q/V

20. A brought the dish T.

21. F – S is the correct combination

22. Either D or H brought the dish V.

Solutions for questions 23 to 26: From (1) and (4), mango is not planted in the city A or C or D.
From (2), either banana or guava is planted in city E. Hence, mango is not planted in city E.
∴ Mango is planted in city B. From (2), apple is planted by Uday in city A.

From (2) and (3), Tarun planted watermelon and hence, Gopal owns a field in City E.

From (3), Suman owns a field either in the city B or in city D. Tarun owns a field in city C. From (2), Gopal planted banana or guava. We get the following distribution.

Field	Plant	Person
A	Apple	Uday
B	Mango	Yadav/Suman
C	Water melon	Tarun
D	Guava/Banana	Suman/Yadav
E	Banana/Guava	Gopal

23. Yadav planted Guava plants. Hence, he owns a field in city D.
∴ Suman owns a field in city B.

24. Uday owns a field in the city A.

25. Tarun owns a field in city C.

26. Mango is planted in the city B.
Either Guava or Banana is planted in city D.

Solutions for questions 27 to 29:

Name	Item
Hemant	Pen, Pencil, Calculator
Jagat	Calculator, Pen
Dweep	Eraser, Bag
Poluami	Eraser, Bag, Pencil

As none among Hemant, Jagat, Dweep and Poulami has a ruler, Manyata has ruler.

27. Manyata has a ruler.

28. Hemant and Poulami have pencils.

29. None of the items is present with more than two people.

Solutions for questions 30 to 33: Let us use the first letter of the names to represent respective professors and first two letters to represent the subjects.

From (1) and (2), we have

Mon		
Tues	Pu	A^x
Wed	Lo^x	G
Thu		
Fri		
Sat		

∴ From (5) Prasad's session is on English but it is scheduled neither on Monday nor on Saturday. It cannot even be on Friday because if it is Friday, (4) cannot be satisfied. Hence, Prasad's session is scheduled on Thursday. Hence, Manoj's session and Arvind's session are scheduled on Friday and Saturday respectively.

And from (3), the distribution is as follows.

Day	Subject	Faculty
Monday	Lo	B/R
Tuesday	Pu	R/B
Wednesday	Ar	G
Thursday	En	P
Friday	Cu/Co	M
Saturday	Co/Cu	A

30. Manoj's session is scheduled on Friday.

31. Logical Reasoning is scheduled on Monday.

32. In the given case Communication Skills is scheduled on Friday.

33. Prasad gives his orientation on Thursday.

Solutions for questions 34 to 37: The given information can be tabulated as shown below.

Flower pot	Flower	Butterfly
A	Columbine	✗ U ✗
B		
C		✗
D		T
E		✗
F	✗ Dahlia	
G		

From (iv) and the above, Dahlia is in B and Clover is in F. V and Q feed on Clover and Dahlia is in any order.

From (vi) and the above, T feeds on the flower which is in G. Hence, R feeds on Columbine and S and U are in C and D in any order.

From (v), (vii) and the above, E and G contains Foxglove and Carnation in any order. U feeds on Buttercup.

∴ The final distribution is as shown below.

Flower pot	Flower	Butterfly
A	Columbine	R
B	Dahlia	V/Q
C	Buttercup/Crocus	S/U
D	Crocus/Buttercup	U/S
E	Foxglove/Carnation	P
F	Clover	Q/V
G	Carnation/ Foxglove	T

34. U feeds on Buttercup.

35. E or G

36. Buttercup

37. Clover

Solutions for questions 38 to 40: The given information can be tabulated as shown below.

Country	Group of disciples
India	
US	✗ Bharath ✗ Dharani ✗ Danush
Bangladesh	(Aman, Balu)/(Ajay, ✗ Bhuvan, ✗ Danush)
UK	(Ajay/Aman, Balu) ✗ Bhuvan ✗
Nepal	
Bhutan	✗ Bharath, ✗ Dharani, ✗ Bhuvan
UK	(Ajay/Aman, Balu) ✗ Bhuvan ✗

From (v) and the above, Arjun and Arhan were sent to Nepal. Bharath and Dharani were sent to India. Bhuvan was sent to US and Danush was sent to Bhutan.

From (vi) and the above, Bharani and Ajay were sent to the same country.

From (iv) and the above, Akhil was sent to US and Amith was sent to Bhutan.

∴ The final distribution is as shown below.

Country	Group of disciples
India	Bharath, Dharani
US	Bhuvan, Akhil
Bangladesh	(Aman, Balu)/(Ajay, Bharani)
Nepal	Arjun, Arhan
Bhutan	Danush, Amith
UK	(Ajay, Bharani)/(Aman, Balu)

38. Bharath and Dharani were sent to India.

39. Bharani was sent to UK.

40. Amith was sent to Bhutan.

EXERCISE-2

Solutions for questions 1 to 3: The given information is as follows.

Name	Profession	Place
A	Architect	
B	Not Doctor	Not Bangalore
C	Engineer	Chennai
D	Not Professorr	Not Bangalore
E		Mumbai
	Not Architect Not Lawyer	Kolkata

The doctor from Bangalore cannot be any one among A, B, C, D and E. Hence, it is F.

Since D is not a professor, he is not from Delhi.

⇒ B is the professor from Delhi.

Since, the person from Kolkata is not an Architect, A is from Hyderabad and D is from Kolkata.

⇒ D is the Painter and E is the Lawyer.

The final distribution is as follows.

Name	Profession	Place
A	Architect	Hyderabad
B	Professor	Delhi
C	Engineer	Chennai
D	Painter	Kolkata
E	Lawyer	Mumbai
F	Doctor	Bangalore

1. F is the doctor.

2. The painter is from Kolkata.

3. E is the lawyer.

Solutions for questions 4 to 7: From the given information, the publishers are as follows:

(1) Reprographic publishers
(2) Holy Faith publishers
(3) Prinston publishers
(4) Penguin publishers and
(5) Johnson publishers

Three books are on History, three books are of 2nd edition, and two books are of 1st edition.

Three books are on Science out of which one is 1st edition and two are 2nd editions.

The books published by Penguin and Reprographic publishers contain Geography. No book contains both Geography and Science.

∴ Books published by Johnson, Prinston and Holy Faith publishers contain Science and are stacked together.

Since no book contains Geography and Science and all the Science books are stacked together, the books containing Geography, i.e., Reprographic and Penguin are stacked together. The Reprographic book is 1st edition. Since the other 1st edition books contain Science, Penguin must be the second edition book, with History, Geography and Mental ability.

∴ Reprographics book is on Geography, Polity and Mental ability.

Holy Faith's book is on Polity, Mental ability and Science; hence, it is 1st edition and is stacked together with Reprographic book. Hence, the order of the books from top to bottom are Prinston, Johnson, Holy Faith, Reprographic and Penguin.

Johnson and Prinston publisher's books are 2nd editions and both of them are on Science, History and either Polity or Mental ability. The final distribution is as follows.

Order from Top	Publishers	Edition	Subjects
1	Prinston	2	History, Science, Polity or Mental ability.
2	Johnson	2	Science, History, Polity or Mental ability.
3	Holy faith	1	Science, Polity and Mental ability.
4	Reprographic	1	Geography, Polity and Mental ability.
5	Penguin	2	Geography, History and Mental ability.

4. The second book from the bottom is 1st edition.

5. The book published by Penguin publishers is on History and it is the only correct combination.

6. Reprographic and Holy Faith books are on Polity.

7. Geography is published by the least number of publishers.

Solutions for questions 8 to 10: The given information can be tabulated as shown below.

Jockey	Horse	Race type	Gambler	Position
H	Pony	Flat		
I	✗ Nunny	✗	✗ Rahul	2nd
J				
K	Honey	Endurance	✗ Rohan	
L	✗ Nunny			
M			Lohith	1st/2nd

From (iv), (vi) and the above, J rides on Nunny. Honey and M finished the race in the 1st position.

From (i) and the above, Tony's jockey is L.

From (vii), (ii), (v) and the above, Rahul bets on Pony; Nunny participates in Harness race.

From (viii) and the above, I rides on Sony, M rides on Rony and Rohan bets on Tony. I and M participate in Hunt Racing. Krish bets on Honey.

∴ The final distribution is as shown below.

Jockey	Horse	Race type	Gambler	Position
H	Pony	Flat	Rahul	2nd
I	Sony	Hunt	Kamal	2nd
J	Nunny	Harness	Kundan	1st
K	Honey	Endurance	Krish	1st
L	Tony	Harness	Rohan	3rd
M	Rony	Hunt	Lohith	1st

8. Only (i) and (ii) are true.

9. J finished the race in the 1st position.

10. Lohith bets on Rony.

Solutions for questions 11 to 14: It is given that, there are three students and three teachers among six persons A through F.

Each one of them took three tests among six tests 1 through 6.

2 tests are only for teachers.
2 tests are only for students.
2 tests are common for all.

From (1), no test is taken by both A and D. So, among A and D one is a student and the other one is a teacher in any order. From (3), A did not take test 5.

From (2), Test 5 is for only teachers. Hence, A is a student and D is a teacher.

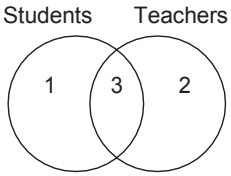
From (1) and (4), we can conclude that tests 3 and 6 are common for both teachers as well as students.

From (2), test 4 is only for students.

From (3), as E took tests 1, 4 and 6.

Test 1 is only for students and test 2 is only for teachers.

The above results can be represented as follows.



The different possible combinations are:

For students	For teachers
143	253
146	256
361	236
364	536

As, E took the tests 1, 4 and 6, E is a student.

A is a student and D is a teacher.

From (1), B is a Teacher.

As only test 6 is given by both E and F. E is a student and F is a teacher, C is a student.

A – Student
B – Teacher
C – Student
D – Teacher
E – Student
F – Teacher

From (4), A and B took only test 3 together.

A took tests 1, 4 and 3.

D took tests 2, 5 and 6 (from (1)).

Hence, C took either 1, 3, 6 or 3, 4, 6, i.e., 3, 6 and (1 or 4).

Similarly, F took 3, 6 and (2 or 5).

B took test 3.

The final combination is as follows.

		Tests		
A	Student	1	3	4
B	Teacher	3		
C	Student	3	6	1/4
D	Teacher	2	5	6
E	Student	1	4	6
F	Teacher	3	6	2/4

11. D took the tests 2, 5 and 6.

12. Test 1 and 4 are only for students.

13. Either four or five persons took test 6.

14. Among the given test C took test 3.

Solutions for questions 15 to 17: Let us take down the data as below:

(i) Three friends – Anand, Bhuvan and Chander (A, B, C).

(ii) Six singers/cassettes: UB40, Vanessa, Williams, Xavier, Yellows and Zoloto (U, V, W, X, Y, Z).

(iii) The three friends choose 5, 4 and 3 cassettes in any order.

(iv) Exactly 2 different singers' cassettes belong to all the three (2 singers common to all the three friends).

(v) B ≠ U; A ≠ Z; C ≠ W.

(vi) A > C (Number of cassettes)

(vii) Each person has either U or Z, but not both.

(viii) If a person has Vanessa, he must have Yellows. (If $V_{\checkmark} \Rightarrow Y_{\checkmark}$)

(ix) If a person has Yellows, he must have Xavier. (If $Y_{\checkmark} \Rightarrow X_{\checkmark}$)

(x) Vanessa is bought by exactly one person.
⇒ Vanessa is owned only by the person who has 5 cassettes.

(xi) Each cassette must be bought by at least one person.

Let us analyse the given data. We assume that V is bought by all the three friends (condition (iv), then Y must also be bought. But if Y is bought by all the three, then they must buy X also [From conditions (viii) and (ix)]. Now there will be three different cassettes (V, Y, X), which are bought by all the three, which violates condition (iv) (exactly two cassettes should be common among all the three friends). Hence, these two singers' cassettes, which are common among all the three friends must be Y and X. Also, A does not have Z, then he must have U [condition (vii)]. Similarly, B does not have U, then he must have Z. Now we get the following arrangement:

	U	V	W	X	Y	Z
A ≠ 3	✓	..	..	✓	✓	✗
B	✗	..	..	✓	✓	✓
C ≠ 5	..	✗	✗	✓	✓	..

Now, as A has more cassettes than C, hence, A cannot have least (i.e., 3) number of cassettes. Also, C cannot have maximum (i.e., 5) number of cassettes.

According to condition (vii), C must have exactly one cassette out of U and Z (hence, C's total now is 3 cassettes) and he will not have V. Thus

C = 3 cassettes
A = 4 or 5 cassettes
⇒ B = 4 or 5 cassettes.

15. C has the least number of cassettes, i.e., three.

16. X and Y are not only bought by two people, but by three people. UB40 and Zoloto cannot be bought together. A does not have Zoloto and C does not have W. Hence, only two people having same two cassettes is not possible.

17. There are only two arrangements which are possible. They are:

A	:	5	4
B	:	4	5
C	:	3	3

Solutions for questions 18 to 20: It is given that A did not go with C or D means A went with B or E or F or G or H **(i)**

Similarly,

B went with A or C or D or F or H **(ii)**
C went with A or B or E or G or H **(iii)**
D went with A or C or E or F or G **(iv)**
E went with B or C or D or F or H **(v)**
F went with B or C or D or E or H **(vi)**
G went with B or D or E or F or H **(vii)**
H went with B or D or E or F or G **(viii)**

From (i) and (v), we get:
A and E do not go with each other.
From (i) and (vi), we get:
A and F do not go with each other.
From (i) and (vii), we get:
A and G do not go with each other.
From (i) and (vii), we get:
A and H do not go with each other.
Hence, A and B go together.

Similarly, we can determine the names of the other people who go together. After this is done we get the following table.

	A	B	C	D	E	F	G	H
A	✗	✓	✗	✗	✗	✗	✗	✗
B	✓	✗	✗	✗	✗	✗	✗	✗
C	✗	✗	✗	✗	✓	✗	✗	✗
D	✗	✗	✗	✗	✗	✗	✓	✗
E	✗	✗	✓	✗	✗	✗	✗	✗
F	✗	✗	✗	✗	✗	✗	✗	✓
G	✗	✗	✗	✓	✗	✗	✗	✗
H	✗	✗	✗	✗	✗	✓	✗	✗

We can find out the places visited by them using the same logic as given above.

The places visited by them are as follows.

	A	B	C	D	E	F	G	H
Resort	✗	✗	✗	✗	✗	✓	✗	✓
Beach	✗	✗	✓	✗	✓	✗	✗	✗
Cinema	✓	✓	✗	✗	✗	✗	✗	✗
Hotel	✗	✗	✗	✓	✗	✗	✓	✗

A and B went to the Cinema.
C and E went to the Beach.
D and G went to the Hotel.
F and H went to the Resort.

18. B goes with A.

19. E went with C and they visited the Beach.

20. If D and H lied about the places they visited, then H goes along with G to the Hotel and D goes along with F to the Resort.

Solutions for questions 21 to 24: The given information can be tabulated as shown below.

Person	Bank Branch	Black Money (in cores)
J	London	
K	✗	`8697
L	Geneva	✗
M	✓	`28,116
N		✗ `2694
P	London	✗
Q		

From (iv) and (v), M and Q kept their black money in Geneva. N's black money is either `6734 or `4537. K and N kept their black money in Switzerland. L kept his black money in London. J's black money is `28,116.

From (ii) and the above, P's black money is 19,898.

From (i) and above, M's black money is `2436 and Q's black money is `3624. L's black money is either `4537 or `6734. Therefore, the final distribution is as shown below.

Person	Bank Branch	Black Money (in cores)
J	London	`28,116
K	Switzerland	`8697
L	London	`4537/`6734
M	Geneva	`2436
N	Switzerland	`6734/`4537
P	London	`19,898
Q	Geneva	`3624

21. Either L's or N's black money is `4537 crores.

22. Either L's or N's black money.

23. Only (i) and (iii).

24. Except in (B), in the remaining pairs, the first person's black money is more than the second person's black money.

Solutions for questions 25 to 27: From (i), (ii) and (iii) none among C, F, D, E and B is wearing a red coloured dress. Hence, A is wearing the red coloured dress.

∴ From (iv), A, B, D or F is not wearing a violet coloured dress.

From (v) E is not wearing a violet coloured dress.

C is wearing the violet coloured dress.

Again, E is not wearing a white, blue or green coloured dress.

E is wearing the yellow coloured dress.

None among B, C and E is wearing a white coloured dress,

∴ F is wearing white coloured dress.

As D is not wearing a blue coloured dress, D is wearing the green coloured dress.

∴ B is wearing the blue coloured dress. The final distribution table is as follows.

A – Red
B – Blue
C – Violet
D – Green
E – Yellow
F – White

25. D is wearing a green coloured dress.

26. A is wearing a red coloured dress.

27. F is wearing a white coloured dress.

Solutions for questions 28 to 31: It is given that six different films are telecasted in four channels, in three slots. The films are Karate, Micky, Tom, Vali, Hanuman and Kumphu.

The channels – W, X, Y, Z.

Slots – 8 to 10, 10 to 12, 12 to 2.

Categories – Comedy, Horror, Action.

As the number of films in any category is not the same, the number of movies is 1, 2 and 3 in different categories.

As no channel telecast movies in two consecutive slots, a channel which telecasts in (10 to 12) slot does not telecast any other movie. Kumphu and Tom are telecast by the same channel, hence, neither of these movies were telecast in (10 to 12) slot. The movies Micky and Karate are telecast in the same slot. It is also given that Karate is telecast by the channel W in (10 to 12) slot. Hence, Micky is also telecasted in the same slot by another channel. Micky is the only comedy film. Hanuman and Vali are telecasted by the same channel in the slots (8 to 10) and (12 to 2). As Vali is not telecasted in (8 to 10) slot, it is telecasted by the channel X in (8 to 10) slot and Vali in (12 to 2). As Hanuman and Tom are not telecasted in the same slot, Tom is telecasted in (12 to 2) slot and Kumphu in (8 to 10) slot by either Y or Z channel. As Karate is not an action movie, it is a horror film as there is only one comedy film. As Vali is a horror movie, Hanuman is an action movie (as no channel telecast two films of the same category).

Between the films Tom and Kumphu, one is a horror film and the other one is an action movie, in any order. The above results can be represented as follows.

	8 to 10	10 to 12	12 to 2
W		Karate	
X	Hanuman		Vali
Y/Z	Kumphu		Tom
Z/Y		Micky	

Comedy	Horror	Action
Micky	Karate Vali Tom/Kumphu	Hanuman Tom/Kumphu

28. Hanuman – (8 to 10) is the correct combination.

29. Vali and Tom are telecasted in the slot 12 to 2.

30. Hanuman is telecasted by channel X is true.

31. Horror movies are maximum in number.

Solutions for questions 32 to 34: The given information can be tabulated as shown below.

Person	Cabin	Game	Year of release
Anju	4	Mirror's Edge	2009
Sanju	2	✗ The Last Express	✗
Raju	3/5	✗ Star Craft	2001
Manju		Max Payne	2008
Billa	1		
Sruthi			

From (i) and the above, Gothic 2 was released in 2002.

From (iii) and the above, Manju played the game in either Cabin 5 or Cabin 3. Sruthi played Star Craft in Cabin 6 and it was released in 1998. Hence, Billa played 'The Last Express' and it was released in 1997. Sanju played 'Gothic 2'.

∴ The final distribution is as shown below.

Person	Cabin	Game	Year of release
Anju	4	Mirror's Edge	2009
Sanju	2	Gothic 2	2002
Raju	3/5	Max Payne	2001
Manju	5/3	Mount & Blade	2008
Billa	1	The Last Express	1997
Sruthi	6	Star Craft	1998

32. Sruthi.

33. 1997.

34. Either 5 or 3.

Solutions for questions 35 to 30: The given information can be tabulated as shown below.

Employee	Place	Month
P	✗	✗ September
		✗ April
Q	✗	✗ April
R	Mumbai	✗ April
S		December
T	Delhi	October/April
U		
V	✗ Hyderabad	September
W		

Given, U and R went to the same place. Hence, U should not go to Mumbai and S and W went to Mumbai, U and R went to Hyderabad, since only one of P, Q and R went to Hyderabad and exactly two employees went to the same place. Given, R and W went in the same month. Hence, it is not April and also neither December nor September, since, exactly two employees went in the same month. Hence, it is October. Therefore, T went in April, P went to Bangalore in December, Q went in September, U went in April and V went to Bangalore.

∴ The final distribution is as shown below.

Employee	Place	Month
P	Bangalore	December
Q	Delhi	September
R	Hyderabad	October
S	Mumbai	December
T	Delhi	April
U	Hyderabad	April
V	Bangalore	September
W	Mumbai	October

35. Q went to Delhi.

36. R went in October.

37. (Q, T) went to the same place.

Solutions for questions 38 to 40: The given information can be tabulated as shown below.

Jockey	Horse	Race type	Gambler	Position
H	Pony	Flat		
I	✗	✗	✗ Rahul	2nd
J				
K	Honey	Endurance	✗	
L	✗			
M			Lohith	1st/2nd

From (iv), (vi) and above, J rides on Nunny. Honey and M finished the race in the 1st position.

From (i) and above, Tony's jockey is L.

From (vii), (ii), (v) and above, Rahul bets on Pony; Nunny participates in Harness race.

From (viii) and above, I rides on Sony, M rides on Rony and Rohan bets on Tony. I and M participate in Hunt Racing. Krish bets on Honey.

∴ The final distribution is as shown below.

Jockey	Horse	Race type	Gambler	Position
H	Pony	Flat	Rahul	2nd
I	Sony	Hunt	Kamal	2nd
J	Nunny	Harness	Kundan	1st
K	Honey	Endurance	Krish	1st
L	Tony	Harness	Rohan	3rd
M	Rony	Hunt	Lohith	1st

38. Only (i) and (ii) are true.

39. J finished the race in the 1st position.

40. Lohith bets on Rony.

EXERCISE-3

Solutions for questions 1 to 4: We have the following table which can be filled as we go through the statements.

	A	B	C	D	E
Car					
Colour					

From statements (i), (ii), (iii), (iv) and (v), we can fill up the following.

	A	B	C	D	E
Car			Mercedes	Fiat	
Colour		Green			

We have used all the information given and hence, we can now start answering the questions.

1. If A owns a blue Sierra, then B owns Audi (because E cannot own Audi) and hence, E owns a Maruti. Similarly, if A's car is blue, then E's car will be red or black. Hence, E will have red Maruti or black Maruti.

2. If A owns white Audi, then E will own Sierra (because B cannot own a Sierra). Only choice (D) has Sierra. (Also note that if A owns a white car, then the colour of E's car can be blue, red or black).

3. If A's car is Maruti, then E can only own a Sierra. If A's car is red and D's white, then E can only own a blue car (because C's car cannot be blue). Hence, E has a blue Sierra.

4. If E owns a red car and A owns a white car, then D can have only a blue car (because C cannot have a blue car).

Solutions for questions 5 and 6:

5. It is given that each of Kapil, Karan, Kusum and Kiran is a lecturer in different subject. Kapil teaches Maths, Kiran is a lecturer in Chemistry and Kusum is not a lecturer in Physics.
⇒ Kusum is a lecturer in Biology and Karan is a lecturer in Physics.
It is given that Kunal, Kamat and Karishma belong to the same subject group as Kapil, i.e., Maths.
It is given that Kamal is a lecturer of Chemistry and Kiran and Kate teach the same subject.
Hence, Kamal, Kiran and Kate teach Chemistry.
Kamini is in the same subject group as Karan, i.e., Physics.
It is given that Amar, Beena, Chander and Deepak are the professors of the subject groups with a lecturer strength of 4, 3, 2 and 1, respectively.
As per the given instructions, we get the following arrangements:

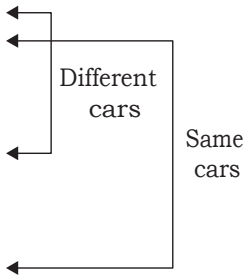
Maths	Physics	Biology	Chemistry
Kapil Kamat Kunal Karishma	Karan Kamini	Kusum	Kiran Kate Kamal
4	2	1	3
Amar	Chandar	Deepak	Beena

Only (B) is correct.

6. None of the given names belongs to the subject group Maths.

Solutions for questions 7 to 10: The given information can be represented in the tabular form as follows.

Name of the people	City	Car
P		BMW
Q		
R	Cochin (×) Bengaluru (×) Baroda (×)	
S	Hyderabad	
T	Pune (×) Bengaluru (×) Baroda (×)	
U	Chennai	Honda City
V	Kolkata	Honda Brio
W	Bengaluru (×)	



From the given information, V is not travelling by Honda Brio, we can say that V is travelling by Honda City, since the person who is travelling by BMW is from Pune.

Also, we can say that only two people are travelling by BMW.

From the given information, R and W are travelling by the same car, we can say that they are travelling by Honda Brio.

∴ T, U and V are travelling by Honda City.

As S is from Hyderabad, he cannot travel by BMW.

S, R, W are travelling by Honda Brio.

Q is from Pune and is travelling by BMW.

P is from Bengaluru, since R, T and W cannot be from Bengaluru.

∴ W is from Baroda.

As R is not from Cochin, T is from Cochin.

∴ R is from Noida.

The final arrangement is as follows.

Name of the person	City	Car
P	Bengaluru	BMW
Q	Pune	BMW
R	Noida	Honda Brio
S	Hyderabad	Honda Brio
T	Cochin	Honda City
U	Chennai	Honda City
V	Kolkata	Honda City
W	Baroda	Honda Brio

7. R is from Noida.

8. R, S and W are traveling by Honda Brio.

9. W is travelling by Honda Brio and is from Baroda.

10. Choice (C) is true.

Solutions for questions 11 to 13: Given that only G and M, went to Zoo – III and one of them has a dog. E has a monkey and went to Zoo – I. The person, who went to Zoo – II has a tiger, but is not C. C and the person, who has a cat, went to Zoo – II. Neither A nor K has a tiger, but one of them went to Zoo – II. A and H went to the same Zoo. H has an elephant. So, A cannot go to Zoo – II as already the person who has a tiger and C went to Zoo – II and A cannot go to Zoo – III as only G and M went to Zoo – III. Hence, A and H went to Zoo – I and hence, K went to Zoo – II. As K does not have a tiger, K has a cat. Three people A, E and H went to Zoo – I, so P went to Zoo – II and therefore, P has a tiger. The person, who has a camel did not go to either Zoo – II or Zoo – III. So A, who went to Zoo – I has a camel. The person, who went to Zoo – III, does not have a lion, hence, C has a lion. One among G and C has a horse. As C already has a lion, G has a horse and therefore, M has a dog.

∴ The tabular form of the people, their animals and the Zoo to which they went is as follows.

Person	Zoo	Animal
A	I	Camel
C	II	Lion
E	I	Monkey
G	III	Horse
H	I	Elephant
K	II	Cat
M	III	Dog
P	II	Tiger

11. A, H and E went to Zoo – I.

12. C has a lion.

13. P has a tiger.

Solutions for questions 14 to 16: The given information can be tabulated as shown below.

Name of the person	Colony	Street
A	xP	I
B	xP	
C	R	
D		
E		
F	P	
G	xQ	III
H	R	

From the given information, A and E belong to neither the same colony nor the same street. So, E belongs to either street II or street III. D and F belong to the same colony. Hence, D belongs to colony P. G and C belong to the same street, hence, C belongs to street III. E and C do not belong to the same street. Hence, E belongs to street II as E cannot belong to the same colony as A and C. B and C do not belong to the same colony, hence, B belongs to colony Q. C, D and E belong to different colonies and different streets. Hence, D belongs to street I as C and E belong to street III and street II, respectively and E belongs to colony Q as C and D belong to colony R and P, respectively. A and B neither belongs to the same colony nor colony P. Hence, A belongs to colony

R. B and G belong to the same street. Hence, H belongs to street III. The given condition is that the people who belong to the same colony do not belong to the same street. Hence, H belongs to street II as A and C belong to street I and III, respectively and at least two and at most three people belong to each colony and each street. Hence, G belongs to colony P and F belongs to street II.

∴ The final arrangement is as shown below.

Name of the person	Colony	Street
A	R	I
B	Q	III
C	R	III
D	P	I
E	Q	II
F	P	II
G	P	III
H	R	II

14. G belongs to colony P.

15. The correct combination of person, colony and street respectively is 'F – P – II'.

16. D, F and G belong to the same colony.

Solution for questions 17 to 19:

Males	Females	Salary (` lakh/annum)
Kambli		$x + 4$
Kumble	Karishma	$x + 1$
Kamlesh		X
Kareem		
Kishan		6

$x + y$ is a natural number and $x \geq 1$

$\Rightarrow x$ is a natural number.

Also, from (4), $x < 6$

If $x = 5$, then salary (in lakh/annum) of husband of Karishma

$= x + 1 = 6$.

This is not possible as each earns a different salary

$\Rightarrow x \neq 5$.

If $x = 4$

Salary (in lakh/annum) of Kumble $= x + 1 = 5$.

This contradicts rule (2).

If $x = 2$

Salary of Kambli (in lakh/annum) $= x + 4 = 6$ salary of Kishan.

This is not possible as each earns a different salary.

If $x = 1$,

Salary (in lakh/annum) of Kambli $= x + 4 = 5$,

This implies, from rule (2), that Kambli must be married to Kamini, which however violates the condition (5) $\Rightarrow x \neq 1$

The only possible value of $x = 3$.

Males (husband)	Females (wives)	Salary (` lakh/annum)
Kumble	Karishma	4/3/2
Kamlesh	(Kareeena/Kunti)	3/2/1
Kareem	Kamini	5
Kishan	Kirti	6
Kambli	Kunti/Kareena	9

17. Kareem earns `5 lakh/annum.

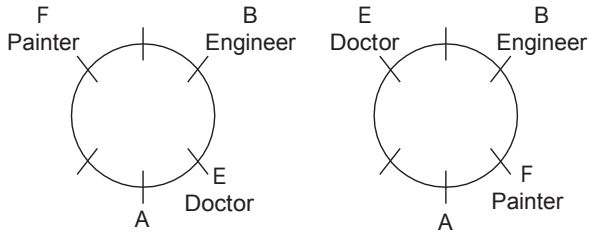
18. Kishan is married to Kirti.

19. Kambli is not married to Kunti, implies Kamlesh is married to Kunti, then the husband of Kunti earns the minimum salary.

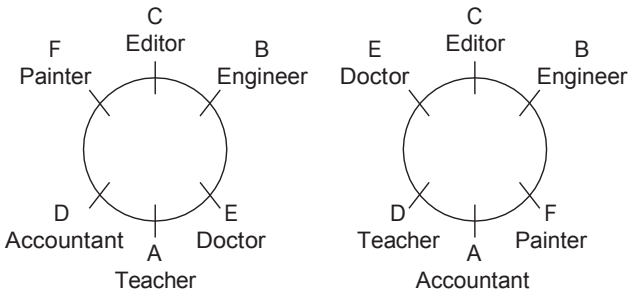
Solutions for questions 20 to 22: B is either Engineer or Editor. Neither A nor D is a Doctor. But exactly one of them is an Accountant. Either E or F is Painter and C is either an Editor or an Accountant. But either A or D is an Accountant. Hence, C is the Editor and B is the Engineer. The information can be represented in the following table. Since E is the Doctor, F is the Painter.

Person	Profession
A	Teacher/Accountant
B	Engineer
C	Editor
D	Accountant/Teacher
E	Doctor
F	Painter

It is given that the Engineer is sitting second to the right of A and the Doctor and F are sitting opposite to each other. We have the following possible arrangements.



Since, the Editor is not sitting opposite to the engineer. Hence, the final arrangements will be as follows.



20. D is sitting opposite to the engineer.

21. The Painter is sitting to the left of the Accountant.

22. 'A is sitting opposite to the Editor' is definitely true.

Solutions for questions 23 to 25: It is given that there are three floors between C's floor and D's floor from top to bottom. Either B or E lives on the top floor and takes exam on Wednesday. Let us represent these points in the following floor arrangement.

Also given that neither F nor G takes the exam on Tuesday and there is one person between them who writes exam on Saturday.

Since there are only two floors below A's floor which means that A lives on the third floor. The possible arrangements are as follows:

Floor	Person	Day
7	B/E	Wednesday
6	F/G	Saturday
5	C	
4	G/F	
3	A	
2		
1	D	
1	D	

Floor	Person	Day
7	B/E	Wednesday
6		
5	C	
4	F/G	
3	A	Saturday
2	G/F	
1	D	

Since either B or E takes an exam on Wednesday, C takes an exam on Sunday and therefore, case (i) is eliminated. Also given that only two people live between B and G, B should live on the top floor and G should live on the fourth floor and as B takes an exam on Wednesday, G takes an exam on Monday.

Floor	Person	Day
7	B	Wednesday
6	E	
5	C	Sunday
4	G	Monday
3	A	Saturday
2	F	
1	D	

Since, the person who takes an exam on Tuesday does not live on an even – numbered floor. Hence, D takes an exam on Tuesday. Also given that the person who takes an exam on Thursday is adjacent to the person who takes an exam on either Saturday or Monday. The only possibility is F takes an exam on Thursday and E takes on Friday. The final arrangement is as follows.

23. E lives on the sixth floor.

24. A takes an exam on Saturday.

25. Three people live between E and F.

4 Selections

Chapter

Learning Objectives

In this chapter, we will :

- Understand how to interpret the conditions given in the question and write down the same in an unambiguous form.
- Find the number of teams that can be formed subject to the constraints/conditions.
- Learn to choose a team(s) without violating the given constraints.
- Learn how to choose a team(s) where multiple parameters are specified.

In this category of questions, a small group of items or people have to be selected from a larger group satisfying the given conditions. The conditions will specify as to when a particular item or person can be included or cannot be included in the subgroup. For example, the condition may specify that two particular people should always be together or that two particular people should not be together.

Sometimes, the conditions given for selection or non-selection of items or people may be based on logical connectives like if-then, either-or, unless, etc. You should be careful in interpreting the logical connectives used in the conditions.

Method of answering the questions:

- Step (i): Analyse the given conditions.
- Step (ii): Try to combine conditions.
- Step (iii): Apply the conditions to the questions.

Solved Examples

Directions for questions 4.01 to 4.05: These questions are based on the following information.

Amit, Bittu, Chintu, Dumpy, Falgun, Hitesh, Ronit, Purav and Saurav are nine players from among whom three teams consisting respectively of 4 members, 3 members and 2 members must be formed subjecting to the following conditions.

Chintu must have three more players with him while Dumpy must have only two more with him.

Chintu and Saurav cannot be in the same team.

Purav and Bittu cannot be in the same team.

Ronit and Hitesh must be in the same team.

4.01: If Dumpy, Falgun, Purav form the team of 3 members, then which of the following must be true?

(A) Hitesh must be in a team with Bittu.

(B) Saurav must form a two-member team with Amit or Chintu.

(C) Saurav must form a two-member team with Bittu or Amit.
(D) Chintu should form a team of 4 members with Hitesh, Ronit and Amit.

4.02: If Dumpy takes Amit as a part of his three-member team, which of the following must go into Chintu's team?
(A) Bittu and Hitesh
(B) Hitesh and Ronit
(C) Purav and Ronit
(D) Purav and Falgun

4.03: If Chintu and Falgun are together and Saurav is in the team of two members, then how many sets of different teams are possible?
(A) 4 (B) 3
(C) 2 (D) 1

4.04: If Chintu does not have Purav in his team and the two-member team consists of Saurav and Amit, then Chintu should take
(A) Hitesh, Bittu and Ronit
(B) Bittu but not Ronit
(C) Bittu and Falgun
(D) Hitesh and Ronit

4.05: If Purav is in the same team as Chintu and Falgun, then Saurav must be in the same team as
(A) Bittu (B) Bittu and Amit
(C) Amit (D) Bittu and Dumpy

Solutions for questions 4.01 to 4.05: It is given that:
Chintu must form a team of 4 members only.
Dumpy must form a team of 3 members only.

Since Chintu and Dumpy are in two different teams, let us for a convenience, denote the two teams as the respective teams of these two persons. Let us call the team with four members as the first team and the team with three members as the second team. The third team should have two people.

Number of members		
4	3	2
Chintu	Dumpy	Saurav
	Saurav	

Now let us take the other conditions and fill them up in the table above.

Chintu and Saurav cannot be in the same team.
Saurav will be in the second or the third team.
Purav and Bittu cannot be in the same team.
Hitesh and Ronit must be in the same team.

We cannot represent these two conditions right now in the table above but we will use them as we go along.

4.01: If Dumpy, Falgun, Purav form the team of 3 members, then Saurav should be in the third team.
Since Hitesh and Ronit must be in the same team, they have to be in the first team. That leaves only Amit or Bittu to be with Saurav in the third team.
(Also, note that we can eliminate choice (B) easily.)

4.02: Dumpy takes Amit as a member of his team.
If we take Hitesh and Ronit as the two members of the third team, then Saurav has to be in the second team, in which case we will have both Purav and Bittu coming into the same team, the first team, which is not possible.
Since Saurav cannot be in Chintu's team and Purav and Bittu cannot be in the same team, the three people required for Chintu's team will have to be Hitesh and Ronit, Falgun or Purav or Bittu.

4.03: Let us analyse the conditions. It is given that Chintu and Falgun are together, whereas Saurav is in the team of two members. Let us fill up these details in the box that we made above and then see in how many ways we can fill up the remaining cells in the box.

Chintu	Dumpy	Saurav
Falgun		

First let us look at Hitesh and Ronit who must be in the same team.
They can go into the first team or the second team. Let us consider these two cases.
Case 1: Hitesh and Ronit go into the first team. Then, one out of Bittu and Purav will go into the third team and the other into the second team. This gives rise to two ways of forming the teams, one with Bittu in the second team and the other with Bittu in the third team.
Case 2: Hitesh and Ronit go into the second team.

In this case too, one out of Bittu and Purav will go into the third team and the other into the second team. Hence, this will also give rise to two ways of forming the teams.
Hence, there are total four ways of forming the teams.

4.04: Let us use the table that we built in the initial analysis and fill up the details that we have in this problem.
Since the two-member team is already formed and Chintu does not take Purav, hence, Purav will have to go into the second team.

Chintu	Dumpy	Saurav
	Purav	Amit

Since Ronit and Hitesh have to be in the same team, they should go into the first team. Since Bittu cannot go with Purav, he should also be in the first team. This leaves Falgun for the second team. Thus, we can fill up the table as follows:

Chintu	Dumpy	Saurav
Ronit	Purav	Amit
Hitesh	Falgun	
Bittu		

4.05: If Purav is with Chintu and Falgun, then Bittu cannot be with them. Since Ronit and Hitesh should be together, the only other person left is Amit. These four members form the first team.
If Hitesh and Ronit together form the two-member team, then Bittu and Saurav will be part of the three-member team.
Instead, if Hitesh and Ronit are in the three-member team, then Saurav and Bittu will form the two-member team.
In either case, Saurav and Bittu are together in one team.

Directions for questions 4.06 to 4.09: These questions are based on the following information.

A, B, C, D, E, F and G are seven players. They form two teams of two players each and one team of three players. A and B cannot be in the same team. B and C cannot be in the same team whereas E and F must be in the same team. G and D cannot be in the same team.

4.06: If C, D and A form a team of three players, which of the following can be the members of one of the other teams?
(A) A and E (B) G and B
(C) E and F (D) Both (B) and (C)

4.07: If E, F and G form a team of three members, then in how many ways can the remaining two teams of two players each be formed?
(A) 2 (B) 4
(C) 3 (D) 1

4.08: If D and A are not in the same team, then altogether in how many ways can the teams of two members be formed?
(A) 4 (B) 7
(C) 8 (D) 5

4.09: If B, E and F form a team of three members, which of the following cannot be the two teams of two members each?
(A) AC, GD (B) AD, CG
(C) AG, CD (D) Both (A) and (B)

Solutions for questions 4.06 to 4.09: Let Team I be of 3 players, Team II be of 2 players and Team III be of 2 players.

It is given that A and B cannot be together. We will represent it as A × B.

Similarly, we have B × C and G × D.

E and F must be in the same team. So, E and F can form a team of 2 members on their own or can form a team of 3 members with another person.

Let us now take up the questions and work them out.

4.06: Given that C, D, A form a team of 3 members, one of the other teams has to have E and F together. Hence, B and G should form one team. Choice (D)

4.07: Given that E, F, G form a team of 3 players. Since A and B or B and C cannot be in the same team, we must necessarily have A and C together in one team and B and D in the other team. So, the teams can be formed only in one way.

4.08: Given that A and D are not in the same team.
Hence, A × B, B × C, G × D and A × D.
We already know that E and F must be in the same team. They may form a team of 3 members or they themselves be a team of 2 members. Let us consider the above two possibilities and then fill up the other teams. They can be formed as follows:

	Team I	Team II	Team III
1.	A E F	B D	C G
2.	A E F	C D	B G
3.	B E F	A G	C D
4.	C E F	A G	B D
5.	D E F	A C	B G
6.	G E F	A C	B D
7.	A C G	B D	E F

Thus, the teams can be formed in 7 ways.

4.09: If B, E, F form a team of 3 members, then the two members teams must be formed from A, C, D, G. The teams can be AD and CG or AG and CD. As D and G cannot form a team, AC and GD cannot be formed. (Please note that we can answer this question from the answer choices.) From choice (A), we find that G and D are together in one team which is not possible. Thus, choice (A) is the answer.

Directions for question 4.10: Select the correct alternative from the given choices.

4.10: At least two boys out of A, B, C and D and at least two girls out of P, Q, R and S have to be chosen to form a group of 5 members.
Neither A nor C can go with Q.
Neither P nor S can go with B.
Q and R cannot be together.

Which of the following is an acceptable team?
(A) ARCQP (B) ASQPD
(C) ASQRP (D) PSRAD

Solution for question 4.10:

4.10: The required group of 5 members must be formed with at least two boys from A, B, C, D and at least 2 girls from P, Q, R, S.
Answers (A), (B) and (C) can be ruled out as A and Q cannot be together.
In choice (D), P, S, R, A, D can be together without violating any of the given conditions.

Exercise-1

Directions for question 1 to 6: Select the correct alternative from the given choices.

1. Adam, Andy, Anil, Ann, Jack, John, James and Jill want to go to a nearby city. Only two vehicles, a van and a car are available. Only Alen and Jack know how to drive the van, hence at least one of them must be in the van.
Each vehicle has a seating capacity of exactly four people. Adam and Anil cannot go in the same vehicle and John and James must go in the same vehicle.
Which of the following cannot be the list of people who are in the car?
(A) John, James, Andy, Alen
(B) Adam, James, John, Jack
(C) Anil, James, John, Jill
(D) Anil, Andy, Jill, Alen

2. A group of five is to be formed from a group of nine students A, B, C, D, E, F, G, H and I.
If A is selected, then F is selected. If F is selected, then D is not selected.
G is selected only if I is selected.
If H is selected, then C is not selected. If B is not selected, then C is selected.
If D is selected, then who among the following must be selected?
(A) C (B) G
(C) D (D) I

3. Each of P, Q and R has to select two items from the six items, such as A, B, C, D, E and F.
If P selects A, then Q does not select E.
Only if R selects E, Q does not select B.
If P selects D, then R will not select C.
If P does not select F, then R will select B.
If Q selects E, then P selects
(A) B and D (B) F and D
(C) C and D (D) F and C

4. A team of three students is to be selected for a quiz competition, a group of students, namely Ankita, Chanchal, Surbhi, Neha and Kanchan such that if Chanchal is selected, then Kanchan should not be selected. Unless Surbhi is selected Neha is selected. Which of the following students must be selected?
(A) Ankita (B) Chanchal
(C) Surbhi (D) None of these

5. A team of four is to be selected from three boys, namely Ajay, Sujay, Vijay and three girls Ena, Meena, Deepa such that exactly two boys are selected. Ajay and Ena should not be selected together. If and only if Meena is selected, then Vijay is selected. In how many ways can the team be selected?
(A) 4 (B) 3
(C) 2 (D) 1

6. A team of three is to be selected from six people, namely from Pavan, Sravan, Raghavan, Aman, Dawan and Bhavan such that if one of Pavan and Sravan is selected then the other must not be selected. If one of Raghavan and Dawan is not selected, then the other must not be selected. If Aman is not selected, then who among the following will not be selected?
(A) Pavan
(B) Bhavan
(C) Raghavan
(D) More than one of the above

Directions for questions 7 to 9: These questions are based on the following data.
A team of five players is to be selected from a group of ten players, such as A, B, C, D, E, F, G, H, I and J.
(i) Exactly one of G and H must be selected.
(ii) H and A must be selected together, if selected.
(iii) B and F must be selected together, if selected.
(iv) F and J cannot be selected together.
(v) C and D cannot be selected together.

7. Which of the following statements must be true?
(A) If G is selected, then B is selected.
(B) If G is selected, then at least one of E and I is selected.
(C) If H and B are selected, then E cannot be selected.
(D) If J is not selected, then B is selected.

8. If G is selected, then which of the following can be the group of players who are not selected?
(A) H, A, F, D, I
(B) H, A, D, E, I
(C) H, C, D, J, A
(D) H, D, J, E, I

9. If G is not selected and J is selected, then the total number of possible selections are
(A) Four (B) Five
(C) Two (D) Six

Directions for questions 10 to 13: These questions are based on the following information.
From a group of five batsmen P, R, S, U and X and five bowlers Q, T, V, W and Y, a group of five players is to be selected. The group must consist of exactly two batsmen.

It is also known that:

(i) At most one among S and Q must be selected.
(ii) Exactly two among R, U, X and V must be selected.
(iii) If R or X is selected, then none among Q, V and T are selected.
(iv) If P is selected, then neither T nor W is selected.

10. Among the batsmen, who must be selected?
(A) R (B) U
(C) X (D) None of these

11. Among the bowlers who must be selected?
(A) Q (B) Y
(C) T (D) None of these

12. If X is selected, then who among the following must be selected?
(A) D (B) U
(C) P (D) Such a case is not possible

13. How many different groups of players can be selected?
(A) 2 (B) 3
(C) 4 (D) 6

Directions for questions 14 to 16: These questions are based on the following information.

A team of three people is to be selected from a group of five people, namely from A, B, C, D and E under the following constraints.

(i) If A is selected, then B must be selected.
(ii) If C is not selected, then E must be selected.

14. In how many ways can the team be selected?
(A) Eight (B) Six
(C) Seven (D) None of these

15. If D is not selected, then who must always be selected?
(A) A (B) B
(C) C (D) E

16. Which of the following is not a possible team?
(A) C, E, D (B) E, A, B
(C) C, B, D (D) A, B, D

Directions for questions 17 to 21: These questions are based on the following information.

A team is to be selected from nine people, namely from R, S, T, U, V, W, X, Y and Z under the following constraints.

(i) If either R or S is selected, then Y must not be selected.
(ii) At least one of W and Z must be selected.
(iii) Unless both T and U are selected then V is selected.
(iv) If and only if W is selected, then Y is selected.
(v) Whenever X is selected, then S must also be selected.

17. What can be the maximum possible number of people selected in a team?
(A) 4 (B) 5
(C) 6 (D) 7

18. What is the minimum possible number of people selected in a team?
(A) 2 (B) 3
(C) 4 (D) 0

19. Which among the following groups can form a team?
(A) TWYZ (B) XYWVU
(C) TUSX (D) None of these

20. In how many ways can a team of four people be selected?
(A) 12 (B) 13
(C) 14 (D) 15

21. If X is selected, then in how many ways can a team of four people be selected?
(A) 4 (B) 2
(C) 3 (D) 1

Directions for questions 22 to 25: These questions are based on the following information.

A team of delegates is to be formed from a group of ten people, N through W by subjecting to the following conditions.

(i) If Q is selected, then none among U, V or W can be selected. Also, U, V and W cannot be selected together.
(ii) If R is selected, then either S or T must be selected. But S and T cannot be selected together.
(iii) At least one out of N, O and P must be selected.
(iv) If P is selected, then neither N nor O can be selected.
(v) N and R cannot be selected together.
(vi) N and Q cannot be selected together.
(vii) P and V cannot be selected together.
(viii) P and W cannot be selected together.

22. If a team of four is selected and Q being one of them, then which of the following must be selected?
(A) R (B) O
(C) T (D) S

23. What is the maximum possible size of a selected team?
(A) Four (B) Five
(C) Six (D) Seven

24. What is the maximum possible size of the team if P is selected?
(A) Four (B) Five
(C) Six (D) Seven

25. In how many different ways can the team be selected if Q is selected?
(A) Seven (B) Eight
(C) Nine (D) Ten

Directions for questions 26 to 28: These questions are based on the following information.

Vijay asked Ajay to select 6 pens of different colours from the available ten colours, such as Orange, Red, Blue, White, Pink, Yellow, Black, Grey, Violet and Brown.

Vijay has laid down some conditions for Ajay, as given below:

(i) If Ajay selects the Blue pen, then he must select the Orange pen also and vice versa.

(ii) If Ajay selects the Grey pen, then he must select the Black pen also and vice versa.

(iii) If Ajay selects the Yellow pen, then he cannot select the Grey pen.

(iv) Exactly one of Red and Violet pens must be selected.

26. If Ajay does not select the Grey or the Brown pen, then among the following choices he can reject the

(A) Pink pen (B) White pen
(C) Red pen (D) Orange pen

27. Which of the following can be the list of colours of pens selected by Ajay?

(A) Yellow, Pink, White, Blue, Brown, Orange.
(B) Red, Blue, Orange, White, Grey, Yellow.
(C) Black, Grey, Brown, Violet, Pink, White.
(D) Red, Pink, Blue, Orange, Violet, White.

28. Which of the following can confirm the selection of pens?

(A) Blue and Yellow pens are selected.
(B) Red and Grey pens are selected.
(C) Orange and Red pens are not selected.
(D) Grey pen is not selected, but the Orange pen is selected.

Directions for questions 29 to 33: These questions are based on the following information.

A team of five members is to be selected from four boys, namely Arjun, Sreekar, Bhavan and Dawan and four girls, namely from Sheela, Rama, Karuna and Nayana under the following constraints.

(i) At least two girls and at least two boys must be selected.

(ii) Sreekar and Karuna cannot be selected together.

(iii) Unless Bhavan is selected, Nayana cannot be selected.

(iv) At most two of Arjun, Dawan and Rama can be selected.

(v) If Sheela is selected, then at most one of the other three girls can be selected.

29. If three girls are selected, then in how many ways can the team be selected?

(A) 5 (B) 4
(C) 3 (D) 2

30. If three boys are selected, then in how many ways can the team be selected?

(A) 7 (B) 8
(C) 9 (D) 10

31. Who must be selected?

(A) Arjun (B) Bhavan
(C) Sreekar (D) Dawan

32. If Sheela is selected, then who is the other girl who must be selected?

(A) Rama (B) Karuna
(C) Nayana (D) None of these

33. If Karuna and Sheela are selected, then who must be selected?

(A) Arjun
(B) Dawan
(C) Nayana
(D) More than one of the above

Directions for questions 34 to 37: These questions are based on the following information.

A company gives an opportunity to its employees to go for a vacation among the months April, May, August, November and December in a year. The employees are A, B, C, D, E, F, G, H, I, J, K, L, M and N. The company gives choice to the employees for selecting the month in which they want to go on a vacation.

But it is stipulated that at least two and at most three persons go on vacation in a month.

(i) F, I, and K want to go on vacation in the same month, but after the month in which J wants to go.

(ii) In May, only two employees want to go on a vacation, but they are neither D nor N.

(iii) M, N, A and E wanted to go in different months.

(iv) If M chooses to go in April, then L wants to go in November and G wants to go in May.

(v) J and H do not want to go in the same month, but one of them wants to go in November.

(vi) A and B want to go in consecutive month in that order. C and E want to go in consecutive months in that order. No two among A, B, C and E wants to go in the same month.

(vii) Only if G wants to go in August, then H and C want to go in the same month.

(viii) If L and N want to go in the same month, then J does not want to go in May.

34. If the company wanted to select five employees for a project, then who wanted to go for the vacation in different months, then which of the following can be the team?

(A) AHMKG
(B) ECHLD
(C) MNHKE
(D) None of these

35. The company has identified three of these employees for promotion and it so happened that these three employees wanted to go on vacation in December, then who among the following will be one among the three?

(A) D (B) L
(C) B (D) M

36. The employees want to go on vacation in November are selected as the three best employees of the company, then who among the following will be in that group?

(A) L, H (B) D, G
(C) A, H (D) G, A

37. The company selects a team of four employees, two of whom want to go on vacation in August, one in April and the other one in May.

Then which of the following cannot be a possible team?

(A) CFKE (B) JGIF
(C) IKFJ (D) FILM

Directions for questions 38 to 40: These questions are based on the following information.

A film-maker wants to select five child artists from a group of children, namely Sakshi Meghana, Neerav, Nihit, Kunal, Kundan, Nabhya and Sagar.

(i) Nihit and Neelam are enemies. So, if one of them is selected, the other one should not be selected.
(ii) Sakshi and Neerav are the best friends. So, if any one of them is selected, then the other one should also be selected.
(iii) The film-maker wants to select exactly one of Sakshi and Sagar.
(iv) Nabhya cannot be selected without Meghana. If both Meghana and Sagar are selected, then Nabhya will not be selected.
(v) Kundan and Nabhya are identical twins. So only one of them must be selected.
(vi) Kunal is selected only if both Meghana and Neerav are selected.

38. In how many ways can the five children be selected?

(A) Five (B) Three
(C) Two (D) Six

39. Who among the following will be selected?

(i) Neerav (ii) Nabhya
(iii) Meghana
(A) (i) (B) (ii) and (iii)
(C) (iii) (D) (i) and (iii)

40. Which of the following is true?

(i) Kundan is not selected.
(ii) Sagar is selected.
(iii) Both Neelam and Kunal are selected.

(A) Only (i)
(B) Only (iii)
(C) Both (i) and (ii)
(D) None of the three

Exercise-2

Directions for questions 1 to 3: These questions are based on the following information.

A team of three people is to be selected from six people, namely from Praveen, Rahul, Qureshi, Swathi, Tarun and Umesh confirming the following conditions.

(i) If at least one of Qureshi and Tarun is selected, then Umesh cannot be selected.
(ii) If at least one of Umesh and Praveen is selected, then either Swathi or Rahul must be selected.

1. If Praveen is selected, then who must not be selected?

(A) Qureshi (B) Tarun
(C) Umesh (D) None of these

2. If Qureshi is selected, then in how many ways can the team be selected?

(A) 4 (B) 5
(C) 6 (D) 7

3. If Tarun is selected, then who must be selected?

(A) Praveen (B) Swathi
(C) Rahul (D) Either Rahul or Swathi

Directions for questions 4 to 6: These questions are based on the following information.

In a beauty pageant, the judges have to select five contestants for final round from three different groups of contestants I, II and III. Each group contains five contestants. Group I contains A, B, C, D, and E group II contains G, H, I, J and K, group III contains F, L, M, N and P.

(i) At least one contestant and at most two contestants should be selected from each group.
(ii) B and D should not be selected together. H and M should be selected together.
(iii) Either E or P must be selected. If H is selected, then J must not be selected.
(iv) Only if C is selected then A should be selected. Unless G is selected, F can not be selected.
(v) Neither I nor K should be selected with either B or M.
(vi) Exactly one among C, L and J should be selected.

4. If M and P are selected, then which of the following is a valid group?

(A) MPCBJ (B) MPHCA
(C) MPJAB (D) MPDAH

5. If only K is selected from group II, then in how many different ways can the five be selected?
(A) Six (B) Five
(C) Four (D) None of these

6. If H, M and E are selected, then in how many different ways can the five be selected?
(A) Four (B) Six
(C) Five (D) Seven

Directions for questions 7 to 9: These questions are based on the following information.

A film-maker wants to select five child artists from a group of children, namely Sakshi Meghana, Neerav, Nihit, Kunal, Kundan, Nabhya and Sagar.

(i) Nihit and Neelam are enemies. So, if one of them is selected, then the other one should not be selected.
(ii) Sakshi and Neerav are best friends. So, if any one of them is selected, then the other one should also be selected.
(iii) The film-maker wants to select exactly one of Sakshi and Sagar.
(iv) Nabhya cannot be selected without Meghana. If both Meghana and Sagar are selected, then Nabhya will not be selected.
(v) Kundan and Nabhya are identical Twins. So only one of them must be selected.
(vi) Kunal is selected only if both Meghana and Neerav are selected.

7. In how many ways can the five children be selected?
(A) Five (B) Three
(C) Two (D) Six

8. Who among the following will be selected?
(i) Neerav
(ii) Nabhya
(iii) Meghana
(A) **(i)** (B) (ii) and (iii)
(C) (iii) (D) (i) and (iii)

9. Which of the following is true?
(i) Kundan is not selected.
(ii) Sagar is selected.
(iii) Both Neelam and Kunal are selected.
(A) Only (i) (B) Only (iii)
(C) Both (i) and (ii) (D) None of the three

Directions for questions 10 to 12: These questions are based on the following information.

Eleven players out of a total of sixteen players have to be selected for a cricket match. Among these sixteen players, there are twelve batsmen, nine bowlers and two wicket-keepers. There are six all-rounders (players who can both bat and bowl are known as all-rounders) and one wicket-keeper who is also a batsman. An ideal eleven consists of at least 6 batsmen, at least six bowlers and exactly one wicket-keeper. No wicket-keeper bowls.

10. If the wicket-keeper, who is also a batsman is selected in the ideal eleven, then what is the minimum possible number of players in the team who can only bowl?
(A) Zero (B) One
(C) Two (D) More than two

11. If the number of all-rounders should be kept at a minimum while selecting the team, then what is the least number of players who can only bat?
(A) Six (B) Five
(C) Four (D) None of these

12. Which of the following statements is never true?
(A) All the eleven players can bat in a team.
(B) In a team, 8 players can bat and 8 players can bowl.
(C) In a team, 7 players can bat and 7 players can bowl.
(D) In a team, when the number of all-rounders is kept at a minimum, then the number of players who can only bat is less to those who can only bowl.

Directions for questions 13 to 16: These questions are based on the data given below.

Four teams are to be formed from fourteen people. A team must consist of at least two people and no two teams can have the same number of people. Each person can be a member of exactly one team. Each of Rama, Ramya, Radha and Raksha must be a member of a different team. Each of Rohini, Padma, Priya and Priyanka must be a member of a different team. Pratima, Pratibha and Sudha must be in the same team. Shreya and Shalini must be in the same team. Rama cannot be in the same team with any of Padma, Priya and Priyanka. Ramya can be in the same team with neither Priyanka nor Priya. Radha cannot be in the same team with Priyanka. Swetha is in one of the teams.

13. How many possible ways are there to form the four teams?
(A) 24 (B) 120
(C) 64 (D) 6

14. Which of the following statements is not definitely true?
(A) Swetha is in a three-member team.
(B) There is a two-member team.
(C) Sudha is in a five-member team.
(D) Shreya is in the two-member team.

15. Which of the following additional statements is sufficient to know the composition of teams?
(A) Rohini and Padma are in teams with five and four members, respectively and Radha is not in a three-member team.

(B) Sudha and Shalini are in teams with five and four members, respectively and Swetha is not in a two-member team.
(C) Pratima and Swetha are in teams with five and three members, respectively and Shreya is not in a two-member team.
(D) None of these

16. Who of the following must be a member of a five-member team?
(A) Priya (B) Priyanka
(C) Pratima (D) Shreya

Directions for questions 17 to 19: These questions are based on the following data.

In a class of ten students, namely A, B, C, D, E, F, G, H, I and J, ranks are given to the top five students, such that the student who gets the highest marks will get the 1st rank, the student getting the second highest marks will get the 2nd rank and so on. It is also known that no two students get equal marks. D gets less marks than G and H gets less marks than I.

If F gets a rank, then D will not get a rank. Exactly one of B and G gets a rank.

If I gets a rank, then C will get a rank and vice-versa.

17. If E did not get a rank and I got less marks than F, then which of the following is definitely false?
(A) J or A gets a rank. (B) D gets a rank.
(C) B gets a rank. (D) F gets a rank.

18. If D and H got two consecutive ranks, then C would not get the
(A) 1st rank (B) 2nd rank
(C) 3rd rank (D) 4th rank

19. If F is not ranked and H gets more marks than G, then who among the following must be ranked?
(A) C (B) G
(C) A or E or J (D) B

Directions for questions 20 to 23: These questions are based on the following data.

A cricket team consisting of 11 players has to be selected from amongst 16 players, A through P.

Among these 16 players
(A) A, C, E, G, I, K, M, J and O are batsmen.
(B) B, D, F, G, H, J, M and P are bowlers.
(C) L and N are wicket-keepers.
(D) Any player who is both a bowler and a batsman is called an all-rounder. The Captain and the Vice-Captain are the all-rounders. The team is selected as per the following restrictions:
(1) The team should contain 5 batsmen, 3 bowlers, 2 all-rounders and a wicket-keeper and the Captain and the Vice-Captain must be selected.
(2) Neither G nor M is the Captain and neither J nor G is the Vice-Captain.
(3) The players mentioned in the following pairs must not get selected together:
J and N; B and F; D and H; D and P; E and I; A and E; and B and C.

20. Which two players are the Captain and the Vice-Captain of the team respectively?
(A) J and G (B) G and M
(C) J and M (D) G and K

21. Who are the three bowlers selected in the team?
(A) F, H and P (B) D, F and H
(C) F, H and B (D) B, D and F

22. Which of the following is definitely false?
(A) J, O, P, A, L and I are selected.
(B) L, O, F, H and C are not selected.
(C) B, D, E and N are not selected.
(D) M, I, K, P and O are selected.

23. If after the first match, in every following match, the Captain and the Vice-Captain exchange their job responsibilities (i.e., Captain takes up the Vice-Captaincy and the Vice-Captain takes up the Captaincy), then who would be the Vice-Captain in the 86th match?
(A) J (B) M
(C) Either J or M (D) L

Directions for questions 24 to 26: These questions are based on the following information.

Two groups of four people each are to be selected from a group of eight people A, B, C, D, E, F, G and H.

The following conditions are to be followed while forming the teams.
(i) If B is selected into a team, then D should also be selected in the same team.
(ii) If E is selected into a team, then C must be selected into the other team.
(iii) G and H should not be selected in the same team.
(iv) Each person is selected into exactly one team.

24. If B is selected into one team, then who among the following pairs must be selected into the other team?
(A) AF (B) CH
(C) EH (D) EG

25. If E and D are selected in one team, then who are the other two people who are selected into the same team?
(A) BH (B) GF
(C) GB (D) Either (BG) or (BH)

26. Which of the following is a valid team?
(A) DEGA
(B) CHFD
(C) EHAF
(D) More than one of the above

Directions for questions 27 to 31: These questions are based on the following information.

Two teams are to be selected from twelve people A, B, C, D, E, F, G, H, I, J, K and L under the following constraints.

(i) Each team must contain at least four people.
(ii) If G is selected in a team, then H must be selected in the other team.
(iii) If I or J is selected in any team, then L must not be selected in any of the teams.
(iv) Unless D or E is selected in a team, K is selected in any team.
(v) F can be selected in a team only if A is selected in the other team.
(vi) If B is selected in a team, then A should not be selected in that team.
(vii) No two of A, C and E can be selected in the same team.

27. If H is selected in a team, then which of the following cannot be the other team?
(A) K, D, L, G
(B) G, D, I, A
(C) A, G, L, F
(D) More than one of the above

28. If B and E are selected in a team and each team has five members, then in how many ways can the other team be selected?
(A) 8 (B) 6
(C) 5 (D) 9

29. If A is selected in a team and J is selected in the other team, then who among the following must be selected in the team where A is selected?
(A) G (B) H
(C) I (D) None of these

30. If X and Y are the names of the two teams and K is selected into the Team X and L is selected, then in how many ways can the Team Y be selected?
(A) 1 (B) 2
(C) 3 (D) 4

31. If F is selected in a team, then how many of the remaining people can be selected in the other team?
(A) 11 (B) 10
(C) 9 (D) 8

Directions for questions 32 to 34: These questions are based on the following information

Each of the six delegates A through F has to give a presentation on different topics that ranges from Terrorism, Trafficking, Poverty, Unemployment, Environmental Protection and Illiteracy, not necessarily in that order, at the World Congress. Each of the six delegates is from a different nation and they are from Brazil, China, India, Russia, South Africa and the USA, not necessarily in that order. Each of the delegates is carrying a folder of different colour among red, green, black, blue, orange and white, not necessarily in that order.

It is known that three delegates have to give presentation in one slot and the remaining three in the other slot. It is also known that:

(i) D is from South Africa and has a presentation on Unemployment.
(ii) The delegate carrying the red folder and the delegate giving a presentation on Traffcking cannot be in the same slot.
(iii) F is not from China or Russia and has to be in the same slot along with the delegate carrying the white folder.
(iv) The delegate giving a presentation on Environmental Protection and the delegate carrying the orange folder must be in the same slot.
(v) B is from India, C is giving a presentation on Illiteracy but she is not carrying the white folder.
(vi) A is carrying neither the red folder nor the white folder but should be with the delegate from China in the same slot.
(vii) E is carrying the green folder.

32. If B is carrying the orange folder, then which of the following must be false?
(A) B is selected for the same slot as A.
(B) F and D are selected for the same slot.
(C) The delegate giving presentation on Environmental Protection is carrying the green folder.
(D) The delegate giving presentation on Unemployment and A are selected for the same slot.

33. If A is presenting on Trafficking and F is carrying the red folder, then which of the following must be true?
I. The delegate carrying the white folder and the delegate from China are selected for different slots.
II. The delegate from China is carrying the orange folder.
III. The delegates giving presentation on Unemployment and Environmental Protection are selected for the same slot.
(A) I only (B) I and II only
(C) III only (D) II and III only

34. If E is from the USA and F is giving presentation on Trafficking, then which of the following must be false?
(A) F is from Brazil and he is not in the same slot with the delegate from Russia.
(B) The delegate carrying the white folder is same slot as the delegate from China.
(C) B is carrying the white folder and he is selected with the delegate carrying the orange folder.
(D) The delegate from Russia is selected with the delegate carrying the blue folder.

Directions for questions 35 to 37: These questions are based on the following information.

A group of three girls, namely Anjali, Bharathi and Chandrika and four boys, namely Kiran, Lala, Manoj and Naveen are to be divided into two teams under the following constraints.

(i) Each team must have at least one girl and at least one boy and at least three people in total.
(ii) If Anjali and Bharathi are selected in a team, then the team must have only one boy.
(iii) Kiran and Lala cannot be in the same team.
(iv) Chandrika and Naveen can be in the same team, only if Bharathi is selected in that team.

35. If Kiran and Chandrika are in the same team, then in how many ways can the other team be selected?
(A) Six (B) Three
(C) Four (D) Five

36. If Manoj is not in the same team as Bharathi, then in how many ways can the teams be selected?
(A) Three (B) Four
(C) Five (D) Six

37. If three boys are selected into one team, then in how many ways can the teams be selected?
(A) Four (B) Five
(C) Three (D) Six

Directions for questions 38 to 40: These questions are based on the following information.

A team of four people is to be selected from seven people, namely Anuj, Bindu, Chanti, Dheeraj, Eswar, Farhaan and Ganesh under the following constraints.

(i) At most two of Chanti, Eswar and Ganesh can be selected.
(ii) At least one of Anuj and Bindu must be selected.
(iii) If Farhaan is selected, then neither Anuj nor Chanti can be selected.

38. If Dheeraj is selected, then in how many ways can the team be selected?
(A) Eight (B) Ten
(C) Nine (D) Eleven

39. If at most one of Farhaan and Ganesh can be selected, then in how many ways can the team be selected?
(A) 11 (B) 12
(C) 13 (D) 14

40. If Eswar is not selected, then in how many ways can the team be selected?
(A) Six (B) Seven
(C) Eight (D) Nine

Exercise-3

Directions for questions 1 to 4: These questions are based on the following information.

Ten candidates appear for an interview and six of them are selected. There are two M.As, two M.B.As, two M.C.As and four B.Techs among the candidates. If at least one M.B.A. candidate is selected, then exactly two B.Tech candidates must be selected and vice versa. Of the six selected candidates, exactly one must be an M.A. candidate.

1. Which of the following statements is definitely true, if two B.Tech candidates are selected?
(A) Two M.C.As and two M.As are selected.
(B) Only two M.B.As and only one M.C.A are selected.
(C) One M.B.A and two M.As are selected.
(D) Two MBAs are selected.

2. If two M.C.A. candidates are selected, then which of the following statements can be true?
(A) One M.B.A. and one B.Tech candidate is selected.
(B) Three B.Tech candidates are selected.
(C) Only one M.B.A. and two B.Tech candidates are selected.
(D) One M.A. and three B.Tech candidates are selected.

3. Which of the following statements is definitely FALSE?
(A) If four B.Tech candidates are selected, then two M.B.A. candidates must be selected.
(B) One M.A. candidate, one M.B.A. candidate and two M.C.A. candidates can be selected.
(C) One M.A., one M.B.A., two M.C.As and two B.Techs is a possible combination of selection.
(D) More than one of the above

4. Which of the following statements, if true, will make the selection of six candidates impossible?
(A) Two M.B.As are selected.
(B) Two M.C.As are selected.
(C) Two B.Techs are selected.
(D) No M.C.A. is selected.

Directions for questions 5 to 9: Read the information given below and answer the questions that follow.

Ajay, Bony and Chetan are three people who go to buy six items, such as P, Q, R, S, T and U. Each one of them buys two different items in such a way that if Ajay buys R, then Bony buys neither P nor S. If Bony buys Q, then Chetan buys neither U nor T.

5. If Ajay buys R and T, then Bony buys
(A) P and S (B) Q and U
(C) P and Q (D) S and U

6. If Bony buys Q and S, then Ajay must buy
(A) P and R (B) T and U
(C) P and T (D) R and U

7. If Chetan has to buy P and S, then which of the following must be true?
(A) Ajay bought R (B) Bony bought Q
(C) Ajay bought T (D) None of these

8. If Ajay buys P and Bony buys Q, then which of the following is true?
(A) Chetan buys R and S.
(B) Chetan can buy any two of P, R and S.
(C) Chetan can buy any three of P, R, S and T.
(D) Chetan can buy any two of P, R, S, T and U.

9. Which of the following is definitely true?
(A) Ajay buys R and Bony buys Q.
(B) If Chetan buys T or U, then Bony buys Q and S.
(C) If Ajay buys R, then Bony buys T.
(D) If Ajay buys R and Bony buys Q, then Chetan has to buy P and S.

Directions for questions 10 and 11: These questions are based on the following information.

Out of seven people from A, B, C, D, E, F and G, four are to be selected.

1. At least one of E or B must be selected and at most one between A or D can be selected.
2. Either C or D must be selected.
3. A, F and G cannot be selected together.

10. If A is selected, then who must be selected?
(A) D (B) F (C) G (D) C

11. If neither A nor D is selected, then in how many different ways can the four people be selected?
(A) Three (B) Four (C) Five (D) Two

Directions for questions 12 to 15: These questions are based on the following information.

A group of six students, namely Jagan, Karan, Madan, Pavan, Rajan and Savan are to be divided into three teams of two students each for quiz competitions in Physics, Chemistry and History under the following constraints.

(1) Pavan does not want to be in the same team as Rajan.
(2) Savan does not want to be in Physics team.
(3) If Jagan is selected for Chemistry, then Madan must be selected for History.
(4) Karan and Madan must be selected in the same team.

12. If Rajan is selected for History team, then who must be the team mate of Pavan?
(A) Jagan (B) Savan
(C) Madan (D) Either (A) or (B)

13. If Rajan is selected for Chemistry, then who must be his team mate?
(A) Jagan (B) Savan
(C) Pavan (D) Madan

14. If Rajan wants to be in Physics, then in how many ways can the teams be selected?
(A) 5 (B) 4 (C) 3 (D) 2

15. If Savan wants to be in Chemistry, then in how many ways can the teams be selected?
(A) 5 (B) 4 (C) 3 (D) 2

Directions for questions 16 to 18: Answer these questions based on the data given below.

A team is to be selected from seven members A through G. In that team at least one among B, D and F must be selected. If B is selected, then neither C nor G can be selected. A and F cannot be selected together. If D is selected, then E must be selected and if C is selected, then A must be selected.

16. If a team of four members is to be selected, then in how many ways can the team be selected?
(A) 3 (B) 4 (C) 5 (D) 2

17. If a team of five members is to be selected, then who among the following cannot be selected?
(A) C (B) A (C) G (D) B

18. If a team of three members is to be selected, then in how many ways can the team be selected?
(A) 7 (B) 6 (C) 5 (D) 4

Directions for questions 19 to 21: These questions are based on the following information.

Rahul has to select five books from nine books. Among those nine books, five books are printed in the following different years, in 2004, 2005, 2006, 2007 and 2008 and the remaining books are written by different authors A, B, C and D. Rahul has to select at least two books which were printed in the above given years. Further, it is known that:

(i) If the book which was printed in either 2004 or 2008 is selected, then the book which was written by A must not be selected.
(ii) The book which was printed in 2006 cannot be selected with the books which were printed in the previous years of 2006.
(iii) The book which was written by D cannot be selected with the books which were printed in the previous years of 2007.
(iv) The books which were printed in 2005 and 2007 should not be selected together.
(v) If the book which was written by C is selected, then only two books are to be selected which were printed in the consecutive years.

19. Which among the following books cannot be selected?
(A) The book written by D
(B) The book printed in 2005
(C) The book printed in 2008
(D) The book written by A

20. Which among the following books must be selected, if the book written by A is selected?
(A) The book written by D
(B) The book printed in 2005
(C) The book printed in 2006
(D) None of the above

21. Which among the following books must not be selected, if the book written by D is selected?
(A) The book written by A
(B) The book written by B
(C) The book printed in 2007
(D) The book printed in 2008

Directions for questions 22 to 25: These questions are based on the following information.

A group of people, namely A, B, C, D, E, F, G, H, I, J and K are football players. Each of them can play in at least one of the positions, such as defence, mid-field, forward and goal keeping. Among them A, B, C and K are defenders. C, D, E and F are mid-fielders. F, G, H and I are forwards. J and K are goalkeepers.

A team of six players is to be selected for an exhibition match with the following restrictions. The team should consist of one goalkeeper, two defenders, one mid-fielder and two forwards. The following is known about selecting the players.
(i) Only one among J and K is selected.
(ii) If D is selected, then neither C nor K is selected.
(iii) If B is selected, then neither F nor I is selected.
(iv) If F or C is selected, then J is not selected.
(v) Among D, F and C, only one is selected.

22. If J is selected, then who will be selected as forwards?
(A) F along with G or I (B) Only G and H
(C) G along with H or I (D) Only F and H

23. If F is selected as the mid-fielder, in how many ways can the team be selected?
(A) Eight (B) Nine
(C) Seven (D) No such team is possible

24. If D is selected as the mid-fielder, then in how many ways can the team be selected?
(A) One (B) Three
(C) Six (D) Five

25. Who among the following cannot be selected as forward?
(A) F (B) G
(C) H (D) I

ANSWER KEYS

Exercise-1

1. (A)	8. (C)	15. (B)	22. (A)	29. (D)	36. (C)
2. (D)	9. (B)	16. (D)	23. (B)	30. (C)	37. (D)
3. (D)	10. (B)	17. (D)	24. (A)	31. (B)	38. (D)
4. (D)	11. (D)	18. (A)	25. (D)	32. (D)	39. (D)
5. (B)	12. (D)	19. (D)	26. (C)	33. (D)	40. (D)
6. (D)	13. (C)	20. (A)	27. (C)	34. (C)	
7. (B)	14. (B)	21. (B)	28. (C)	35. (C)	

Exercise-2

1. (D)	8. (D)	15. (A)	22. (B)	29. (D)	36. (D)
2. (B)	9. (D)	16. (C)	23. (A)	30. (B)	37. (A)
3. (D)	10. (A)	17. (B)	24. (A)	31. (D)	38. (D)
4. (B)	11. (C)	18. (D)	25. (D)	32. (D)	39. (C)
5. (B)	12. (D)	19. (A)	26. (A)	33. (A)	40. (A)
6. (D)	13. (A)	20. (C)	27. (D)	34. (B)	
7. (D)	14. (D)	21. (A)	28. (A)	35. (D)	

Exercise-3

1. (D)	6. (B)	11. (B)	16. (C)	21. (A)
2. (C)	7. (D)	12. (D)	17. (D)	22. (B)
3. (A)	8. (A)	13. (B)	18. (A)	23. (D)
4. (D)	9. (D)	14. (D)	19. (B)	24. (A)
5. (B)	10. (D)	15. (B)	20. (C)	25. (A)

SOLUTIONS

EXERCISE-I

1. Alen or Jack or both must be in the van.

Adam × Anil

John, James

(A) is the answer as none of Adam and Anil is in the car.
∴ They both are in van which violates the given condition.

2. ('✓' means selected, 'K' means not selected)
If $A_{✓} \Rightarrow F_{✓}$
If $F_{✓} \Rightarrow D_{K}$
Only if $I_{✓} \Rightarrow G_{✓}$
If $H_{✓} \Rightarrow C_{K}$
If $B_{K} \Rightarrow C_{✓}$
If D is selected, then F is not selected. As F is not selected, A is also not selected.
Only one of H and C can be selected. So, we must select I. If I is not selected, then G cannot be selected, there will be only four people left, which means that the group cannot be formed.

3. It is given that: (✓ is select and x is not selected)
(1) If P ✓ A, then Q K E.
(2) Only if R ✓ E, then Q K B.
(3) If P ✓ D, then R K C.
(4) If P K F, then R ✓ B.
(5) Q ✓ E.
As we know that Q selects E, it means P does not select A (from 1). From 2, we know that Q selects B as R does not select E.
As R does not select B, it means P selects F.
Let us now represent the above information on a table.

	P	Q	R
Selects	F	E, B	
Does not select	A		1

As P does not select A, it means R selects A. From 3, we know that if P selects D, then R does not select C which means that no one selects C, which is not possible. Hence, R selects D and P selects C.
The final table is as follows.

P	Q	R
F	E	A
C	B	D

4. From the given information at most one of Chanchal and Kanchan is selected, and at least one of Surbhi and Neha must be selected.
∴ Some of the possible teams are:
Chanchal, Surbhi, Ankita
Neha, Surbhi, Kanchan
Neha, Chanchal, Ankita.
∴ No one must be selected.

5. From the given information at least one of Ajay and Ena must not be selected, exactly one of Meena and Vijay must not be selected. As four have to be selected, both Meena and Vijay are to be selected.
If Ajay is the other boy, then Deepa is the other girl.
If Sujay is the other boy, then Deepa or Ena is the other girl.
Hence, in three ways we can select the team.

6. Aman is not selected.
At least one of Pavan and Sravan must not be selected.
⇒ At least one of Raghavan and Dawan must be selected.
⇒ Raghavan and Dawan must be selected.
One of Bhavan, Pavan and Sravan is the third person.

Solutions for questions 7 to 9: A team of five players is to be selected from a group of ten players A, B, C, D, E, F, G, H, I and J. It is given that:

(i) One of G and H must be selected.

(ii) H and A must be selected together and B and F must be selected together ⇒ HA and BF.

(iii) F and J cannot be selected together, and C and D cannot be selected together ⇒ F ≠ J, C ≠ D.

7. If G is selected, then H and A cannot be selected but B can be selected or cannot be selected.
∴ (A) is not correct.
If H and B are selected, then we cannot say anything about E.
∴ (C) is incorrect.
If J is selected, then we cannot say anything about B.
∴ (D) is not correct.
If G is selected, then H and A cannot be selected which means that the selection can be done as follows:

G | C / D | F / J | B E I

One of C and D can be selected and one of F and J can be selected. If F is selected, then B is also selected. We can select atmost one of C and D which means that one of E or I must be selected. If J is selected, then F and B are not selected. We can select one of C or D in the team which means at least one of E or I must be selected.

8. If G is selected, then H and A are not selected and F is definitely selected because either H and A or B and F must be selected.
So, (A) is not the answer.
(B) cannot be the answer because both F and J are selected.
(D) cannot be the answer because if G is selected then A definitely is not selected.
So, (C) is the correct answer.

9. If G is not selected and J is selected, then the total possible selections are
(1) H A J E I
(2) H A J C I
(3) H A J D I
(4) H A J C E
(5) H A J D E

Solutions for questions 10 to 13: From (i), if R or X's selected then none of Q, V and T are selected, then three bowlers cannot be selected. Hence, neither R nor X can be selected.
Hence, from (ii) U and V must be selected.
∴ One among S and P must be selected.
If P is selected, then the bowlers, Q, V and Y must be selected.
If S is selected, then the other two bowlers that are to be selected must be from Y, T and W.
∴ The possible teams are
(U, P, Y, Q, V), (U, S, V, Y, T), (U, S, V, Y, W) and (U, S, V, T, W).

10. U must be selected.

11. V must be selected always.

12. Such a case is not possible.

13. The different ways in which a team can be selected is four.

Solutions for questions 14 to 16: From (i), A and B can be selected as follows:
→ Both A and B are selected.
→ Only B is selected.
→ Neither A nor B is selected.
From (ii), C and E can be selected as follows:
→ Only E is selected.
→ Only C is selected.
→ Both E and C are selected.

14. From the above explanation, it is clear that at least one among C and E must be selected. If only C is selected, then the possibilities are
(1) C, A, B
(2) C, B, D
If only E is selected, then the possibilities are
(3) E, A, B
(4) E, B, D
If both C and E are selected, then the possibilities are
(5) C, E, D
(6) C, E, B
∴ There are 6 possible ways.

15. From the above solution, if D is not selected, then B must always be selected.

16. A, B, D is not a possible team.

17. From (i), it is clear that if Y is selected then only one of R and S should not be selected
∴ To maximize the strength of the team, 'Y' must not be selected. Hence, from (iv), W must not be selected.
∴ At most seven members can be selected into a team, i.e., R, S, T, U, V, X, Z.

18. From the rule (iii), either T and U or V must be selected. From the rule (ii), either W or Z must be selected but if W is selected, then Y must be selected. Hence, to minimize the team W and Y should not be selected. Hence, the team with minimum strength is Z, V and its strength is 2.

19. Choice (A) is violating the rule (iii). Choice (B) is violating the rule (v). Choice (C) is violating the rule (ii).

20. From (ii), among W and Z, we must select:
(a) only W or
(b) only Z or
(c) both W and Z.
(a) Only W is selected and Z is not selected.
From (iv), Y is selected.
From (i), R and S are not selected and from (v) X is not selected.
As already three are not selected, at least two of T, U and V must be selected.
∴T and U are to be selected.
Hence, one team can be selected, i.e., W, Y, T, U.
(b) only Z is selected but not W.
From (iv) Y is not selected and
∴ R or S or both can be selected.
From (iii), among T, U and V either T or U cannot be selected alone.
Also, X and S together can also be selected, but not only X.
∴ Hence, along with Z the other three members can be as follows.
R, S, X
R, S, V
T, U, R
T, U, S
T, V, R
T, V, S
U, V, R
U, V, S
X, S, V
T, U, V
∴ Hence, in ten different ways a team with Z but not W can be selected.

(c) If W as well as Z is selected.
⇒ Y must be selected.
∴ Only one of the remaining six has to be selected.
From (iii), V must be selected.
∴ Only one team, i.e., W, Z, Y, V can be selected.
Total number of ways of selecting a team of size 4 is 1 + 10 + 1 = 12 ways.

21. From the above solution if X is selected then a team of strength four can be selected in two different ways, i.e.,
(A) ZRSX and (B) ZSXV

Solutions for questions **22 to 25:** From (i), the pairs QV, QU, QW cannot be selected together. Also, UVW cannot be selected together.

From (ii), the possibilities are RS, RT, only S or only T.

From (iii) and (iv), among the possibilities only N, only O, only P or only N and O one must happen.

From (v) to (viii), the pairs NR, NQ, PV and PW should not be selected together.

22. If Q is selected, then none among N, V, U or W can be selected.
Among the remaining, one among O and P will be selected. The remaining two members have to be selected from R, S and T. S and T cannot be selected. Hence, R must be a part of the team.

23. The maximum number of selections in the team can be as shown below.
(A) N, O, two people out of (U, V, W) and one person out of (S, T).
(B) O, two people out of (U, V, W), R and one person out of (S, T).
Hence, the maximum team size is five.

24. If P is selected, then the maximum selections in the team can be as shown below.
(A) P, Q, R, S
(B) P, Q, R, T
Hence, the maximum team size is four.

25. If Q is selected, then the number of ways the team can be selected is shown below.
(A) O, Q, R, S (i) Q, O
(B) O, Q, R, T
(C) O, Q, S (j) Q, P
(D) O, Q, T
(e) P, Q, R, S
(f) P, Q, R, T
(g) P, Q, S
(h) P, Q, T
Hence, the team can be selected in ten ways.

Solutions for questions **26 to 28:** It is given that:
(i) If Ajay selects the Blue pen, then he selects the Orange pen also and vice versa.
(ii) If he selects the Grey pen, then he selects the Black pen also and vice-versa.
(iii) If Ajay selects the Yellow pen, then he cannot select the Grey pen.
(iv) Exactly one of Red and Violet pens must be selected.

26. If he did not select Grey and Brown, then he must select White, Pink, Orange, Blue, Yellow, Red/Violet.
∴ He can reject Red.

27. (A) is not the answer, as there is neither the Red nor the Violet coloured pens.
(B) is not the answer, as both the Yellow and the grey coloured pens are selected.
(D) is not the correct answer, as both the Red and the Violet coloured pens are selected.

28. If the Orange coloured pen is not selected, then the Blue coloured pen also cannot be selected.
If the Red coloured pen is not selected, then the Violet coloured pen should be selected.
Hence, there are seven coloured pens out of which Ajay has to select six coloured pens.
He must select the Grey coloured pen and he cannot select the Yellow coloured pen.
The six coloured pens he selects are White, Pink, Black, Grey, Violet and Blue.

29. Since at least two girls are to be selected, from (v), Sheela must not be selected.
∴ Rama, Karuna and Nayana are selected.
From (iii), Bhavan must be selected.
From (ii), Sreekar must not be selected.
∴ Arjun or Dawan is the other boy.
In two ways we can select the team.

30. As three boys are selected, the teams are:
(A) If Arjun, Sreekha, Bhavan are the boys, then any two of Sheela, Rama and Nayana can be the girls, i.e., the team can be selected in three ways [From (ii)].
(B) If Arjun, Sreekhar, Dawan are the boys, then Karuna, Rama and Nayana cannot be selected [From (ii), (iii) and (iv)].
(C) If Arjun, Bhavan, Dawan are the boys, then any two of Sheela, Karuna and Nayana can be the girls [From (iv)], i.e., the team can be selected in three ways.
(D) If Sreekar, Bhavan, Dawan are the boys, then any two of Sheela, Rama and Nayana can be the girls [From (ii)],
i.e., the team can be selected in three ways.
Hence, in total, there are nine ways to select the team with three boys.

31. Let Bhavan not be selected then,
from (ii), Nayana is not selected.
From (v), at most two of the other three girls can be selected.
⇒ Arjun, Sreekar and Dawan must be selected.
⇒ Rama must not be selected [From (iv)]
⇒ Karuna and Sheela must be selected which is a contradicting statement (ii).

Hence, no team can be selected without Bhavan.
From solution (B), without Arjun or Sreekar or Dhawan we can select a team.

32. If Sheela is selected, then three boys must be selected.
From solution (B), any one of the remaining three girls can be the other girl.

33. Given that, Karuna and Sheela is not selected.
From (ii), Sreekar is not selected.
⇒ Arjun, Dawan and Bhavan must be selected.

Solutions for questions 34 to 37: From (i) and (vi), we can say that F, I and K want to go in August. J wants to go in either April or May.

From (v) and above, H wants to go in November.

From (vii) and above, C and E want to go in April and May, respectively. A and B wants to go in November and December, respectively.

From (ii), (iii), (iv), (viii) and above, the possible cases are as follows.

Case	April	May	August	November	December
(i)	C, J, M	E, G	F, I, K	A, H, L	B, D, N
(ii)	C, G, N	E, J	F, I, K	A, H, D,/L	B, M, L/D
(iii)	C, J, N	E, L	F, I, K	A, H, D/G	B, M G/D
(iv)	C, J, N	E, G	F, I, K	A, H, D/L	B, M, L/D

34. A and H are in the same month. Hence, (A) cannot be the answer. In option (B), one among the three pairs EL, HL and HD will be in the same month. MNHKE is a possible team.

35. None among D, L and M is definitely in December. But B is definitely in December.

36. A and H are definitely in November.

37. Each of (A), (B) and (C) is a possible team but not (D).

Solutions for questions 38 to 40: From (i), only Nihit, only Neelam or neither of them is selected.

From (ii), both Sakshi and Neerav or neither of them is selected.

From (iii), only Sakshi or only Sagar is selected.

From (iv), only Meghana, both Meghana and Nabhya or neither of them is selected. Only Sagar, only Meghana and Sagar or none of them is selected.

From (v), only Kundan or only Nabhya is be selected.

From (vi), only Meghana or only Neerav or Meghana, Neerav and Kunal or only Meghana and Neerav or none of them is selected.

∴ The final possible selections are as follows.

(i) Sakshi, Neerav, Meghana, Nabhya, Nihit.
(ii) Sakshi, Neerav, Meghana, Nabhya, Neelam.
(iii) Sakshi, Neerav, Meghana, Nabhya, Kunal.
(iv) Sakshi, Neerav, Kundan, Meghana, Kunal.
(v) Sakshi, Neerav, Kundan, Meghana, Nihit.
(vi) Sakshi, Neerav, Kundan, Meghana, Neelam.

38. The group can be selected in six different ways.

39. Among the given, Neerav and Meghana will be selected.

40. None of the statements is true.

EXERCISE-2

Solutions for questions 1 to 3: Let each person be denoted by the first letter of his name

1. If P is selected, then some of the possibilities are PSR, UPS and PQS, PTS.

2. If Q is selected, then U should not be selected.
Now from (ii), the possible selections are QTS, QTR, QPS, QPR, QSR.
∴ A total of 5 possibilities.

3. As T is selected, then U should not be selected.
If P is selected, then S or R must be selected.
If Q is selected, then P must not be selected and vice versa.
∴ To select a team of three, S or R must be selected.

Solutions for questions 4 to 6: From (ii), only B or only D or neither of them is selected. Both H and M or neither of them is selected.

From (iii), only E, only P or both E and P are selected. Only H, only J or neither of them is selected.

From (iv), C and A, only C or neither of them is selected. Only G, G and F or neither of them is selected.

From (v), only I, only K, both I and K, only B, only M, both B and M or none of them is selected.

From (vi), only C or only L or only J should be selected.

4. MPHCA is a valid group.

5. The group can be selected in five different ways.
(i) KCENP (ii) KDELN (iii) KDELP
(iv) KDENP (v) KPCDN

6. The group can be selected in six different ways.
(i) EHMCG (ii) EHMCN (iii) EHMCP
(iv) EHMLG (v) EHMLB (vi) EHMLD

Solutions for questions 7 to 9: From (i), only Nihit, only Neelam or neither of them is selected.

From (ii), both Sakshi and Neerav or neither of them is selected.

From (iii), only Sakshi or only Sagar is selected.

From (iv), only Meghana, both Meghana and Nabhya or neither of them is selected. Only Sagar, only Meghana and Sagar or none of them is selected.

From (v), only Kundan or only Nabhya is be selected.

From (vi), only Meghana or only Neerav or Meghana, Neerav and Kunal or only Meghana and Neerav or none of them is selected.

∴The final possible selections are as follows.

(i) Sakshi, Neerav, Meghana, Nabhya, Nihit
(ii) Sakshi, Neerav, Meghana, Nabhya, Neelam
(iii) Sakshi, Neerav, Meghana, Nabhya, Kunal
(iv) Sakshi, Neerav, Kundan, Meghana, Kunal
(v) Sakshi, Neerav, Kundan, Meghana, Nihit
(vi) Sakshi, Neerav, Kundan, Meghana, Neelam

7. The group can be selected in six different ways.

8. Among the given, Neerav and Meghana will be selected.

9. None of the statements is true.

Solutions for questions 10 to 12: Following is the given information:

(i) From a total of 16 players, out of which 11 are to be selected.

(ii) Among these 16 players:
Number of batsmen = 12
Number of bowlers = 9
Number of wicket-keepers = 2
Number of all-rounders = 6 (out of 12 batsmen and 9 bowlers)
Number of wicket-keeper + Batsman = 1
Now, number of only wicket-keeper = 2 – 1 = 1
Number of only batsman = 11 – 6 = 5
(Eleven, because one batsman is wicket keeper)
Number of only bowlers = 9 – 6 = 3

(iii) Ideal Team
At least 6 batsmen, at least 6 bowlers and at least one wicket-keeper.

10. Ideal Eleven: (W.K. = Wicket-keeper)

Batsmen	Bowlers (6)	All-rounders
1 + 5 or more W.K.	6 or more	?

If all the 6 bowlers are also batsmen (i.e., 6 all-rounders), plus one wicket-keeper batsman gives 7 players. Thus, the least number of only bowlers will be zero.

11. As there are 3 players who can only bowl, but at least 6 bowlers are required, hence, minimum number of all-rounders = 3. The wicket-keeper selected is a batsman. Hence, there are three bowlers who can only bowl. Therefore, the team consists of 3 bowlers + 3 all-rounders + 1 wicket-keeper = 7.

But the total number of players who can only bat is (11 – 7) = 4

Total players (as shown below):

Only			Wicket-keeper	
Batsmen	Bowlers	All-rounders	Not Batsman	Batsman
4	3	3	–	1

12.

(A) If all eleven are batsmen, then the wicket-keeper, who can also bat must be selected, along with 6 all-rounders (so we can have six bowlers) and 4 only batsman.

(B) For 8 players to bat and 8 players to bowl, we can have the following arrangement:
Only batsman = 2
All-rounders = 6
Only bowler = 2
Only wicket-keeper = $\frac{1}{11}$

(C) For 7 players to bat and 7 to bowl, we can have the following arrangement:
All-rounders = 4
Only batsman = 3
Only bowler = 3
Only wicket-keeper = $\frac{1}{11}$

(D) The number of all-rounders = 3
(3 is the minimum number of all-rounders, as found earlier). Now, the number of only batsman can NEVER be less than the number of only bowlers, as out of these 8 remaining players, one is a wicket-keeper and the number of only bowlers cannot be more than 3.

Solutions for questions 13 to 16: Let us list out the conditions specified in the question.

(1) Each team must consist of a minimum of two members and each of the four teams must have a distinct number of members. This implies that the number of people in different teams must be 2, 3, 4 and 5.
(2) Each of Rama, Ramya, Radha and Raksha must be in a different team.
(3) Each of Rohini, Padma, Priya and Priyanka must be in a different team.
(4) Pratima, Pratibha and Sudha must be in the same team.
(5) Shreya and Shalini must be in the same team.
(6) Rama cannot be paired with any of Padma, Priya and Priyanka.
(7) Ramya cannot be paired with Priyanka or Priya.
(8) Radha cannot be paired with Priyanka and Swetha is in one of the teams.

From (1) we know that the teams should consist of 2, 3, 4 and 5 members respectively.

From (2) and (3), we know that each team should have two members out of Rama, Ramya, Radha, Raksha, Rohini, Padma, Priya and Priyanka, since as per (2) each of Rama, Ramya, Radha and Raksha should be in a different team and same is the case with (3).

From (2) and (3), we know that one each of Rama, Ramya, Radha, Raksha must be paired with one each of Rohini, Padma, Priya and Priyanka.

From (6), (7) and (8), we know that Priyanka cannot be paired with Rama, Ramya or Radha, which implies that Priyanka is paired with Raksha. Using a similar logic we find that Rama and Rohini, Ramya and Padma, Radha and Priya are paired together.

From (4), we know that Pratima, Pratibha and Sudha must be in a team together but since all teams already have two members each, these people can only be accommodated in the team that has five members in it.

From (5), we know that Shreya and Shalini must be in a team together which means that can only be accommodated in a team that has four members in it.

From (8), we know that Swetha is one of the members and she can only be placed in the team that has three members in it.

Teams	I (2 members)	II (3 members)	III (4 members)	IV (5 members)
Members		Swetha	Shreya Shalini	Pratima Pratibha Sudha

13. There are 4 pairs, i.e., Raksha–Priyanka, Rama–Rohini, Ramya–Padma, Radha–Priya who must be allocated to 4 teams which can be done in 4! ways.4! = 24 ways.

14. We can see that statements made in choices (A), (B) and (C) are true as per the above discussion. Shreya is in a four-member team, hence, choice (D) is definitely not true.

15. As per choice (A), if Rohini is in a team of five members, it means that Rama is also in that team. Padma is in a four-member team implies that Ramya is also in that team and Radha is not in a three-member team implies that she is in a two-member team along with Priya which leaves us with Priyanka and Raksha in a three-member team which completes the arrangement. Hence, choice (A) gives us the complete arrangement.

16. Pratima is a member of the five-member team.

Solutions for questions 17 to 19: The given data can be represented as follows.

(1) D < G and H < I

⇒ If D gets rank, then G also gets a rank and if H gets a rank, then I also gets a rank.

(2) F × D

(3) B / G (Only one of the two)

(4) IC (If I gets a rank, then C will also get a rank. If I gets a rank, both I and C get ranks.)

17. It is given that E did not get a rank and that F got more marks than I, which means that F > I > H. So, if F does not get a rank, then none of I or H gets a rank. If I does not get a rank, then C also does not get a rank, which means that A, B, D, G and J get ranks. However, this is not possible as only one out of B or G gets a rank, but not both, as per the given conditions. This means that F has to get a rank, which means that D will not get a rank.

18. If D and H get ranks, then G, I and C should also get ranks because G got more marks than D and I got more than H. If I gets a rank, then C also should get a rank. As D and H got two successive ranks, G and I must always be ranked higher than D and H. So, D and H gets either 3rd or 4th rank or 4th or 5th rank. Hence, C would not get the 4th rank.

19. If F is not ranked and H got more marks than G, then H and I both are selected. If I is selected C, must be ranked.

Solutions for questions 20 to 23: It is given that A, C, E, G, I, K, M, J and O are batsmen, B, D, F, G, H, J, M and P are bowlers, L and N are wicket-keepers. The players who are both bowlers and batsmen are known as all-rounders. Hence, G, M and J are all-rounders. The Captain and the Vice-Captain are all-rounders.

Neither G nor M is the Captain, that means J is the Captain. Similarly, M is the Vice-Captain. As only two all-rounders are to be selected, J and M are selected and G cannot be selected. Five batsmen are to be selected from A, C, E, I, K and O. It is also given that if E is selected, then A and I cannot be selected which means that 5 batsmen cannot be selected. Therefore, E should not be selected and the batsmen selected are A, C, I, K and O. It is given that three bowlers are to be selected from B, D, F, H and P.

It is also given that if D is selected, P and H cannot be selected and the bowlers selected would be B, D, F which is not a feasible combination (as B and F cannot be together). Therefore, D is not selected. We already know that C is selected, hence, B cannot be selected. The bowlers who are selected are F, H and P.

J and N cannot be selected. As J is already selected as the Captain. Hence, N cannot be selected into the team. Therefore, L is selected as the wicket-keeper.

The 11 players who are selected into the team are J (Captain), M (Vice-Captain), L (Wicket-keeper), O, F, H, P, A, C, I, K.

20. J and M are the Captain and the Vice-Captain of the team, respectively.

21. F, H and P are the three bowlers selected in the team.

22. L, O, F, H and C are not selected is definitely false.

23. In the 2nd match J is the Vice-Captain and M is the Captain. As, 86th match is an even numbered match, J will be the Vice-Captain in that match.

24. If B is selected into a team, then D must also be selected into that team also one person from E and C should be in this team and one person among G and H should be in this team. So, A and F should be in the other team.

25. (Let the teams be Team 1 and Team 2) Given that E and D are in one team.
So, C is in team 2. Now if B is in team 2, then D should also be in team 2 which is not possible. So, B is in team 1.
Also, exactly one person among G and H is in team 1.
∴ B and G (or) B and H are in team 1.

26. B and D should be together (as described in previous question). So option (A) and (B) are not valid teams. Option (C) does not violate any rule.
∴ EHAF is a valid team.

27. Let H be the member of a team, and let us consider choice (A) i.e. KDLG as the other team. From (iii) we get that, since L belongs to one of the teams, neither I nor J can be selected into any of the teams.
Among the remaining A, B, C, E and F only one among A, C and E can be selected.
∴ B and F must be selected and from (iv), A cannot be selected. The possible teams are H, B, F, C / E.
Choice (B) does not violate any rule to form a team. Consider
choice (C), as A, G, L, F is a team, H must be there in the other team. But A and F both are in the same team, which violate (v).

28. We need to eliminate only two people.
From the rule (vii), one of A, C and E must not be selected. Hence, we can select from only 11 people.
From the rule (iii), If L is selected none or I and J should be selected, hence, L cannot be selected.
∴From (v), if A is not selected then F cannot be selected.
Let B and E belong to team α.
∴ A must be selected in team β, C should not be selected and F must be selected in team 'α'.
From (ii), G and H should be in two different teams.
∴ The possible teams are as follows:
α: B, E, F, G/H, I/J/K/D
β: A, H, G and any two among I, J and K.
Therefore, in 8 different ways, the other team can be selected.

29. The two teams can be ADIG and JFBH or A, D, K, H and JFBG or AIKG and JFBH.
Hence, none must be selected with A.

30. As K is selected, neither D or E can be selected.
As L is selected then I and J must not be selected.
∴ A, B, C, F, G, H, K and L are selected.
From (v), (vi) and (vii), B, F and C are into one team, which does not contain A.
From (ii), G and H are in different teams.
∴ Y has B, F and C and X has K, L and A.
Now, G and H can be distributed in two ways.

31. From (v), A must be selected into the other team.
∴ From (vi) and (vii), B, C and E cannot be selected into the other team.
Of the remaining, each person can be selected into the other team.

Solutions for questions 32 to 34: Based on the given information, the following inferences can be made:
(a) From (III), F is not carrying the white folder.
(b) From (VI), A is not from China.
We have the following distribution:

From the above, we can say that either B or D is carrying the white folder and either C or E is from China. There is no condition for (Brazil, USA), (Black, Blue) and (Terrorism, Poverty). All these can be taken in any combination.

32. If B is carrying the orange folder, then D will be carrying the white folder.
As per (iii), F and D must be in the same slot. Hence, (B) is true.
As per (vi), A and the delegate from China must be selected together.
⇒ $\left\{\begin{matrix}\text{F}\\ \text{Brazil/USA}\end{matrix}\right\}$ and $\left\{\begin{matrix}\text{D.}\\ \text{S. Africa}\\ \text{Unemployment}\end{matrix}\right\}$ cannot be selected with A, since only 3 people can be allowed for any one slot. Hence, (D) is false.

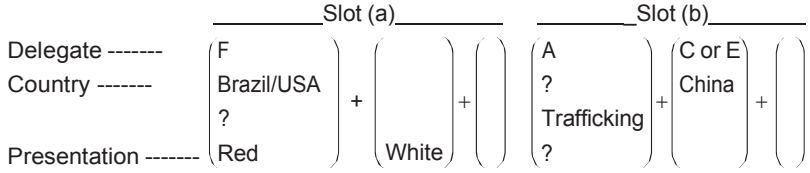
We can get the following arrangement, without violating any of the given conditions.

Slot – I	Slot – II
A – Red	F – Trafficking
B – Orange – India	D – White – SA – Unemployment
E – Green – Ching – EP	C – Illiteracy

From the above, we infer that (A) and (C) are true.
∴ (D) is false.

33. Including the additional condition, we have:

Delegate	A	B	C	D	E	F
Country	x China	India		S. Africa		x China x Russia Brazil / USA
Area of presentation	Trafficking		Illiteracy	Unemployment		
Colour	x White x Red		x White		Green	Red



F and A must be selected for different slots as per (ii).
So, statement I is definitely true.

Statement II and III are not true in the following arrangement.

Slot - I	Slot - II
A – Orange – Trafficking	F – Brazil/USA - Red – Terrorism/Poverty
E – China – Green – EP	D – SA – White – Unemployment
C – Blue/Black – Illiteracy	B – India – Black/Blue – Poverty/Terrorism

∴ Only I is true.

34. Since E is from the USA, F is from Brazil and A is from Russia.
Since, F and A have to be in different slots (A) is true.
Since A and the one from China are in one slot and F and the one carrying white folder are in the other slot, (B) is false.
(C) and (D) are true in the following:

Slot – I	Slot – II
A – Russia – Black – Trafficking	F – Brazil – Red – EP
C – China – Blue – Illiteracy	D – SA – White – VE
E – USA – Green –	B – India – Orange

In the above, (C) and (D) are true.
∴ Only (B) is false.

Solutions for questions 35 to 37: Let each person be denoted by the first letter of his / her name.

35. K and C are in the same team.
∴ L must be in the other team. [From (iii)]
If A and B are in the same team as L, then it violates (iv) [From (ii)].
Only one of A and B is in the same team as L.
∴ Using other conditions, the possibilities are:
(a) K, C, A, M and L, B, N
(b) K, C, B, M and L, A, N
(c) K, C, A and L, M, N, B
(d) K, C, B and L, M, N, A
(e) K, C, B, N and L, M, A

36. M and B are not in the same team.
From (iii), either K or L is with B.
Now, if A is with B, then C and N must be with M, which violates (iv).
∴ A is with M.
Now, at least one of C and N is with B.
The teams are:
B, K/L, C, N and M, L/K, A
B, K/L, C and M, L/K, A, N
B, K/L, N and M, L/K, A, C
∴ There are six possibilities.

37. From (iii), M and N are in the same team.
One of K and L is with them.
C cannot be with them as it violates (iv).
From (ii), only one of A and B is with them.
∴ The possibilities are:
M, N, K/L, A/B and L/K, C, B/A.
Therefore, there are four possibilities.

Solutions for questions 38 to 40: Let each person be denoted by the first letter of his/her name.
From (iii), if F is selected, then A and C are not selected.
From (ii), one among A and B must be selected.

∴ The possibilities are:
If F is selected, then

(a) F, B, E, G
(b) F, B, E, D
(c) F, B, D, G

If F is not selected, then A or B or A, B must be selected in the team as we have to select 4, we have to reject 3 and among C, E and G at least one must be rejected.

From (i), at most two of C, E and G can be selected.
∴ The possibilities are as follows.

(d) A, B, C, E
(e) A, B, C, G
(f) A, B, G, E
(g) A, B, D, C
(h) A, B, D, E
(i) A, B, D, G
(j) A, D, C, E
(k) A, D, C, G
(l) A, D, G, E
(m) B, D, C, E
(n) B, D, C, G
(o) B, D, G, E

38. Except possibilities (a), (d), (e) and (f), all other team have Dheeraj.

39. Except (a) and (c), all have at most one of F and G.

40. (c), (e), (g), (i), (k) and (n) are the possibilities.

EXERCISE-3

Solutions for questions 1 to 4: It is given that there are ten candidates, out of which 2 are M.A.s, 2 are M.B.As, 2 are M.C.As and 4 are B.Techs. The conditions are as follows.

1 M.B.A ⇒ 2 B.Techs
2 B.Techs ⇒ M.B.A ≥ 1
Exactly one M.A. candidate must be selected.

1. If two B.Tech candidates are selected, then one M.B.A. and one M.A. are selected. More than one M.As cannot be selected according to the data. One M.B.A. and only M.C.A. with one M.A. does not make a total of six. One M.A. is already there. Now 2 B.Techs, one M.B.A. and one M.A make a total of four candidates. Now 2 more candidates must be there. Those two can be 1 M.B.A. + 1 M.C.A. So, the correct option is choice (D).

2. Two M.C.A. candidates are selected. So, the choices must be 2 M.C.As + 1 M.A. + 1 M.B.A. + 2 B.Techs 1 M.B.A. and 1 B.Tech is not accepted. 3 B.Techs implies 2 M.C.As cannot be selected.

3. The given data says that 1 M.B.A. is followed by 2 B.Tech candidates. If four B.Techs are selected, 2 M.B.As cannot be selected because 1 M.A. must be selected and the total has to be six candidates only.

4. Let us validate each choice.
Choice (A): If 2 M.B.As are selected, then 2 B.Techs must also be selected and 1 M.A. is in every selection, which makes a total of five people and the 6th can be an M.C.A., which is an acceptable selection.
Choice (B): If 2 M.C.As are selected, then any way 1 M.A. is there and the remaining three will be M.B.As and B.Tech, i.e., 1 M.B.A. and 2 B.Tech.
Choice (C): If 2 B.Techs are selected, then it does not violate any rule as explained in choice (B).
Choice (D): If no M.C.A. is selected, then we need to select 6 out of M.B.As, M.As and B.Techs, i.e., 1 M.A and 5 out of M.B.A and B.Tech. The maximum of 2 M.B.A. can be selected and then only 2 B.Tech should be selected. If so, we have to take 1 M.C.A. also. So, this choice is false.

Solutions for questions 5 to 9: A group of three people, namely Ajay, Bony and Chetan buy two each out of 6 items P, Q, R, S, T and U. If Ajay buys R, Bony does not buy P or S or both. If Bony buys Q, Chetan does not buy U or T or both.

5. If Ajay buys R and T, then Bony cannot buy P or S or both. So Bony buys Q and U.

6. If Bony buys Q and S, then Chetan cannot buy T and U. So, Ajay must buy T and U, as each one has to buy two each.

7. If Chetan bought P and S, Ajay and Bony have to choose any two each of Q, R, T, U. Ajay may have any pair of QR, QT, QU, RT, RU or TU. So, we cannot say anything about their purchases as all the choices (A), (B) and (C) be true always.

8. If Ajay buys P and Bony buys Q, then Chetan buys neither T nor U. So, Chetan can buy the pair of R and S only.

9. Let us validate each choice.
Choice (A): If Ajay buys R, Bony cannot buy P and S but he can buy Q or T or U. So, it is not necessary to buy Q.
Choice (B): If Chetan buys T or U, that means Bony cannot buy Q. So, this is also false.
Choice (C): Ajay bought R, then it is not necessary for Bony to buy T as explained in choice (A).
Choice (D): If Ajay buys R and Bony buys Q, then Chetan has to buy only P and S, as he cannot buy T and U. Chetan has to buy P and S.

Solutions for questions 10 and 11: From (1), at least one of E or B must be selected.

E can be selected.
B can be selected.

B and E can be selected.

At most one of A or D can be selected.

One of A or D can be selected or none of A or D is selected.

From (3), A, F and G together cannot be selected.

From (2), either C or D must be selected.

10. If A is selected, then D cannot be selected. D is not selected implies that C must be selected.

11. If neither A nor D is selected, then the four people can be selected in four ways.

1. CEFG
2. CBFG
3. CBEF
4. CBEG

Solutions for questions 12 to 15: Let each student be denoted by the first letter of his name.

From (1) and (4), the teams can be (K, M), (P, J), (R, S) or (K, M), (P, S), (R, J).

From (3), in any case, if J is in Chemistry team, then M is in History team.

S must be in Physics team, which is violating (2).

J cannot be in the Chemistry team.

∴ We have the following possibilities:

	Physics	Chemistry	History
1	R, J	P, S	K, M
2	R, J	K, M	P, S
3	K, M	P, S	R, J
4	P, J	R, S	K, M
5	P, J	K, M	R, S
6	K, M	R, S	P, J

Solutions for questions 16 to 18: We will represent the instructions as below.

(1) B, D and F → at least 1 must be selected.
(2) If B → not C and not G
(3) A and F is not together
(4) If D → E
(5) If C → A

16. The possible combinations of a team with 4 members are as follows:

(1) B, A, D, E
(2) B, D, E, F
(3) D, E, A, C
(4) D, E, A, G
(5) D, F, E, G

∴ There are five ways to select a team of four members.

17. A team of five members is ACDEG.

Hence, B cannot be selected.

18. The possible combinations of the team with three members are as follows:

(1) A, B, E
(2) B, D, E
(3) D, E, F
(4) B, E, F
(5) D, E, A
(6) D, E, G
(7) E, F, G

∴ There are 7 ways possible.

Solutions for questions 19 to 21: From (i), the book printed in either 2004 or 2008 is selected or the book written by A is selected or the book printed in 2004 and 2008 are selected or none among them is selected.

From (ii), only the book printed in 2006 or the books printed in 2006 and 2007 or 2006 and 2008 or 2006, 2007 and 2008 can be selected or none among them is selected.

From (iii), (the book written by D and the book printed in 2007) or (the book written by D and the book printed in 2008) or (the book written by D and the books printed in 2007 and 2008) can be selected or none among them is selected.

From (iv), the book printed in only 2005 or only 2007 or none among them is selected.

From (v), the book written by C and the books printed in 2004 and 2005 or the book written by C and the books printed in 2005 and 2006 or the book written by C and the books printed in 2006 and 2007 or the book written by C and the books printed in 2007 and 2008 can be selected or none among them is selected.

∴ The possible selections are:

(i) A, B, C, 2006, 2007
(ii) B, C, D, 2007, 2008

19. The book printed in 2005 cannot be selected.

20. The book printed in 2006 must be selected, if the book written by A is selected.

21. The book written by A must not be selected, if the book written by D is selected.

Solutions for questions 22 to 25: *From the given data, the* possible combinations for each position are as follows.

Goalkeeper: J or K
Defenders: A + B, A + C, A + K, B + C, B + K, C + K
Mid-fielder: C or D or E or F
Forward: F + G, F + H, F + I, G + H, G + I, H + I

22. Given that J is selected. From (i), K will not be selected. According to (iv), neither F nor C will be selected. Hence, only A and B can be selected as defenders. According to (iii), when B is selected neither F nor I will be selected. Thus, only G and H can be selected as forwards.

23. Given that F is selected as the mid-fielder. From (iii), B will not be selected. From (iv), J will not be selected.

Hence, A and C both have to be in the team as defenders, but it violates (v), i.e., only one among C and F can be selected.
∴ No such team is possible.

24. When D is selected, from (ii) neither C nor K will be selected. Then J will be the goalkeeper and there is only possible combination of defenders to select, i.e., A + B. Since B is selected, from (iii), neither F nor I will be selected. Then there is only one possible combination of forwards to be selected, i.e., G + H. Thus, there is only one way in which the team can be selected.

25. When F is selected as forward, from (iv) K will be the goalkeeper and from (v) C will not be selected. In such case only A and B can be selected as defenders. But from (iii), even B cannot be selected. Thus, F cannot be selected as forward.

5 Comparisons

Chapter

Learning Objectives

In this chapter, you will:

- Understand how to interpret the data given in the question and get a final sequence or ranking out of it based on the given constraints
- Understand how to rank people/objects based on multiple parameters
- Learn how to deal with questions which are a combination of comparisons and other topics.

Questions based on Order Sequencing appear frequently in MBA entrance exams either as simple comparison questions or along with other topics like Linear/Circular Arrangements, Distributions etc. These puzzles involve comparison of persons or objects in various parameters like height, age, marks scored etc. The term 'Order Sequence' is self-explanatory. In questions for this category, you will be asked to deal with relative positions of subjects. The absolute values of the subjects is not what you should be interested in. It is the comparison between different subjects that you have to deal with. The data also specifies the relationships like 'A is greater than B' or 'C is not less than D' and so on. You have to decide the positions of the subjects in ascending or descending order on the parameters given. The subjects of comparison can be people or things.

In short, data will be given to compare the quality or quantity. The parameters on which the subjects are compared can be heights or weights of people, the money with them, complexion, sizes of things, etc.

In such questions, you will come across typical statements like 'A is taller than B', 'B is not shorter than C' and so on.

You may use the following symbols to symbolically represent the conditions given and then later, represent all the subjects pictorially.

Greater than	>
Less than	<
Greater than or equal	≥
Less than or equal	≤

'Not greater than' is the same as 'less than or equal to'. Similarly, 'not less than' is the same as 'greater than or equal to'.

Words like 'Who, And, Which, But' used in the data play a significant role in analysing the data. 'AND' and 'BUT' play the same role whereas 'Who' and 'Which' play the same role.

Let us illustrate with one statement.

'A is taller than B, who is shorter than C and taller than D but shorter than E, who is taller than F and G but shorter than H'.

By using appropriate symbols, the above statement can be represented as follows.

A > B; B < C; B > D; B < E; E > F; E > G; E < H

Questions on the above data can be as follows.

(i) Who is the tallest?
(ii) Who is the shortest?
(iii) Who is the second tallest in the group?

Let us take some examples.

Solved Examples

Directions for questions 5.01 to 5.05: These questions are based on the following information.

A, B, C, D and E are five cars while P, Q and R are three motorcycles. A is the fastest of the cars and R is the slowest of the motorcycles. C is costlier than D and Q but cheaper than B. Among cars, A is not the costliest. D is cheaper than E and there is no car whose cost lies between the cost of these two. E is faster than three of the cars and all the motorcycles. Q is costlier than R but cheaper than P, who is faster than Q.

5.01: Which of the following cars cannot stand exactly in the middle position among cars as far as their cost is concerned?
(A) A (B) C (C) E (D) D

5.02: Which of the following statements is true about the motorcycles?
(A) P is the costliest as well as the fastest motorcycle.
(B) The fastest motorcycle is not the costliest motorcycle.
(C) The slowest motorcycle is also the cheapest motorcycle.
(D) Both (A) and (C)

5.03: If P is costlier than E, how many cars are cheaper than P?
(A) 1
(B) 2
(C) 3
(D) Cannot be determined

5.04: If P is cheaper than A which is not costlier than E, which of these is the cheapest of all the cars and motorcycles put together?
(A) R
(B) Q
(C) E
(D) Cannot be determined

5.05: Which of these is the slowest of the cars, if B and C are faster than D?
(A) B (B) D (C) E (D) A

Solutions for questions 5.01 to 5.05: Let us first write down all the comparisons given for costs and speeds. Then we will tabulate them.

Speed:

A ➔ Fastest car
E ➔ Faster than three of the cars ➔ E is the second fastest car
R ➔ Slowest motorcycle
P > Q

Cost:

C > D
C > Q
B > C
A ➔ Not the costliest among cars
E > D ➔ No other car lies between these two
Q > R
P > Q
Now let us tabulate this data.

Speed:

Cars

Fastest	A	E				Slowest

Motorcycles

Fastest	P	Q	R	Slowest

Cost:

Cars

Costliest	B C E D	Cheapest

Here, we know that A is not the costliest car but we do not know where it will fit in. It can come anywhere after B except between E and D.

Motorcycles

Costliest	P	Q	R	Cheapest

In addition to the above, we also have to keep in mind that C > Q in cost. (From this we can conclude that B > Q, B > R, C > R in cost).

5.01: In terms of cost of the cars, A can come between B and C or between C and E or to the right of E. In each of the above cases, the middle car will be C, A and E, respectively. Hence, among the cars given, D cannot be in the middle.

5.02: By looking at the tables above, we can make out that choices (A) and (C) are both correct and hence, the correct answer is (D).

5.03: If P is costlier than E, we can also conclude that it is costlier than D but we cannot conclude anything about the relationship between the cost of P and that of B, C and A.

5.04: Since A is not costlier than E, it means that A is at the same level of E or cheaper than E. We

cannot conclude which of these two positions A is in. Hence, we cannot conclude which is the cheapest of all the vehicles. [Please note that if A is the cheapest car, then R will be the cheapest of all the vehicles. However, if A is at the same level as E in cost, then there is a possibility of R or D being the cheapest of all the vehicles.]

5.05: If B and C are faster than D, then the order will be as follows:

1	2	3	4	5
A	E	B/C	C/B	D

Hence, D is the slowest of all the cars.

Directions for questions 5.06 to 5.09: These questions are based on the following information.

J, K, L, M and N are five boys in a class. They are ranked in the order of heights ranked from the tallest to the shortest and in the order of cleverness ranked from the cleverest to the dullest. K is taller than N, but not as clever as J and L, whereas M is the cleverest of all but shorter than J. While L is shorter than M but taller than K, L is not as clever as J. No two people got the same ranks in any of these parameters.

5.06: Who is the third in the order of heights?
(A) J (B) N
(C) K (D) L

5.07: If N is not the last in at least one of the two comparisons, which of the following is the dullest of all the five?
(A) K (B) L
(C) M (D) J

5.08: If L is the third in order of cleverness, then who is the dullest of all?
(A) M
(B) N
(C) L
(D) Cannot be determined

5.09: Who among the following is cleverer as well as taller than K?
(A) L and J only (B) N
(C) L and N (D) J, L and M

Solutions for questions 5.06 to 5.09: Let us first write down all the conditions given and then tabulate the data.

Cleverness:
J > K
L > K
M is the cleverest.
J > L

Height:
K > N
J > M
M > L
L > K
Now let us put together all the information we have.

Cleverness

Cleverest	M J L K	Dullest

We do not know where N will come in the order of cleverness but he will definitely be after M.

Height

Tallest	J M L K N	Shortest

5.06: From the table above, we can clearly see that L is ranked third in order of heights.

5.07: N is the last in terms of height. Since we are given that he is not the last in at least one of the lists, he cannot be the last in cleverness. So, K is the dullest of all. Choice (A)

5.08: If L is the third in the order of cleverness, as can be seen from the table above, either N or K can be the dullest. Choice (D)

5.09: By looking at the tables we made above and from the answer choices, we find that L, J and M are taller as well as cleverer than K.
Choice (D)

Directions for question 5.10: Select the correct alternative from the given choices.

5.10: P, Q, R, S, and T are five girls competing in a running race. R and P have at least two girls ahead of each of them. T and P do not have more than one girl behind each of them. Who arrives at the finishing line after two girls as well as before two other girls, if no two girls finish the race at the same time?
(A) Q (B) S
(C) T (D) R

Solution for question 5.10:

5.10: R and P have at least two girls before them. ➔ R and P have to be in two out of 3rd, 4th and 5th positions.
T and P have not more than one girl behind each of them ➔ T and P have to be in the 4th or 5th positions.
The above two statements together mean that R will have to be in the third position.

Exercise-1

Directions for questions 1 to 9: Select the correct alternative from the given choices.

1. Each of the five people, such as K, L, M, P and Q is of a different weight. It is known that the number of people heavier than P is the same as the number of people lighter than Q. L is the heaviest and K is not the lightest. Who is the lightest?
(A) P (B) K
(C) Q (D) M

2. Each of the five people from A, B and C is ranked 1 to 3 in the order of their heights as well as in the order of weights. No person got the same rank in both height and weight. C is heavier than B but shorter than A, who is not the tallest. Who is the heaviest?
(A) A (B) B
(C) C (D) Cannot be determined

3. A group of five boys, namely Lalit, Mohan, Naveen, Omi and Pavan are compared with each other in terms of their heights. Lalit is taller than Mohan but shorter than Pavan, who is shorter then Naveen, who is taller than Omi. Who among these five friends is the second tallest?
(A) Omi (B) Naveen
(C) Naveen or Pavan (D) Cannot be determined

4. A, B, C, D and E are five people working in an office. C comes to the office before B, but after A. E comes after D, but not immediately after him. The number of people who came between D and E is the same as those who come between C and B. Who was the first person to come to the office?
(A) A (B) D
(C) A or D (D) C

5. Each of the four students, namely Gopi, Hari, Murali and Anil did exactly one project out of four different projects, such as P.T., T.D., D.M.E. and H.T. No two students got the same marks. The project H.T. secured more marks than the project T.D. and the project P.T. did not get the first or the fourth rank. The projects are ranked from first to fourth from the maximum to minimum marks in that order.

Anil secured more marks than Murali and Hari got less marks than Gopi, who did the project H.T.

If the project P.T. got more marks than H.T., then who did the project P.T.?
(A) Murali (B) Anil
(C) Hari (D) Hari or Anil

6. The following are the comparisons made between five business tycoons Mukesh, Aditya, Prem, Murthy and Raju.

Mukesh is richer and younger than Murthy. Aditya is poorer than Prem but richer than Mukesh. The poorer of Mukesh and Prem is the younger of the two. Murthy is richer than Raju, who is older than Aditya but younger than Mukesh. How many people are richer but younger than Mukesh?
(A) 1 (B) 2
(C) 3 (D) 0

7. A group of seven people, namely Rama, Ramana, Rana, Ravi, Raju, Ramesh and Raman finished a race, not necessarily in the same order. No two people finished the race at the same time.
Rana finished the race before Raju but after Raman.
Rama finished the race after Ramana but before Rana.
Only Ramesh finished the race between Ramana and Raman. Ravi finished the race before Raman.
If no other person finished the race between Ravi and Raman, then who is the 6th person to finish the race?
(A) Rama (B) Ravi
(C) Ramesh (D) Rana

8. Anand, Mohan, Ravi and Kamal together have ten apples. Each person has at least one apple and no two people have the same number of apples. Kamal has more number of apples than Anand but does not have the highest number of apples. Mohan has more number of apples than Ravi. How many apples does Mohan have?
(A) Two (B) Three
(C) Four (D) Cannot be determined

9. Vinit, Karan, Santosh and Sid participated in a race. No two people ran with the same speed. Speed of Karan is more than that of Santosh and Sid finished the race before Vinit finished. It is known that Karan did not finish the race before Vinit. The speed of which person is the lowest?
(A) Vinit (B) Karan
(C) Santosh (D) Sid

Directions for questions 10 to 12: These questions are based on the following information.

A group of seven people, namely P, Q, R, S, T, U and V, who are of different ages, are comparing their ages. We know the following information.

(i) P is younger than R, who is not older than S.
(ii) S is younger than only two people.
(iii) Q is not the oldest but older than the fourth youngest person.
(iv) T is older than only U.

10. Who is the oldest?
(A) S (B) T
(C) U (D) V

11. Who is the third youngest?
(A) V (B) P
(C) R (D) S

12. Who is the fourth eldest?
(A) R (B) P
(C) S (D) V

Directions for questions 13 to 15: These questions are based on the following information.

A group of five people,namely P, Q, R, S and T are of different heights and different weights. Further, it is known that
(1) Either P or Q is the tallest.
(2) T is taller as well as heavier than both S and R.
(3) The heaviest person is the third tallest whereas the second tallest is the lightest.
(4) Only one person is lighter than Q, R is heavier and shorter than S.

13. Who is the lightest?
(A) P (B) Q
(C) R (D) S

14. Who is / are taller and heavier than S?
(A) P and T (B) Only T
(C) Only T and Q (D) Only R

15. How many people are heavier than P?
(A) One (B) Two
(C) Three (D) Four

Directions for questions 16 to 18: These questions are based on the following information.

A, B, C, D, and E are the top five rankers in each of the subjects Maths and Physics, respectively. No two people got the same rank in any subject and no person got the same rank in both subjects. The following information is known about them.
(1) B's rank in Maths is the same as that of D's rank in Physics.
(2) C got a better rank than at most one person in both subjects, respectively.
(3) E got the least rank in Maths.
(4) D got second rank in Maths and B got third rank in Physics.
(5) In Physics A's rank is better than E's rank.

16. What is the rank of D in Physics?
(A) 1 (B) 2
(C) 3 (D) 4

17. What is the rank of A in Physics?
(A) 1 (B) 2
(C) 3 (D) 4

18. The rank of A in Maths is the same as the rank of _____ in Physics.
(A) B (B) C
(C) D (D) E

Directions for questions 19 and 20: These questions are based on the following information.

Pavan, Sravan, Charan, Tarun and Kiran are the top five rankers in a class, not necessarily in the same order. Each of these five is of a different height. The tallest person is the fourth ranker while Kiran is the second ranker. Tarun is taller than at least two people and is the third ranker. The shortest person is the first ranker but he is not Charan. Sravan is taller than only one person and Tarun is taller than Kiran.

19. Who is the fourth ranker?
(A) Pavan (B) Charan
(C) Sravan (D) Tarun

20. How many people are taller than Pavan?
(A) One (B) Two
(C) Three (D) Four

Directions for questions 21 to 23: These questions are based on the following information.

Each of the six children, namely Amit, Sumit, Kamat, Namit, Ranjit and Charit has a different number of chocolates among 3, 4, 5, 6, 7 and 8, not necessarily in the same order. We know the following information.
(i) The difference between the number of chocolates with Charit and Ranjit is the same as that between the number of chocolates with Kamat and Ranjit.
(ii) The number of chocolates with Charit is less than that with Sumit which in turn is less than that with Ranjit.
(iii) The number of chocolates with Sumit is more than that with Namit.

21. Who has 6 chocolates?
(A) Sumit (B) Ranjit
(C) Amit (D) Charit

22. What is the number of chocolates with Sumit?
(A) 5 (B) 6
(C) 7 (D) 4

23. What is the difference between the number of chocolates with Namit and Kamat?
(A) 2 (B) 3
(C) 4 (D) 5

Directions for questions 24 to 26: These questions are based on the following information.

A group of six students, namely Anand, Brijesh, Charan, Deepti, Gopal and Hriday are the top six rankers of a class. No two people got the same rank. We know the following information regarding their ranks.
(i) Deepti got a better rank than at least two students.
(ii) Gopal got a better rank than Brijesh.
(iii) The number of persons who got better rank than

Anand is the same as the number of persons who got worst rank than Charan.

(iv) Anand got a better rank than Deepti.

(v) Only one person got a rank between the ranks of Hriday and Brijesh.

24. If Hriday got the third rank, then the only person whose rank is between the ranks of Deepti and Charan is

(A) Anand (B) Gopal
(C) Hriday (D) Brijesh

25. Who got the sixth rank?

(A) Charan (B) Brijesh
(C) Hriday (D) Cannot be determined

26. If Deepti got the second rank, then who got the fifth rank?

(A) Brijesh (B) Charan
(C) Hriday (D) Cannot be determined

Directions for questions 27 to 29: These questions are based on the following information.

A group of eight people, namely Anurag, Bhadri, Chakri, Dayanand, Eleena, Firoz, Goutam and Hemant who got different marks are comparing their marks. We know the following information regarding their marks.

(i) Anurag got more marks than Bhadri and the number of people who got less marks than Anurag is the same as the number of people who got more marks than Bhadri.

(ii) Chakri got more marks than Dayanand, but less marks than Eleena.

(iii) Firoz got the fifth highest marks.

(iv) Goutam got more marks than Hemant, who did not get the lowest marks.

(v) Dayanand got more marks than Goutam.

27. Who got the fourth highest score?

(A) Anurag (B) Eleena
(C) Chakri (D) Dayanand

28. Who got the third lowest score?

(A) Firoz (B) Dayanand
(C) Goutam (D) Hemant

29. Who got the highest score?

(A) Eleena (B) Anurag
(C) Girish (D) Cannot be determined

Directions for questions 30 to 34: These questions are based on the following information.

Each of the four athletes, namely Johnson, Bolt, Lewis and Powell competed in the World Athletic Meet in each of the four different events, such as 100 m, 200 m, 400 m and 800 m. In each event, these athletes finished in the top four positions.

No athlete finished any two events in the same position.

(1) The athlete who finished first in 100 m finished fourth in 800 m.

(2) The athlete who finished second in 200 m finished third in 400 m and first in 800 m.

(3) Bolt finished second in 100 m and Lewis is not the last one to finish in 200 m.

(4) Johnson finished after Bolt in 200 m and 800 m.

30. Who is the fourth to finish 200 m?

(A) Johnson (B) Bolt
(C) Lewis (D) Powell

31. Who is the first to finish 400 m?

(A) Johnson (B) Bolt
(C) Lewis (D) Powell

32. Who is the third to finish 800 m?

(A) Johnson (B) Bolt
(C) Lewis (D) Powell

33. Who is the second to finish 200 m?

(A) Johnson (B) Bolt
(C) Lewis (D) Powell

34. Who is the second to finish 800 m?

(A) Johnson (B) Bolt
(C) Lewis (D) Powell

Directions for questions 35 to 37: These questions are based on the following information.

An employee is recruited on the basis of eight parameters, such as Honesty, Communication, Sense of humour, Confidence, Commitment, Positive attitude, Creativity and Intuition.

These parameters are arranged in the order of importance.

(i) Confidence is ranked higher than Sense of Humour, which is ranked higher than Creativity.

(ii) Honesty is an important factor and only one parameter is ranked above it.

(iii) Commitment is ranked higher than Intuition, which is ranked higher than Positive Attitude.

(iv) Creativity is ranked higher than Communication but lower than Positive Attitude.

(v) Commitment is ranked lower than Confidence.

35. Consider the following statements:

(x) Sense of Humour is ranked as the fourth most important factor.

(y) Positive Attitude is ranked as the sixth most important factor.

(z) There are exactly three parameters between Creativity and Commitment.

(A) x is always true.

(B) z is always true.

(C) x and z can be true simultaneously.

(D) y and z can be true simultaneously.

36. Which of the following statements is true?
(A) There are at least 3 parameters which are ranked lower than Positive Attitude.
(B) There are at most 3 parameters which are ranked higher than Intuition.
(C) There are at least 3 parameters which are ranked higher than Intuition.
(D) There are at least 3 parameters which are ranked lower than Sense of Humour.

37. Which of the following is true if Intuition is the fourth most important factor?
(A) There are exactly four parameters which are ranked higher than Sense of Humour.
(B) There are at least three parameters which are ranked lower than Positive Attitude.
(C) There are at least three parameters which are ranked lower than Sense of Humour.
(D) There are at least four parameters which are ranked higher than Sense of Humour.

Directions for questions 38 to 40: These questions are based on the following information.

A group of eleven students A, B, C, D, E, F, G, H, I, J and K are given ranks according to their total marks in a final exam. The student who got the highest marks is given Rank 1. The following information is known:

(i) The only student whose rank is between H and I is D.
(ii) C scored more than G.
(iii) No one scored more than B.
(iv) H is eight ranks above F.
(v) The only student whose rank is between C and G is E.
(vi) The only student whose rank is between A and F is J.
(vii) C scored more than K.

38. Who scored the fifth highest marks?
(A) G (B) H
(C) C (D) J

39. How many students scored less than J?
(A) One (B) Two
(C) Four (D) Six

40. How many students scored less than D but more than A?
(A) Two (B) Four
(C) Six (D) None of these

Exercise-2

Directions for questions 1 to 3: These questions are based on the following information.

A group of five people, namely Alfa, Beta, Gamma, Delta and Zeta have different efficiencies in completing a work. Each of them is of different height. All of them are given the same amount of work. It is known that Beta is more efficient but shorter than Alfa. Gamma takes the least time to complete the given work and is the shortest. Delta takes more time than Zeta to complete the work but is shorter than Zeta. Alfa is less efficient than Zeta but takes less time than Delta to complete the work. Zeta is taller than Beta who is taller than Delta.

1. Who is the least efficient?
(A) Beta (B) Zeta
(C) Alpha (D) Delta

2. Who is the second tallest?
(A) Alpha (B) Zeta
(C) Beta (D) Cannot be determined

3. If the people are ranked as per their height and efficiencies, such that the tallest will be given first rank, the second tallest will get second rank and so on and the most efficient will get first rank, the second most efficient will get second rank and so on, it can be observed that no person got same rank in two categories, then who is the third tallest and the third efficient, respectively?
(A) Zeta, Delta (B) Beta, Zeta
(C) Delta, Alpha (D) Zeta, Beta

Directions for questions 4 to 8: These questions are based on the following information.

Six people A, B, C, D, E and F are of different heights and they were made to stand in a queue in the decreasing order of their heights. They made the following statements regarding their position in the queue where all of which are true.
(1) A says, 'I am taller than both B and C. The number of people standing ahead of D is the same as the number of people standing behind me.'
(2) B says, 'I am taller than D but not as tall as E.'
(3) C says, 'I am not standing at any end of the queue.'
(4) D says, 'F is shorter than at least two people.'
(5) E says, 'I am not standing adjacent to A.'

4. Who is the tallest?
(A) A (B) B
(C) C (D) D

5. Who is standing between A and E?
(A) Either B or C (B) Only C
(C) Only F (D) Either C or F

6. Who is the shortest?
(A) A (B) B
(C) C (D) D

7. How many people are standing behind C?
(A) One (B) Two
(C) Three (D) Four

8. How many people are standing ahead of B?
(A) One (B) Two
(C) Three (D) Cannot be determined

Directions for questions 9 to 12: These questions are based on the following information.

Six employees, namely P, Q, R, S, T and U are comparing their income and expenditure. The following information is known about them.

(i) The income of P is more than that of U and his expenditure is more than that of T.
(ii) The income of Q is more than that of S, but his expenditure is less than that of R.
(iii) The income of U is less than that of R, but his expenditure is more than that of R.
(iv) No two people have the equal income and the equal expenditure.
(v) The person whose income is the second highest has the second lowest expenditure, but it is not Q.
(vi) The person whose expenditure is the highest has the second lowest income, but it is not S.
(vii) T's expenditure is the third highest and his income is less than that of U.
(viii) The person whose expenditure is the lowest has the third highest income.

9. Whose income is less than that of S but the expenditure is more than that of T?
(A) P (B) U
(C) Q (D) R

10. Who has the lowest income?
(A) P (B) Q
(C) S (D) T

11. How many people have the expenditure less than that of R?
(A) One (B) Two
(C) Three (D) Cannot be determined

12. How many people have more income than that of S but less expenditure than that of T?
(A) One (B) Two
(C) None (D) Three

Directions for questions 13 to 16: These questions are based on the following information.

A group of seven cousins, namely Abhay, Bhargav, Chandini, Deekshit, Ekta, Falgun and Giri was born in a different year from 1981 to 1989. The following information is known about them.

(i) Deekshit was not born before 1985.
(ii) The oldest among them was born in 1981 and the youngest in 1989.
(iii) Abhay and Chandini were born two years apart and neither of them is the oldest.
(iv) There are as many people older than Falgun as there are people younger than him. Falgun is also as many years younger than the oldest cousin as he is older than the youngest cousin.
(v) Both Ekta and Deekshit were born in leap years.
(vi) Giri was born five years before Chandini.

13. Who is the oldest among the seven?
(A) Giri (B) Bhargav
(C) Deekshit (D) Ekta

14. In which year was Chandini born?
(A) 1983 (B) 1985
(C) 1987 D) 1989

15. Who is four years older than Abhay?
(A) Bhargav (B) Giri
(C) Falgun (D) Ekta

16. Who among them is the fifth youngest?
(A) Deekshit (B) Chandini
(C) Ekta (D) Abhay

Directions for questions 17 to 20: These questions are based on the following information.

A group of four boys A, B, C, D and four girls W, X, Y, Z compare their heights. It is found that there are two boys each of whom is taller than exactly two girls. Similarly, there are two girls each of whom is taller than exactly two boys.

Also, it is known that B is taller than W, who is taller than A, who is taller than X. Y is taller than X, but shorter than D, who is shorter than Z, who is not as tall as C, who is taller than B.

17. Which of the following statements can be false?
(A) The shortest among girls is X.
(B) The shortest among boys is A.
(C) The tallest among boys is C.
(D) The tallest among girls is W or Z.

18. If W is taller than Z, then which of the following statements is not definitely true?
(A) X is the shortest among all.
(B) B is the second tallest and Y is the second shortest.
(C) W is the third tallest and D is the third shortest.
(D) Z is taller than four people.

19. If D is shorter than A, then which of the following statements can be false?
(A) W and Z are the two girls each of whom is taller than exactly two boys.
(B) A and D are the two boys each of whom is taller than exactly two girls.
(C) D and X are the shortest among the boys and the girls respectively.
(D) W is the tallest among the girls.

20. Which choice among the following has the names of the shortest boy and the tallest girl, respectively, given that D is taller than A?

(A) C and X (B) A and X
(C) C, and Z or W (D) A, and Z or W

Directions for questions 21 to 24: These questions are based on the following information.

In a cricket match, eleven players, from A to K, scored different number of runs against the opposite team. The first two top scorers are called openers and the four lowest scorers are tailenders.

(i) G is a tailender but did not score the lowest runs.
(ii) Only three people scored more runs than K, who scored more runs than A and C.
(iii) C did not score more runs than A, who scored less runs than E. C is not a tailender.
(iv) E did not score more runs than F, who did not score the highest runs.
(v) There are at least three people who scored more runs than E.
(vi) The scores of four people are between the scores of D and B. D scored more runs than B.
(vii) H scored more runs than I, who did not score less runs than G.

21. Who scored the lowest runs?

(A) B (B) J
(C) C (D) E

22. How many people scored more runs than G and less runs than K?

(A) Two (B) Three
(C) Four (D) Five

23. If C's score is 68 and F's score is 100, then what can be the score of E?

(A) 56 (B) 67
(C) 96 (D) 105

24. In a certain way, if A is related to B and D is related to E, then in the same way, who is related to K?

(A) B (B) A
(C) F (D) H

Directions for questions 25 to 27: These questions are based on the following information.

A group of six websites, such as gmail, rediff, eBay, LinkedIn, Ask and MSN have different average number of visitors per hour and the uploading speed is different for each website. The first three websites with the most number of visitors have the lowest uploading speeds not necessarily in the same order. No two websites have the equal uploading speed.

(i) 'Ask' has the lowest uploading speed but not the highest number of visitors.
(ii) 'eBay' has less number of visitors than 'Ask' and the uploading speed of 'eBay' is more than only two websites.
(iii) The number of visitors for 'Gmail' is greater than the number of visitors for 'LinkedIn' and the uploading speed is greater for 'LinkedIn' when compared to the uploading speed of 'Gmail'.
(iv) The uploading speed of 'gmail' is not less than that of 'eBay'.

25. Which of the following is false?

(A) The number of visitors for 'LinkedIn' is the lowest.
(B) The uploading speed of 'MSN' is the second lowest.
(C) The number of visitors for 'eBay' is less than that of 'LinkedIn'.
(D) The uploading speed of 'Gmail' is not the highest.

26. Consider the following statements and chose the appropriate answer choice.

(i) The number of visitors for 'eBay' is less than that of 'MSN'.
(ii) The uploading speed of 'MSN' is less than that of 'eBay'.

(A) If (i) is true, (ii) is false.
(B) If (ii) is true, (i) is false.
(C) If (i) is true, (ii) is also true.
(D) None of these

27. Which of the following is true, if the uploading speed of 'rediff' is less than 'eBay' and the number of visitors for 'gmail' is the second lowest?

(A) The number of visitors for 'MSN' is the lowest.
(B) The uploading speed of 'rediff' is the second highest.
(C) The uploading speed of 'MSN' is the highest.
(D) The number of visitors for 'LinkedIn' is the lowest.

Directions for questions 28 to 30: These questions are based on the following information.

A group of four brothers, namely A, B, C, and D bought shares of three different companies P, Q and R. Each of them has different number of shares in each of the companies.

The following information is known about them.

(i) A has the most number of shares in Company P and least number of shares in Company Q.
(ii) B's shares in each of Company P and Q are greater than C's shares, but lesser in Company R.
(iii) D's shares are more than A in two of the given companies but D's shares are not the highest in any of the companies.
(iv) B's shares are not the second lowest in any of the companies.
(v) No person has the same rank in any two of the companies.

28. Who has the highest number of shares in Company Q?

(A) B (B) C
(C) D (D) Either C or B

29. Who has less number of shares than B in Company Q and more number of shares than B, in Company R?
(A) A (B) C
(C) D (D) All of A, C, and D

30. How many people have more number of shares than C in Company Q?
(A) One (B) Two
(C) Three (D) None

Directions for questions 31 to 33: These questions are based on the following information.

A group of five people, namely Abanti, Bhabani, Chandan, Deeptam and Fahrook were comparing their expenditure and savings. It is known that:

(i) Expenditure of no two of them is the same but their income is the same.
(ii) For every person, income is the sum of his/her expenditure and savings.
(iii) Chandan's savings are more than Deeptam's savings.
(iv) Abanti's expenditure is more than Fahrook's expenditure.
(v) The savings of Bhabani are more than that of Fahrook and the expenditure of Bhabani is more than that of Deeptam.

31. Whose expenditure is the highest?
(A) Abanti (B) Bhabani
(C) Deeptam (D) Fahrook

32. Whose savings are the highest?
(A) Fahrook (B) Bhabani
(C) Deeptam (D) Chandan

33. Savings of how many people are more than that of Fahrook?
(A) 1 (B) 2 (C) 3 (D) 4

Directions for questions 34 to 37: These questions are based on the following information.

Each of the five women, namely Amala, Kamala, Nirmala, Parimala and Vimala are of different ages and each of them has exactly one child. The five children are of different ages from 1 year through 5 years. If all the women were given ranks according to the decreasing order of their ages (i.e., the eldest woman gets the first rank) and all the children were given ranks in the similar manner, no woman has the same rank as her child. The names of their children are Chinna, Kanna, Munna, Rinku and Tinku. We know the following information about them.

(i) Chinna is the eldest but his mother is not the youngest and Nirmala is not the eldest.
(ii) Nirmala, who is the mother of the three-year-old child is elder than Vimala and Amala is elder than Kamala.
(iii) The number of years by which Tinku is elder than Munna is same as the number of years by which Chinna is elder than Rinku.
(iv) Parimala's child is Tinku and the number of women elder than Parimala is same as the number of children younger than Tinku.

34. Who is the child of Nirmala?
(A) Chinna (B) Kanna
(C) Rinku (D) Cannot be determined

35. If Munna is the child of Vimala, then Parimala is elder than
(A) Vimala (B) Kamala
(C) Nirmala (D) Cannot be determined

36. If Nirmala is elder than only one woman, then who is the mother of Rinku?
(A) Kamala (B) Vimala
(C) Amala (D) Cannot be determined

37. Which of the following statement is true?
(A) Rinku is three years old.
(B) Amala's child is five years old.
(C) Nirmala got the same rank as Tinku.
(D) Kanna is the child of either Vimala or Kamala.

Directions for questions 38 to 40: These questions are based on the following information.

There is a group of five friends A, B, C, D and E. It is known that A is heavier and shorter than D, who is richer and younger than C, who is older and shorter than E. B is lighter, shorter and richer than E, but is neither the shortest nor the youngest. The person who is the richest is also the youngest and the person who is the heaviest is also the shortest. The person who is the second eldest is also second poorest. The person who is the second heaviest is also third shortest. The person who is the second shortest is also third poorest. The person who is second richest is third eldest. The ranks are from most to least, for instance, the heaviest is ranked first and the lightest is ranked fifth or last and so on for other parameters. In any of these four comparisons, D is never ranked least and E is never ranked first, and also no person gets the same rank in any of the two comparisons. Based on the above information, solve the following questions.

38. Which of the following statements would be required to complete the arrangement?
(I) A is shorter than E.
(II) E is lighter than A.
(III) The youngest person is heavier than the poorest person.
(A) Only I and II
(B) Only I and III
(C) Only II and III
(D) Any one of I, II and III

39. What is the total sum of the ranks obtained by all the five people?
(A) 50 (B) 60
(C) 90 (D) 120

40. Which choice consists of the correct order of the names of the people with the following characteristics, such as second richest, fourth richest, fourth heaviest, second shortest?
(A) D, E, D, (A or E)
(B) (A or E), C, B, D
(C) D, C, D, B
(D) B, D, (A or E), (A or E)

Exercise-3

Directions for questions 1 to 4: Read the given data carefully and answer the questions that follow.

A, B, C, D and E are five students in a class. A is cleverer than B but scores less marks than D. C is cleverer than B and also scores more marks than B. E is the least clever of all but scores more marks than C. The order of the five students is 1 to 5 from the cleverest to the least clever and from the highest scorer to the least scorer.

1. If D is the cleverest, then which of the following can be the order of the five students starting from the cleverest to the least clever?
(A) D, C, B, E and A (B) D, B, A, C and E
(C) D, C, A, B and E (D) D, A, B, C and E

2. If B is cleverer than D, then who can be the cleverest of all?
(A) B (B) C
(C) A (D) A or C

3. If C stands second in terms of marks scored, then who gets the third position?
(A) D (B) B
(C) A (D) Cannot be determined

4. Which of the following students is cleverer than and also scores more marks than two other people?
(A) A (B) B
(C) C (D) Cannot be determined

Directions for questions 5 to 8: These questions are based on the following information.

A group of four students, namely Praneeth, Rajesh, Sravan and Tarun got the top four ranks in Quant, Reasoning and Verbal. For each student, the ranks in no two subjects is the same. In each subject, no two students got the same rank. We know the following additional information.

(1) The sum of the ranks of no two students is the same.
(2) Rajesh got the first rank in Quant, Praneeth got the third rank in Reasoning and Tarun got the fourth rank in Verbal.
(3) The sum of the ranks of Sravan is the highest.
(4) The rank of Rajesh in Reasoning is not same as the rank of Sravan in Verbal.

5. Who got the third rank in Quant?
(A) Tarun (B) Praneeth
(C) Sravan (D) Either (A) or (B)

6. What is the sum of the ranks of Praneeth?
(A) 8 (B) 7
(C) 6 (D) Either (A) or (B)

7. Who got the second rank in Verbal?
(A) Praneeth (B) Rajesh
(C) Sravan (D) Either (A) or (B)

8. What is the sum of the ranks of Rajesh?
(A) 6 (B) 7
(C) 8 (D) Either (A) or (B)

Directions for questions 9 to 12: These questions are based on the following information.

A group of six people, namely Anil, Sunil, Bunty, Chanty, Tarun and Varun are of different heights and weights. They are given ranks according to the descending order of their heights and weights such that the heaviest person is the first ranker and lightest person is the sixth ranker in weight category and the tallest person is the first ranker and the shortest person is the sixth ranker in the height category.

(1) The rank of Bunty in each of the categories is the same as the rank of Tarun in the other category.
(2) Varun is heavier as well as taller than both Sunil and Chanty.
(3) No person got the same rank in both the categories.
(4) Anil is the fifth shortest and Chanty is thefourth heaviest.
(5) Sunil is taller than at least two people.
(6) Tarun is shorter than Sunil and Bunty is heavier than Anil.

9. Who got the third rank in weight?
(A) Sunil (B) Tarun
(C) Varun (D) Either (A) or (B)

10. What is the rank of Chanty in weight?
(A) 2 (B) 3
(C) 4 (D) 5

11. What is the rank of Bunty in height?
(A) 4 (B) 3
(C) 2 (D) 1

12. What is the sum of the ranks of Varun?
(A) 7 (B) 6
(C) 3 (D) 5

Directions for questions 13 to 15: These questions are based on the following information.

A green grocer sells five types of vegetables, such as Carrot, Tomato, Brinjal, Cabbage and Cauliflower. Tomato is more fresh and heavier than Cauliflower. Carrot is heavier than Brinjal and more fresh than Cabbage. Cabbage is heavier than Tomato, but less fresh than Cauliflower. Brinjal is heavier than Tomato, but less fresh than it.

13. Which of the following must be the least fresh of all the vegetables?
(A) Cabbage (B) Carrot
(C) Tomato (D) Cabbage or Brinjal

14. If Cabbage is the heaviest of all, then the second heaviest can be
(A) Brinjal (B) Cauliflower
(C) Tomato (D) Carrot

15. If Carrot is not the freshest of all the vegetables, then which of the following is the most fresh of all of them?
(A) Cabbage
(B) Tomato
(C) Cabbage or Brinjal
(D) Brinjal or Tomato

Directions for questions 16 to 18: These questions are based on the following information.

A group of seven boys, namely A, B, C, D, E, F and G are standing in a row in alphabetical order from left to right in the increasing order of their weights (in kgs). The weights of all the seven boys are distinct 2-digit numbers. The following is the additional information known about them.

(i) E's weight is the average of D's, F's and G's weights.
(ii) D's weight is the average of the weights of two boys, one whose weight is a perfect square and the other, whose weight is a perfect cube.
(iii) G's weight is the sum of B's weight and D's weight.
(iv) B's weight is 10 kg less than the weight of the person whose weight is a perfect square.
(v) A's weight is a multiple of 9.

16. F's weight is____(in kgs)
(A) 67 (B) 65
(C) 66 (D) Cannot be determined

17. What is the difference between G's weight and A's weight? (in kgs)
(A) 48 (B) 58
(C) 68 (D) 52

18. What is the weight of all the boys together? (in kgs)
(A) 336 (B) 436
(C) 326 (D) Cannot be determined

Directions for questions 19 to 21: These questions are based on the following information.

Six teams A, B, C, D, E and F play a game. In the first round of the game every team plays with every other team exactly once. If a team wins, it scores 40 points, if it loses, it loses 10 points and a draw results in 20 points for each team. After the first round, the top two teams advance to the finals.

The following are the results of the first round:

(i) Team C neither won nor lost a match.
(ii) Teams B and E lost exactly one match.
(iii) Team F lost exactly three matches.
(iv) Team D won as well as lost exactly two matches.
(v) Team A lost exactly two matches.
(vi) The match played between team E and team F was drawn.

19. Which of the following teams advanced to the finals?
(A) A, B (B) A, E
(C) B, E (D) B, C

20. Which of the following teams scored the same number of points at the end of the first round?
(A) B, D (B) A, D
(C) D, E (D) None

21. The total number of winners in the first round is
(A) 10 (B) 9
(C) 8 (D) Cannot be determined

Directions for questions 22 to 25: These questions are based on the following information.

Four people A, B, C and D participated in a bike racing competition on Road W, which is a North-South road. The race distance is 100 km. In every stretch of 20 km, there is one signal post, which controls the roads in four directions for a maximum time of 9 minutes. At exactly 8:30 a.m., all signal turn green towards North on Road W. At all signals, in any direction the signal will be red for a duration of 9 minutes. In each stretch, between any two signals, a person travels with uniform speed. The race begins at signal 0 and ends at signal 5. Signal 0, Signal 1, Signal 2 up to Signal 5 are consecutive signals on Road W from South to North. Race will be towards the north direction from Signal 0 and will begin at exactly 8.30 a.m. To travel any stretch between any two signals by any person, the time taken is 15 min, 16 min, 20 min and 30 min.

22. If D is travelling with 75 kmph initially, by what earliest time will he reach Signal 3?

(A) 9:30 a.m. (B) 9:33 a.m.
(C) 9:42 a.m. (D) 9:36 a.m.

23. If B has reached Signal 5 at 10:45 a.m., then at what speed did he travel in all stretches respectively?
(A) (40, 60, 80, 40, 60)
(B) (40, 40, 80, 80, 80)
(C) (40, 40, 80, 40, 80)
(D) (40, 60, 40, 80, 75)

24. If C has only 4 min halting time at Signal 3 and travelled with the initial speed of 80 kmph, then at what time will he reach Signal 3?
(A) 9:50
(B) 9:38
(C) 10:02
(D) Either (A) or (B)

25. If A travelled with greater speed on Stretch 1 than on Stretch 2 and starts at Signal 2 at 9:30 a.m., then what is minimum and maximum halting timings?
(A) (10, 15)
(B) (10, 14)
(C) (14, 15)
(D) (12, 14)

ANSWER KEYS

Exercise-1

1. (D)	8. (C)	15. (D)	22. (A)	29. (B)	36. (C)
2. (D)	9. (C)	16. (A)	23. (D)	30. (D)	37. (D)
3. (D)	10. (D)	17. (B)	24. (D)	31. (D)	38. (C)
4. (A)	11. (B)	18. (A)	25. (D)	32. (B)	39. (B)
5. (A)	12. (A)	19. (B)	26. (A)	33. (C)	40. (B)
6. (A)	13. (A)	20. (D)	27. (D)	34. (D)	
7. (D)	14. (B)	21. (B)	28. (C)	35. (C)	

Exercise-2

1. (D)	8. (D)	15. (C)	22. (D)	29. (D)	36. (B)
2. (D)	9. (B)	16. (C)	23. (C)	30. (A)	37. (C)
3. (B)	10. (D)	17. (B)	24. (C)	31. (A)	38. (D)
4. (A)	11. (A)	18. (C)	25. (C)	32. (D)	39. (B)
5. (D)	12. (B)	19. (D)	26. (C)	33. (C)	40. (C)
6. (D)	13. (B)	20. (D)	27. (D)	34. (D)	
7. (D)	14. (C)	21. (B)	28. (A)	35. (A)	

Exercise-3

1. (C)	5. (A)	9. (A)	13. (D)	17. (B)	21. (B)	24. (D)
2. (D)	6. (C)	10. (C)	14. (D)	18. (A)	22. (B)	25. (A)
3. (D)	7. (B)	11. (D)	15. (B)	19. (C)	23. (B)	
4. (D)	8. (B)	12. (D)	16. (C)	20. (B)		

SOLUTIONS

EXERCISE-1

1. Given L is the heaviest and K is not the lightest.
Also, the number of people heavier than P is same as the number of people lighter than Q.
∴ The possible arrangements are (in decreasing order).
L P/Q K Q/P M
Therefore, M is the lightest.

2. Given C is heavier than B but shorter than A. A is not tallest. So, A has to be the second tallest and B is the third tallest. The different possibilities are:

	Height	Weight			Height	Weight
A	2	1		A	2	3
B	1	3	OR	B	1	2
C	3	2		C	3	1

∴ Either A or C is the heaviest. Hence, the answer cannot be determined.

3. The greater than sign '>' used here means 'taller than'.
Using the first letter of the names of the boys, we get the following arrangements.
L > M; P > L; N > P; N > O
On collating the above data, we get:
N > (o) P(o) > L(o) > M(o) and N > O
[Here, 'O' can be placed anywhere, as indicated].
As it is not known whether P or O is taller, hence, the person who is the second tallest cannot be determined.

4. C comes before B and after A.

$$A > C > B \quad (A)$$

D comes before E.

$$D > E \quad (B)$$

From (A) and (B), we get that either D or A comes first.
We also know that there is at least one person between D and E.
Case I: D comes first.
The possible order could be
(A) DAECB
(B) DACEB
(C) DACBE
But all of the above orders violate the condition that there must be the same number of people between D and E as between C and B.
This means that A comes first and the order is ACDBE or ADCEB.
∴ A comes first.

5. H.T. > T.D. (H.T. got more marks than T.D.)
We also know that P.T. did not get I or IV rank.
∴ It would get either II or III rank.
Anil > Murali
Gopi > Hari (H.T.)
We also know that P.T. got more marks than H.T which in turn got more marks than T.D.
⇒ P.T. > H.T. > T.D
∴ P.T. should get the 2nd rank and DME the 1st rank. Since Gopi's project got more marks than Hari, it means that Hari did project T.D. Since we also know that Anil's project got more marks than Murali's project, it means that Anil did project DME and Murali did project P.T.

6. **In terms of richness:**
Muk > Mur
Pre > Ad > Muk > Mur > Ra
Age:
Mur > Muk
Pr > Muk > Raj > Adi
∴ The number of people richer and older than Mukesh is only one, i.e., Aditya.

7. Raman > Rana > Raju
Ramana > Rama > Rana
Ramana Ramesh Raman
Ravi > Raman
If no other person finished the race between Ravi and Raman, then we get the following arrangement:
Ravi > Raman > Ramesh > Ramana > Rama > Rana > Raju.
The 6th person to finish the race is Rana.

8. Since each person has at least one apple and no two people have the same number of apples, we can say number of apples as 1, 2, 3 and 4. Given that Kamal has more apples than Anand. Mohan has more apples than Ravi. But Kamal does not have the highest number of apples. So, Mohan has the highest number of apples that is four apples with him.

9. Given Karan has more speed than Santosh and Sid finished the race before Vinit.
So, Karan > Santosh
Sid > Vinit
Since Karan did not finish before Vinit, we can say that Santosh finished the race last or his speed is the lowest.

Solutions for questions 10 to 12: From (i), P < R < S.
From (ii), S is the third eldest.
From (iii), Q is elder than fourth youngest [i.e., fourth eldest]
∴ Q is the second eldest.
From (iv), T is the second youngest and U is the youngest.
∴ V must be the eldest.
Also, R is the fourth eldest and P is the fifth eldest.
∴ We have,
U < T < P < R < S < Q < V.

10. V is the oldest.

11. P is the third youngest.

12. R is the fourth oldest.

Solutions for questions 13 to 15: A group of five people, namely P, Q, R, S and T are of different heights and different weights.

From (1), we have either P or Q is the tallest.

From (2), T is taller as well as heavier than R and S.

∴ T is either the 2nd or the 3rd tallest and is not the lightest.

From (3), the lightest and the 2nd tallest are the same.

∴ T is 3rd tallest and from (3), T is the heaviest.

From (3), the second tallest, i.e., either P or Q is the lightest. But from (4), Q is the fourth heaviest, i.e., he is not the lightest.

∴ P is the lightest and the 2nd tallest, Q is the heaviest.

From (4), R is heavier and shorter than S.

∴ The final order is as follows.

	Height	Weight
1	Q	T
2	P	R
3	T	S
4	S	Q
5	R	P

13. P is the lightest.

14. Only T is taller as well as heavier than S.

15. Four people are heavier than P.

Solutions for questions 16 to 18: Given that E got last rank, i.e., 5th rank in maths. D got second rank in Maths and got third rank in Physics.

From (2), we can say that C got fourth and fifth rank in Maths and Physics, respectively. (∵ E got fifth rank in Maths)

The data can be represented as follows.

	Maths	Physics
A		
B	x	3
C	4	5
D	2	x
E	5	

So, x cannot be 2, 3, 4 or 5. Now, $x = 1$ also from (5), in Physics A's rank is better than E's rank. Hence, the ranks are as follows:

	Maths	Physics
A	3	2
B	1	3
C	4	5
D	2	1
E	5	4

16. D got 1st rank in Physics.

17. A got 2nd rank in Physics.

18. The rank of A in Maths is same as the rank of B in Physics.

Solutions for questions 19 and 20: A group of five students, namely Pavan, Sravan, Charan, Tarun and Kiran are the top five rankers in a class. Each one of these is of a different height. It is given that, the tallest person is the fourth ranker, Kiran is the 2nd ranker, Tarun is taller than at least two people. Hence, Tarun could be either the tallest, the second tallest or the third tallest. Tarun is the third ranker. As Tarun is the third ranker he cannot be the tallest because the fourth ranker is the tallest.

The shortest person is the first ranker but he is not Charan.

Charan is neither the first ranker nor the shortest.

Sravan is taller than only one person. Hence, Sravan is the fourth tallest.

∴ Sravan cannot be the first or the fourth ranker. As Tarun is taller than Kiran, Kiran is not the shortest. Pavan is the first ranker and the shortest.

Tarun is the second tallest and Charan is the tallest.

The final order is as follows.

Name	Rank	Height
Pavan	1	5
Sravan	5	4
Charan	4	1
Tarun	3	2
Kiran	2	3

19. Charan is the fourth ranker.

20. As Pavan is the shortest, the remaining four people are taller than Pavan.

Solutions for questions 21 to 23: Let the number of chocolates with each of them be denoted by the first letter of his name.

From (ii), C < S < R.

From (iii), S > N

From (iv), R − C = K − R

As R − C is at least two, and no number has a difference of three with more than one of the given numbers.

R − C = 2

∴ K − R = 2

From (ii) and (iii), we get:
N < C < S < R
As K − R = 2,
A must be greater than R.
∴ The final arrangement will be as follows.

N	<	C	<	S	<	R	<	A	<	K
3	4	5	6	7	8					

21. Ranjit has 6 chocolates.

22. Sumit has 5 chocolates.

23. The difference is = 8 – 3 = 5.

Solutions for questions 24 to 26: From (i) and (iv), Anand got a better rank than at least three people, i.e., Anand's rank can be 1 or 2 or 3.

From (iii), Charan's rank can be 6 or 5 or 4.

If Anand's rank is 3, then Charan's rank must be 4, in this case, condition (v) is violated.

∴ Anand's rank is either 1 or 2.

Here we have three possibilities:

(A)

1	2	3	4	5	6
Gopal	Anand	Deepti	Hriday/Charan	Brijesh/Brijesh	Harish

(B)

1	2	3	4	5	6
Anand	Gopal	Hriday/Deepti	Brijesh/Charan	Brijesh	Hriday

(C)

1	2	3	4	5	6
Anand	Deepti	Hriday	Gopal	Brijesh	Charan

24. It is possible in case (b) and (c).
But only in case (b), we have one person between Deepti and Charan, i.e., Brijesh.

25. We have more than one possibility.

26. It is possibly (c), in which Brijesh got the fifth rank.

Solutions for questions 27 to 29: Let the marks scored by each person be denoted by the first letter of his name.

From (ii), E > C > D
From (iv), G > H
From (v) D > G
Combining the above, we get.
∴ E > C > D > G > H
From (iii), we get

1	2	3	4	5	6	7	8
						F	

As H did not get the lowest score, either A or B got the lowest score.
From (i) and the above data, A got the first rank and B got the eighth rank.
∴ The final arrangement will be as follows.
A > E > C > D > F > G > H > B

27. Dayanand got the fourth highest score.

28. Goutam got the third lowest score.

29. Anurag got the highest score.

Solutions for questions 30 to 34: It is given that four athletes, namely Bolt, Johnson, Lewis and Powell competed in four different events 100 m, 200 m, 400 m and 800 m. In each event these athletes finished in four different timings. No athlete finished any two events in the same position.

From (1), we have the same athlete (say x) finished first in 100 m and fourth in 800 m.

From (2), we have the same athlete (say y) finished 2nd in 200 m, 3rd in 400 m, 1st in 800 m and hence, 4th in 100 m events.

We can conclude that the person x finished 2nd in 400 m and 3rd in 200 m event.

	100 m	200 m	400 m	800 m
1	x			y
2		y	x	
3		x	y	
4	y			x

From (3), we have Bolt finished second in 100 m. Hence, Bolt is neither x nor y and hence, Bolt finished 3rd in 800 m.

Let z be the remaining athlete. z is the 2nd in 800 m, 3rd in 100 m.

From (4), as Johnson finished after Bolt in 200 m.

Bolt is the first to finish 200 m and is the fourth to finish in 400 m.

z is the first to finish in 400 m.

As Johnson finished after Bolt in 800 m, from this we can determine that x is Johnson.

As Lewis is not the last one to finish 200 m, Powell finished fourth in 200 m and y is Lewis.

The final order is as follows.

	100 m	200 m	400 m	800 m
1	Johnson	Bolt	Powell	Lewis
2	Bolt	Lewis	Johnson	Powel
3	Powell	Johnson	Lewis	Bolt
4	Lewis	Powell	Bolt	Johnson

30. Powell is the fourth to finish 200 m.

31. Powell is the first to finish 400 m.

32. Bolt is the third to finish 800 m.

33. Lewis is the second to finish 200 m.

34. Powell is the second to finish 800 m.

Solutions for questions 35 to 37: From (i), Confidence > Sense of Humour > Creativity.

From (ii), Honesty is ranked 2 from the top.

From (iii), Commitment > Intuition > Positive Attitude.

From (iv), Positive Attitude > Creativity > Communication.

From (v), Confidence > Commitment.

Combining the above statements, we get the following possibilities:

(i) Confidence > Honesty > Sense of Humour > Commitment > Intuition > Positive Attitude > Creativity > Communication.

(ii) Confidence > Honesty > Commitment > Sense of Humour > Intuition > Positive Attitude > Creativity > Communication.

(iii) Confidence > Honesty > Commitment > Intuition > Sense of Humour > Positive Attitude > Creativity > Communication.

(iv) Confidence > Honesty > Commitment > Intuition > Positive Attitude > Sense of Humour > Creativity > Communication.

Solutions for questions 38 to 40: From (iv), (iii), (i) and (vi), we get the following cases:

(A) B > H > D > I ≥ – > – > – > A > J ≥ F > –

(B) B > – > H > D > I ≥ – > – > – > – > A > J ≥ F

But from the above data, (ii), (v) and (vii) we can eliminate case (b). The final arrangement is B > H > D > I > C > E > G > A > J > F > K.

38. C scored the fifth highest marks.

39. Two students scored less than J.

40. Four students scored less than D but more than A.

EXERCISE-2

Solutions for questions 1 to 3: Let us represent Alfa, Beta, Gamma, Delta and Zeta with familiar symbols as α, β, γ, δ and ƶ, respectively.

For efficiency of doing the work:

Given that β is more efficient than α. γ takes least time, so he has the highest efficiency. Also δ is more efficient than ƶ. α is less efficient than ƶ and more efficient than δ.

So, in terms of efficiencies γ > β > ƶ > α > δ or γ > ƶ > β > α > δ

For heights:

Given that β is shorter than α ⇒ β < α

γ is shortest.

δ is shorter than ƶ ⇒ δ < ƶ

Also, ƶ is taller than β who is taller than δ.

⇒ α > ƶ > β > δ > γ or ƶ > α > β > δ > α

1. Delta is the least efficient.

2. Either Alpha or Zeta is the second tallest.

3. Under the given condition, the order of efficiencies is as follows.

γ > β > ƶ > α > δ

The order of heights is as follows:

ƶ / α > α / ƶ > β > δ > γ

∴ Beta and Zeta are the third tallest and the third efficient, respectively.

Solutions for questions 4 to 8: It is given that six people, namely A, B, C, D, E and F are standing in a queue and each of them is of a different height. These six stands in the decreasing order of their heights.

From (1), the different possible arrangements are as follows:

(i) ___ ___ D A B/C C/B

(ii) ___ ___ A D B/C C/B

(iii) ___ A ___ ___ D ___

(iv) A ___ ___ ___ ___ D

From (2), B is taller than D. Hence, the arrangements (i) and (ii) are not possible.

Possibility (iii): From (1) and (2), B is taller than D and shorter than A. Hence, B is between A and D.

From (1) and (3), C is shorter than A but does not stand at any end. Hence, B and C are in between A and D. From (2), E is taller than B. Hence, E should be the tallest and next to A which contradicts the condition (5). Hence, (iii) is not possible.

The only possible way is (iv).

A ____ ____ ____ ____ D

The different possible ways are:

A C E B F D
A C E F B D
A C F E B D

4. A is the tallest.

5. Either C or F stands between A and E.

6. D is the shortest.

7. Four people are standing behind C.

8. Either three or four people stand ahead of B.

Solutions for questions 9 to 12: From (i), Income: P > U
Expenditure: P > T
From (ii), Income: Q > S
Expenditure: R > Q
From (iii), Income: R > U
Expenditure: U > R
From (vii), Income: U > T and from the other given conditions, we derive the following data.

	Income	Expenditure
Highest	P	U × S
	R × Q	P
	Q	T
	S	S
	U × S	R × Q
Lowest	T	Q

9. U's income is less than that of S and more than that of T.

10. T has the lowest income.

11. One person has expenditure less than that of R.

12. Two people have income more than that of S but less expenditure than that of T.

Solutions for questions 13 to 16 : From (ii), the oldest was born in 1981 and the youngest was born in 1989.

From (iv), Falgun is the fourth oldest, who was born in 1985.

From (i) and (v), Ekta and Deekshit are born in 1984 and 1988, respectively. Ekta is the third oldest and Deekshit is the second youngest.

From (iii), Abhay and Chandini are the fifth and seventh oldest, respectively but not necessarily in the same order. They are born in 1987 and 1989, respectively.

From (vi), Chandini was born in 1987 (and is the fifth oldest) so that Giri was born in 1982 (and is the second oldest). Abhay is the youngest, who was born in 1989. Hence, Bhargav is the oldest being born in 1981.

The final order, from the oldest to the youngest is as follows. A D

Bhargav (1981) > Giri (1982) > Ekta (1984) > Falgun (1985) > Chandini (1987) > Deekshit (1988) > Abhay (1989)

13. The oldest is Bhargav.

14. Chandini was born in 1987.

15. Falgun is four years older than Abhay.

16. The fifth youngest or third oldest is Ekta.

Solutions for questions 17 to 20: Given that:

(i) Four boys – A, B, C, D
Four girls – W, X, Y, Z

(ii) There are two boys, each of whom is taller than exactly two girls.

(iii) There are two girls, each of whom is taller than exactly two boys.

(iv) ('>' symbol represents taller than)
B > W > A > X

(v) C > Z > D > Y > X and C > B

From (ii) and (iii), we can judge that there are two possibilities.

(I) 2 boys > 2 girls > 2 boys > 2 girls
(II) 2 girls > 2 boys > 2 girls > 2 boys

But from (iv) and (v), we can judge that C is the tallest. Hence, (I) is the acceptable arrangement.

Analysing (iv):

B > W > A > X
(boy) (girl) (boy) (girl)

Analysing (v):

C > Z > D > Y > X
(boy) (girl) (boy) (girl) (girl)

Hence, we conclude that:

2 boys > 2 girls > 2 boys > 2 girls

C > B > W, Z > A, D > Y > X

Also, among boys, we have:
C > B > A and C > D

Hence, the tallest boy is C (C anyhow is the tallest among all the eight people).

Among girls, we have:
Z > Y > X and W > X

Hence, the shortest girl is X, who also happens to be the shortest among all eight. Hence, the shortest boy and the tallest girl is unknown. Also, the person who is taller among (W, Z) and (A, D) is not known.

17. As discussed above, the shortest among boys could be D. Hence, (B) can be false.

18. Given that W > Z, but the person who is taller out of A and D is not known. Hence, statement (C) is not definitely true.

19. Given that D < A or A > D, but the person who is taller between W and Z is not known.

20. Given that D > A, hence, the shortest boy is A. The tallest girl is either W or Z.

Solutions for questions 21 to 24: From (ii), (iii) and (v), K scored the fourth highest, E scored the fifth highest. A scored the sixth highest and C scored the seventh highest runs.

From (i), (vi) and (vii), D scored the third highest runs, B scored the fourth lowest runs. H scored the highest runs or the second highest runs and I scored the third lowest runs or the second highest runs.

From (iv) and the above data, J scored the lowest, F scored the second highest runs, I scored the third lowest runs and H scored the highest runs.

Therefore, the final arrangement is as follows:

$$\underline{H} > \underline{F} > \underline{D} > \underline{K} > \underline{E} > \underline{A} > \underline{C} > \underline{B} > \underline{I} > \underline{G} > \underline{J}$$

21. J scored the lowest runs.

22. Five players scored more than G and less than K.

23. E's score can be 96.

24. The number of people who scored between A and B is one and A scored more runs than B.
Similarly, F is related to K.

Solutions for questions 25 to 27: From the given information we can say that the top three websites which have the most number of visitors will have the lowest speed, i.e., the first lowest, the second lowest and the third lowest.

From (i) and (ii), 'Ask' has the second highest number of visitors and 'eBay' has the third highest number of visitors.

From (iii) and (iv), the uploading speed of 'gmail' is the highest or the second highest or the third highest and the number of visitors is the lowest or the second lowest or the third lowest. 'LinkedIn' has the lowest or the second lowest number of visitors and uploading speed is the highest or the second highest.

	Number of visitors	Uploading speed
1		
2	Ask	
3	eBay	
4		eBay
5		
6		Ask

25. Statement (C) is false.

26. If (i) is true, (ii) is also true.

27. Statement (D) is true.

Solutions for questions 28 to 30: From (i), (ii) and (iii), D could have bought the second highest or the third highest number of shares in company Q.

B could have bought the second highest or third highest number of shares in P and the highest or the second highest number of shares in Q.

From (iv) and (v), the number of shares bought by B is the second highest in P, the highest in Q and the lowest in R.

∴ The final distribution is as shown below.

P	Q	R
A	B	C
B	C	D
C	D	A
D	A	B

28. B has the highest number of shares in Q.

29. All of A, C and D.

30. One person has one more share than C in company Q.

Solutions for questions 31 to 33: Let each person be represented by the first letter of his respective name. As the expenditure of no two of them is the same and their income is the same, the person who has the maximum expenditure would have the least savings, the person who has the second highest expenditure would have the second least savings and so on.

From (iii) C's savings are more than D's savings.
∴ C's expenditure is less than D's expenditure.
From (iv) A's expenditure is more than F's expenditure.
∴ A's savings are less than F's savings.
From (v) B's savings are more than F's savings.
and B's expenditure is more than D's
∴ B's savings are less than D's.
In terms of savings the order is as follows:
C > D > B > F > A
In expenditure, the order is as follows.
A > F > B > D > C

31. Abanti's expenditure is the highest.

32. Chandan's savings is the highest.

33. Savings of three people are more than that of Fahrook.

Solutions for questions 34 to 37: Let us consider case (I).
From (i) and (ii), Nirmala does not have Rank 1, 3 or 5.
From (iv), Parimala's Rank is 2.
Hence, Nirmala's Rank is 4.
⇒ Nirmala's Rank is 5 (From (ii)).
From (ii), Amala's rank is 1 and Kamala's rank is 3.

Case (I)

Rank	Child	Woman
1	Chinna	Amala
2	Rinku	Parimala
3	Kanna	Kamala
4	Tinku	Nirmala
5	Munna	Vimala

From the above table, Kanna's mother is Nirmala and Chinna's mother is neither Amala nor Vimala.
Since Tinku's mother is Parimala, Chinna's mother is Kamala.
⇒ Munna's mother is Amala and Rinku's mother is Vimala.
Hence, the mother child pairs are as follows.

Amala – Munna, Parimala – Tinku, Kamala — Chinna, Nirmala – Kanna, Vimala – Rinku

Let us consider case (II):
Nirmala's rank is none of 1, 3 or 5.
From (iv), Parimala's rank is 4.
Hence, Nirmala's rank is 2.
From (ii), Rank 3 and 5 are for Vimala and Kamala in any order. Hence, Amala's rank is 1.

Case (II)

Rank	Child	Woman
1	Chinna	Amala
2	Tinku	Nirmala
3	Rinku	Vimala/Kamala
4	Munna	Parimala
5	Kanna	Kamala/Vimala

From the above table, Rinku's mother is Nirmala, Tinku's mother is Parimala, Chinna's mother is not Amala. Hence, Chinna's mother is either Vimala or Kamala, the woman whose rank is 3.
Hence, Kanna's mother is neither 3rd nor 5th ranked women.
Hence, Kanna's mother is Amala.
The following are the mother – child pairs.

Amala – Munna, Parimala – Tinku, Kamala — Chinna, Nirmala – Kanna, Vimala – Rinku

Let us consider case (III).
Parimala's rank is 4.
Nirmala's rank is none of 1, 3 and 5.
Hence, Nirmala's rank is 2.
From (ii), the rank's of Vimala and Kamala is 3 and 5 in any order.
Hence, Amala's rank is 1.

Case (III)

Rank	Child	Woman
1	Chinna	Amala
2	Tinku	Nirmala
3	Kanna	Vimala/Kamala
4	Rinku	Parimala
5	Munna	Vimala/Kamala

From the above table, Nirmala's child is Kanna and Parimala's child is Tinku. Chinna's mother is 3rd ranked woman.
Hence, Munna's child is Amala.
The following are the mother – child pairs.

Amala – Kanna, Nirmala – Rinku, Vimala — Munna/Chinna, Parimala – Tinku, Kamala – Munna/Chinna.

34. Nirmala's child is either Rinku or Kanna.

35. If Munna is the child of Vimala, cases (II) and (III) prevail. But in case (III) Vimala is the mother of Munna, then Vimala should have Rank 3. But Chinna's mother got Rank 3. Hence, case (III) is does not hold good. In case (II) Vimala has Rank 5 and Kamala has Rank 3.
⇒ Parimala is elder than Vimala.

36. If Nirmala is elder than only one person, then case (I) prevails. Then Vimala is Rinku's mother.

37. Statement (C) is true.

Solutions for questions 38 to 40: There is a total of four comparison parameters, such as Weight, Height, Richness and Age. Let us put down the data given for the comparison (greater than symbol '>', which represents a person being heavier, taller richer or older than the other).

	Weight	Height	Richness	Age
(i)	A > D	D > A	D > C	C > D
(ii)	E > B	E > C	B > E	C > E
(iii)	E > B	B ≠ Youngest		

(iv) B ≠ Shortest
(v) Richest = Youngest
(vi) Heaviest = Shortest
(vii) Second Oldest = Second poorest (or Fourth richest)
(viii) Second Heaviest = Third shortest (or Third tallest)
(ix) Second Shortest = Third poorest (or Third richest)
(x) Second Richest = Third eldest
(xi) E ≠ Heaviest, Tallest, Richest, Eldest
(xii) No person gets the same rank in any two comparisons
Now, neither B nor C can be the tallest, as E is taller than

these two. Also, A cannot be the tallest, as D is taller than A. E anyhow cannot be ranked first.

Hence, D must be the tallest.

It is given that E is never ranked first. Hence, the first rank in these 4 different comparisons must belong to A, B, C and D. Also, the last ranks must belong to A, B, C and E as D is never ranked last. Now B is neither the youngest nor the shortest and as B > E in richness. Here, B is not the poorest. Therefore, B must be the lightest.

Now the richest person cannot be D (already D is the tallest and no one can have the same rank in any two comparisons), nor E (B > E). Also, the youngest person is neither C (C > D, E) nor B (given B is not the youngest) nor D (D is never ranked last). Also, the richest and the youngest person is the same. As E is not the richest (E is never ranked first). Hence, the remaining person 'A must be the richest as well as the youngest'.

Now, the shortest person can neither be E (E > C, B) nor B nor A.

(They are already ranked fifth in some other comparison) nor D (D can never be ranked last). Hence, C must be the shortest as well as the heaviest person. This means that E must be the poorest person. Also, B must be the eldest person.

Now let us represent the ranks as given below

Person	Weight	Height	Richness	Age
A			1	5
B	5			1
C	1	5		
D		1		
E			5	

Also, Second poorest = Fourth richest, Third shortest = Third tallest, and Second shortest = Fourth tallest; Third poorest = Third richest.

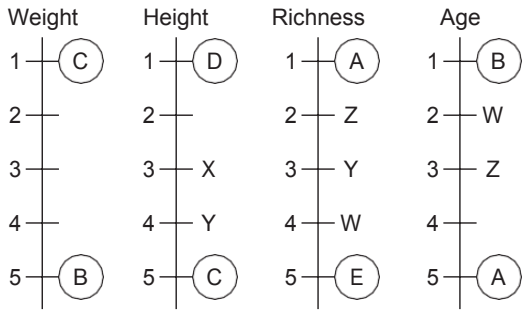
→ Second oldest, Fourth richest = W

→ Second heaviest, Third tallest = X

→ Fourth tallest, Third richest = Y

→ Second richest, Third eldest = Z

We now represent the ranks on a scale as shown below:



Now D is neither X nor Y. Hence, D ≠ Third poorest. Then D must be Z (as D ≠ 4, ∴ D > C) this means that D must be the second richest and third oldest.

Now D has first, second and third ranks in three of the parameters and as D ≠ 5. Hence, D must be the fourth heaviest.

As D is the third oldest, C must be the second oldest and the fourth richest (∴ C > D, E in age).

Then E must be the fourth eldest and B must be the third richest as well as the fourth tallest.

Now A or E is second or third heaviest. Similarly, A or E is second or third tallest. We complete the table as given below:

Person	Weight	Height	Richness	Age
A	Second or Third	Third or Second	1	5
B	5	4	3	1
C	1	5	4	2
D	4	1	2	3
E	Third or Second	Second or Third	5	4

38. Statement I (A is shorter than E) can complete the arrangement and fix the positions of A and E.
Statement II (E is lighter than A) makes A the second heaviest and the third tallest and E as the third heaviest and the second tallest thus completing the arrangement. Similarly, 'The youngest person (A) is heavier than the poorest person (E)', also helps in completing the arrangement. Hence, any one of these statements is sufficient to complete the arrangement.

39. Since in every comparison ranks 5, 4, 3, 2 and 1 are awarded, the sum of the ranks in any comparison is 5 + 4 + 3 + 2 + 1 = 15. Total sum of all ranks awarded is 15 × 4 (since there are 4 comparisons) = 60.

40. Second richest = D
Fourth richest = C
Fourth heaviest = D
Second shortest = B
Hence, the order is DCDB.

EXERCISE-3

Solutions for questions 1 to 4: In terms of cleverness, it is known that

A is cleverer than B, C is cleverer than B, E is the least clever of all, i.e., A > B and C > B, but there is no relation between A and C.

So, both A and C are cleverer than B and E is the last in order of cleverness. So, it is clear that neither A nor C can be 4th and B cannot be 1st or 2nd, as A and C are cleverer than him.

1	2	3	4	5
-	-	-	-	E

So, nothing can be decided about the exact order. In terms of scores, it is given that A scores less marks than D, i.e., D > A and C gets more marks than B, i.e., C > B, whereas E scores more than C, i.e., E > C so E > C > B. Now the order cannot be decided. It can be only said that E can be neither 4th nor 5th. B cannot be 1st and 2nd. D cannot be 5th and A cannot be 1st in the order of score.

1. If D is the cleverest of all, then the order is as follows:

1	2	3	4	5
D	A or C	C Or A	B	E

Then one of the orders can be, D, C, A, B, E.

2. If B is cleverer than D, then A or C stands first in terms of cleverness.

1	2	3	4	5
A/C	C/A	B	D	E

3. C stands second in order of marks. Then the third score may be of B or D. So, who gets the third position cannot be determined.

4. The order of cleverness or marks is not clearly given. So, it cannot be determined who is cleverer and also scores more marks than two people.

Solutions for questions 5 to 8: As, the total sum = 30 and least sum (1, 2, 3) = 6, and the highest sum is (2, 3, 4) = 9, the sum of the ranks must be 6, 7, 8 and 9.

From the given information, we have the following table.

	Rajesh	Tarun	Praneeth	Sravan
Quant	1			
Reasoning			3	
Verbal		4		
Total				9

As the sum of the ranks of Sravan is 9, the ranks must be 2, 3 and 4.

∴ Praneeth got the first rank in Verbal.

⇒ Tarun got the first rank in Reasoning.

In Reasoning, if Rajesh got the second rank and Sravan got the 4th rank, then Praneeth must have got the fourth rank in Quant. As only Rajesh can get the sum (1, 2, 3) as 6, Rajesh's rank in Verbal must be 3.

∴ Sravan's rank in Verbal must be 2nd, which is violating (4).

∴ In Reasoning, Rajesh got the fourth rank and Sravan got the second rank.

Now, only Praneeth can get the sum as 6.

∴ Praneeth's rank must be two in Quant.

Tarun's sum cannot be 7, Rajesh's rank in Verbal must be two.

∴ Sravan's ranks in Verbal and Quant are 3 and 4, respectively.

∴ Tarun got the third rank in Quant.

	Rajesh	Tarun	Praneeth	Sravan
Quant	1	3	2	4
Reasoning	4	1	3	2
Verbal	2	4	1	3
Total	7	8	6	9

5. Tarun got the third rank in Quant.

6. Sum of the ranks of Praneeth is 6.

7. Rajesh got the second rank in Verbal.

8. Sum of the ranks of Rajesh is 7.

Solutions for questions 9 to 12: Let each person be denoted by the first letter of his name.

From the given information we have:

	A	S	B	C	T	V
Height	2					
Weight				4		

From (2) and (6), we have

Height: V > S, V > C, S > T

⇒ V > S > T, V > C

Weight: V > S, V > C, B > A

From (1), neither B nor T got 2nd or 4th rank in any category.

∴ T's rank in height must be 5 or 6.

If T's rank in height is 6, then B's rank in weight will be 6, which violates (6).

T's rank in height is 5 and B's rank in weight is 5.

∴ A's rank in weight will be 6.

Also, as none of B, S, T, V can get the 6th rank in height, then C gets the 6th rank in height.

B and V got the first and the third ranks in height, respectively.

∴ S got the 4th rank in height.

Now, in weight, if V gets the first rank, then T must get the third rank.

In height, B must get the third rank.

⇒ V gets the 1st rank in weight as well, which violates (3).

∴ In weight, V gets the second rank.

∴ S gets the third rank.

⇒ T gets the first rank.

In height, B gets the first rank and V gets the third rank.

∴ The final results will be as follows:

	A	S	B	C	T	V
Height	2	4	1	6	5	3
Weight	6	3	5	4	1	2

9. Sunil got third rank in weight.

10. Chanty's rank in weight is 4.

11. Bunty got the 1st rank in height.

12. Five

Solutions for questions 13 to 15: The given data is that the five types of vegetables are Carrot, Tomato, Brinjal, Cabbage and Cauliflower.

In terms of freshness, it is given that:

Tomato is more fresh than Cauliflower, i.e., Tomato > Cauliflower.

Carrot is more fresh than Cabbage, i.e., Carrot > Cabbage.

Cauliflower is more fresh than Cabbage, i.e., Cauliflower > Cabbage.

Tomato is more fresh than Brinjal, i.e., Tomato > Brinjal.

So, Tomato is more fresh than Brinjal and Cauliflower.

Carrot and Cauliflower are more fresh than Cabbage.

Let us denote Tomato by To, Brinjal by Br, Cauliflower by Cl, Carrot by Cr and Cabbage by Cb.

The following things are known.

Freshness wise	To > Br To > Cl > Cab Cr > Cab
Weight wise	Cr > Br > To > Cl Cab > To

So, the order of freshness cannot be decided.

Tomato is heavier than Cauliflower, i.e., Tomato > Cauliflower.

Carrot is heavier than Brinjal, i.e., Carrot > Brinjal.

Cabbage is heavier than Tomato, i.e., Cabbage > Tomato.

Brinjal is heavier than Tomato, i.e., Brinjal > Tomato.

So, the order can be as follows:

Table I

1	2	3	4	5
Carrot	Brinjal	Cabbage	Tomato	Cauliflower
Cabbage	Carrot	Brinjal	Tomato	Cauliflower
Carrot	Cabbage	Brinjal	Tomato	Cauliflower

13. The order of freshness is:

Tomato, Brinjal, Cauliflower, Carrot, Cabbage

Tomato, Carrot, Cauliflower, Brinjal, Cabbage

Tomato, Carrot, Cauliflower, Cabbage, Brinjal

So, either Cabbage or Brinjal is the least fresh of all the vegetables.

14. If Cabbage is the heaviest, the order is in terms of the heaviest to the least heavy.

1	2	3	4	5
Cabbage	Carrot	Brinjal	Tomato	Cauliflower

So, Cabbage is the heaviest and Carrot is the 2nd heaviest.

15. If Carrot is not the freshest of all, then only Tomato is the freshest.

Solutions for questions 16 to 18: From (ii), the square and cube numbers can be (16, 64), (25, 27), (36, 64), (49, 27), and (81, 27). The weight of all the seven boys is a 2-digit number. (64, 64) is not possible, since no two boys have the same weight. Hence, D's weight can be 40, 26, 50, 38 and 54, respectively. From (iv) and the above data, the possible weights are as shown below.

Person	A	B	C	D	E	F	G
Case (i)		6		40			
Case (ii)		15		26			
Case (iii)		26		50			
Case (iv)		39		38			
Case (v)		71		54			

Case (i) is eliminated, since the weight of B is a single digit number. Case (iv) and case (v) are eliminated, since the people are standing in increasing order of their weights from left to right.

In case (ii), C's weight is 25 and E's weight is 27.

In case (iii), C's weight is 36 and E/F/G's weight is 64.

From (v), case (ii) is eliminated, since A's weight can be 9 or 18 or 27 and so on. A's weight cannot be 9, as 9 is a single digit and A's weight cannot be > 15.

In case (iii), A's weight is 18.

Persons	A	B	C	D	E	F	G
Case (i)	18	26	36	50	64		
Case (ii)	18	26	36	50		64	
Case (iii)	18	26	36	50			64

From (iii), in case (i) and case (ii) G's weight is = 26 + 50 = 76.
Case (iii) is eliminated as G's weight ≠ 76.
From (i):

In case (i), E's weight = $\frac{50 + \text{F's weight} + 76}{3}$

$$64 = \frac{126 + \text{F's weight}}{3}$$

∴ F's weight = 66.

In case (ii), E's weight = $\frac{50 + 64 + 76}{3}$ = 63.3 not a 2-digit number.

Hence, case (ii) is eliminated.
∴ The seven people and their weights are as shown below.

People	A	B	C	D	E	F	G
Weights	18	26	36	50	64	66	76

16. F's weight is 66 kgs.

17. The difference between G's weight and A's weight is 58 kgs.

18. The weight of all the boys together is 336 kgs.

Solutions for questions 19 to 21: From the given information, we derive the following table.

Team	Win	Loss	Draw
A		2	
B		1	
C	–	–	5
D	2	2	1
E		1	1
F		3	1

As C had drawn a match with every other team the five matches should reflect in the other's score sheets also.
Hence, the number of matches drawn by A and B should be at least '1' each and E and F should be at least '2'.
It can be further seen that the number of matches drawn is 6, as we already have 9 losses in the loss column, we need to have 9 wins in the wins column.
Hence, the final score sheet is as follows.

Team	Win	Loss	Draw	Score
A	2	2	1	80
B	3	1	1	130
C	–	–	5	100
D	2	2	1	80
E	2	1	2	110
F	–	3	2	10

19. B and E advance into the finals.

20. A and D have the same score.

21. The total number of winners in the first round is 9.

Solutions for questions 22 to 25: From the information on time taken to traverse a stretch, we can determine their speeds in km/h. Further, at all signals, the maximum wait time in any direction is 9 minutes, this implies that the signal remains green for three minutes each direction. It also implies that the signal turns green after every 12 minutes in each direction: Towards north, signal turns green at 8.30, 8.42, 8.54, 9.06, 9.18, 9.30 and so on. Thus, in any hour, at any signal, the signal turns green at 6th, 18th, 30th, 42nd and 54th minutes invariably.

No given speed or travel matches the cycle of green signal at the signal posts.

Thus, invariably each person will wait at each signal post irrespective of his speed.

Speed KMPH	Travel time to reach next signal	Waiting time	Time to start next stretch
80	15 minutes	9 minutes	24 minutes
75	16 minutes	8 minutes	24 minutes
60	20 minutes	4 minutes	24 minutes
40	30 minutes	6 minutes	36 minutes

22. D's initial speed = 75 kmph
⇒ Time on 1st stretch = 16 minutes
Earliest time
⇒ Speed has to be increased = 80 kmph
⇒ Time taken on second and third signal stretches = 15 minutes.
⇒ Time taken = (16 + 8) + (15 + 9) + (15 + 0) = 63 minutes.
Earliest time = 8.30 + 63
= 9.33

23. 10 : 45 − 8 : 30 = 2 : 15 = 135 minutes
Choice (A) = 36 + 24 + 24 + 36 + 20
= 140 minutes
Choice (B) = 36 + 36 + 24 + 24 + 15
= 135 minutes

Choice (C) = 36 + 36 + 24 + 36 + 15
= 157 minutes
Choice (D) = 36 + 24 + 36 + 24 + 16
= 136 minutes.
Speeds in choice (B) takes B to Signal 5 by 10.45 p.m.

24. Initial speed = 80 kmph ⇒ Time to reach Signal 3
= (15 + 9) + x + 20 x can be 24 or 36
∴ Time to reach Signal 3 = 44 + 24 or 44 + 36
= 68 or 80 minutes
⇒ Time = 9.38 or 9.50

25. Starts at Signal 2 = 9.30
⇒ Time = 60 minutes = 24 + 36 (24 > 36) minimum waiting time = 4 + 6 = 10 minutes. Maximum waiting time = 9 + 6 = 15 minutes

6 Binary Logic

Chapter

Learning Objectives

In this chapter, you will:

- Understand the concept of Binary Logic, truth tellers, liars and alternators.
- Figure out how to reject a person based on his/her statements.
- Understand how to arrive at facts by identifying whether statements made by a person are true or false and identify whether a person is a truth teller or a liar or an alternator.
- Learn how to solve questions which have a combination of Binary Logic and other topics.

In some of the competitive exams, we come across questions which are to be answered based on the truth or falsity of statements given in the question. In these questions we come across three kinds of terms. They are 'Truth-Teller', 'Liar' and 'Alternator'. These terms may or may not be explicitly defined in the question. The following are the definitions of these terms, which can be applied while answering these questions, unless otherwise defined.

Truth-teller: A person whose each and every statement is true.

Liar: A person whose each and every statement is false.

Alternator: If the first statement of the person is true, then the next statement is false or vice versa.

The question does not specify as to which statement is true or false. It has to be found out by trial and error and by checking for consistency in the given statement.

If the question states that there is a truth teller among the given persons, we assume one person as the truth teller and list down statements stated by that person as facts. We compare the statements of the other persons with the facts listed out. If we do not come across any contradiction, we can conclude that our assumption holds good, otherwise we continue by assuming another person to be the truth teller.

In case there is no indication whether or not there is a truth teller, we go by assuming a fact. The following illustrations help in understanding the concept.

Solved Examples

6.01: Among the three people A, B and C, one is a truth-teller, one is a liar and the other is an alternator. Each of them made the following statements in reply to the question asked about them.

A: I am not the liar. C is the liar.
B: I am the liar. A is the truth-teller.
C: I am the alternator. B is the liar.

Find out who the truth-teller is, who the liar is and who the alternator is.

Sol: The statement, 'I am not the liar', could be that of a truth-teller or of a liar or of an alternator. Hence, we cannot find out the nature of A. From the statement of B, i.e., 'I am a liar', it can be concluded that B is the alternator, because neither a truth-teller nor a liar would say that he is a liar. Hence, the second statement of B, i.e., 'A is the truth-teller' is true. From the above, it can be concluded that the statement of C, i.e., I am the alternator is false. Hence, C is the liar. Let us check the truth in each of the statements of A, B and C with the help of the conclusions made.

A: I am not the liar (True). C is the liar (True).

B: am the liar (False). A is the truth-teller (True).

C: I am the alternator (False). B is the liar (False).

From the above, it is clear that the conclusions made, i.e., A is the truth-teller (both the statements are true), B is the alternator (one statement is true and the other is false) and C is the liar (both the statements are false) are correct. The questions asked may have one, two, three or even four statements made by each person.

Directions for questions 6.02 to 6.04: These questions are based on the following information.

Each of the boys Raman, Raghu and Rajan likes a different colour among red, blue and green. One of them always speaks the truth, one of them always lies and the third one alternates between the truth and lie. They made the following statements.

Raman : I like green.
Raghu likes red.
I am an alternator.

Raghu : Rajan likes Blue.
Raman does not like green.
I am a liar.

Rajan : I do not like red.
Raghu does not like red.
Raman is a liar.

6.02: Who is the alternator?
(A) Raman
(B) Raghu
(C) Rajan
(D) Cannot be determined

6.03: Who likes red colour?
(A) Raman
(B) Raghu
(C) Rajan
(D) Cannot be determined

6.04. Who is the liar?
(A) Raman
(B) Raghu
(C) Rajan
(D) Cannot be determined

Solutions for questions 6.02 to 6.04: We cannot take Raman as a truth-teller, since his third statement is contradicting.

Similarly, we cannot take Rajan as a truth-teller since his third statement is contradicting.

Rajan is a truth-teller.

Person	Statement 1	Statement 2	Statement 3	Colour
Raman	F	F	F	Red
Raqhu	F	T	F	Blue
Raian	T	T	T	Green

Hence, Rajan is a truth-teller.

6.02: Raghu is the alternator.

6.03: Raman likes red colour.

6.04: Raman is the liar.

6.05: Each one of the three friends Divya, Bhanu and Ravi went to a different place among Goa, Ooty and Shimla for summer vacation. They replied to the question, "Who went to Goa?", in the following manner:

Divya : I went to Shimla;
Ravi did not go to Ooty.

Bhanu : Divya did not go to Shimla;
Ravi did not go to Shimla.

Ravi : Bhanu did not go to Ooty;
I went to Goa.

If exactly two of the friends always tells the truth then who went to Ooty?
(A) Divya
(B) Bhanu
(C) Ravi
(D) Cannot be determined

Solution for question 6.05:

6.05: (i) Let us assume that Divya is truth-teller.

Name	Statement 1	Statement 2	Place
Divya	T	T	
Bhanu	F	T	
Ravi	F	T	Goa

It we take Ravi as a truth-teller, then we won't have two truth tellers.

Therefore, Divya went to Ooty.

(ii) If Bhanu is a truth-teller.

Name	Statement 1	Statement 2	Place
Divva	F	F	Ootv
Bhanu	T	T	Shimla
Ravi	T	T	Goa

6.06: In the Dhola award ceremony, Salman, Abhishek and Shah Rukh were nominated for the awards-- Hero No. 1 and Zero No. 1. The awards were given to two persons. When the reporters asked them about the awards, each of them made two statements as follows. It is known that one among them always speaks truth, one always lies and the other one alternates between truth and lie in any order.

Salman: I did not get any award.
Shah Rukh got the Hero No. 1 award

Abhishek: I got the Hero No. 1 award
Shah Rukh got the Zero No.1 award

Shah Rukh: I got the Hero No. 1 award
Salman got the Zero No. 1 award

If at least one of the statements made by Abhishek is a lie, then who got the Hero No. 1 award?

(1) Salman
(2) Abhishek
(3) Shah Rukh
(4) Cannot be determined

Solution for question 6.06: Assuming both the statements of Salman as true, we get

Name	I	II	Award
Salman	T	T	-
Abhishek	F	F	Zero No. 1
Shah Rukh	I	F	Hero No. 1

Here Shah Rukh got the Hero No 1. award.

Assuming both the statement of Shah Rukh as true, we get,

Name	I	II	Award
Salman	F	T	Zero No. 1
Abhishek	F	F	–
Shah Rukh	T	T	Hero No. 1

In this case also Shah Rukh got the Hero No.1 award.

Directions for questions 6.07 to 6.08: These questions are based on the following information.

I met four students A, B, C and D. They have four different nick names among, Kaka, Mama, Baba and Lala. Each of them is from a different class among 1 through 4, not necessarily in the same order. When I asked them about their nick, name and the respective classes, each of them made three statements and no two of them made the same number of true statements. The statements made by them are as follows.

A: Baba is in class 2.
Kaka is in class 1.
Mama is in class 3.

B: My nick name is Mama.
I am in class 2.
Baba is in class 1.

C: My nick name is Lala.
I am in class 4.
Mama is in class 3.

D: My nick name is Lala.
I am in class 3.
Kaka is in class 1.

All the statements made by C are true and the second statement of either B or D is true but not both. Answer the following questions.

6.07: Whose nick name is Baba?
(1) A (2) D
(3) B (4) C

6.08: Who is in class 2?
(1) A (2) B
(3) D | (4) C

Solution for question 6.06: As none of them made the same number of true statements, one of them made three true statements, one made two true statements, one made one true statement and other one made no true statement.

It is given that all the statements of C are true. We get, C's name as Lala and he is in class 4.

Also Mama is in class 3.

$\therefore$ The third statement of A is also true.

So Kaka and Baba are in class one and two (in any order).

Therefore Third statement made by B or D is lie. Let us assume that the third statements of B is a lie. So , the third statement of D will be true, i.e. Kaka is in class 1. Then the first two statements of A become true which violates the conditions.

∴ The third statement of B is true. So, the third statement of D is a lie. One among A, B, C and D has made all false statements. As A, B and C has made at least one true statement all the statements made by D are false.

∴ D's nick name is not Lala and D is not in class 3. Kaka is not in class 1.

As D's second statement is false, B's second statement must be true. Hence B is in class 2 and his nick name is Kaka. Also the nick name of A is Mama and he is in class 3.

D's name is Baba, and he is in class 1.

	I	II	II	Class	Name
A	F	F	T	3	Mama
B	F	T	T	2	Kaka
C	T	T	T	4	Lala
D	F	F	F	1	Baba

6.07: D's nick name is Baba

6.08: B is in class 2.

Exercise-1

Directions for questions 1 to 8: Select the correct alternative from the given choices.

1. Amit, Ashok and Azad made one statement each.
The following are the statements made by them:
Amit: I am a liar.
Ashok: I am not a truth-teller.
Azad: I neither always make true statements nor always make false statements.
It is known that a truth-teller is one who always speaks the truth, while a liar is one who always lies (or makes false statements) and an alternator is one who alternates between a truth and a lie.
Whose statement is definitely true?
I. Amit's
II. Ashok's
III. Azad's
(A) Only I
(B) Only II
(C) Only III
(D) Only II and III

2. On 'Kya-Kya' island, there are two tribes, they are truth-tellers and liars. Truth-tellers always speak the truth and liars always lie. One day I met three Kya-Kya islanders A, B and C, and asked them 'Who among you is the truth-teller?' Following were their replies.
A : I am not a liar.
B : C is not a liar.
C : B is a truth-teller.
If it was known that exactly one person among the three was a truth-teller and the other two were liars, then who among them must be the truth-teller?
(A) A (B) B
(C) C (D) Cannot be determined

3. One day I met three people, named Anand, Bharat and Chandu each of whom belonged to a different tribe amongst truth-tellers, liars and alternators. When asked to introduce themselves, each of them gave two replies, as given below. Also, it is known that the truth-tellers always speak truth, the liars always lie and the alternators alternate between truth and lie, in any order.
Anand: I am the truth-teller. Bharat is the liar.
Bharat: I am not the liar. Chandu is the truth-teller.
Chandu: I am not the liar. Anand is not the truth- teller.
Who among these three people is the alternator?
(A) Anand (B) Bharat
(C) Chandu (D) Cannot be determined

4. A group of three players, namely Aalu, Kachaalu and Bhalu were playing poker and suddenly started to quarrel among themselves by blaming each other for cheating. It was found out that at least one person among the three cheated. When they were asked who cheated, their replies were as follows:
Aalu: I did not cheat.
Kachaalu cheated.
Kachaalu: I did not cheat.
Both Aalu and Bhalu cheated.
Bhalu: I did not cheat.
Only Kachaalu did not cheat.
If exactly one person among them always spoke truth, another always lied and the third alternated between the truth and lie, then which of the following statements can never be true in any case?
(A) Only Aalu and Bhalu cheated.
(B) Only Aalu and Bhalu did not cheat.
(C) Bhalu always spoke the truth.
(D) Bhalu alternated between truth and lie.

5. Sameer, Sameep and Sumer participated in a quiz contest and each one of them received exactly one title among the three titles, such as the winner, the 1st runner-up and the 2nd runner-up. When asked, 'Who among you three is the winner?', following were their replies:
Sameer: I am the winner.
Sameep is not the 1st Runner-up.
Sameep: I am the winner.
Sameer is the 2nd runner up.
Sumer: I am the winner.
Sameep is the 2nd runner-up.
It is also known that one among them always tells the truth, one always lies and one alternates between the truth and lie (not necessarily in that order).
Who can never be the 1st runner-up?
(A) Sameer (B) Sameep
(C) Sumer (D) Cannot be determined

6. Each person out of A, B and C had exactly one different title amongst the Good, the Bad and the Ugly. Also, each person always gave two answers to any question. Exactly one among them always spoke the truth, another always lied and the last person always alternates between truth and lie (in any order). When asked about their titles, following were their replies:
A: B is 'the Good'.
I am 'the Ugly'.
B: C is 'the Bad'
A is not 'the Good'.
C : B is 'the Ugly'.
A is not 'the Bad'.

Which among the following choices has the names of the persons who had the title the Good, the Bad and the Ugly, respectively?

(A) A, B, C (B) C, A, B
(C) B, C, A (D) A, C, B

7. John, Johny and Janardan participated in a race and each won a different medal among Gold, Silver and Bronze, not necessarily in that order. Each person among them gives two replies to any question, one of which is true and the other is false (in any order). When asked about the details of the medals obtained by them, the following were their replies:

John: I won the Gold medal.
Johny won the Bronze medal
Johny: John won the Silver medal.
I won the Gold medal.
Janardan: Johny won the Silver medal.
I won the Gold medal.

Which among the following is the correct order of the people who won the Gold medal, the Silver medal and the Bronze medal, respectively?

(A) John, Johny, Janardan
(B) Janardan, John, Johny
(C) Johny, Janardan, John
(D) Janardan, Johny, John

8. The inspector of police, Chulbul Pandey is questioning five suspects, namely Sheroo, Santhosh, Bhayankar, Chola, and Bhala about a bank robbery. They made the following statements.

Sheroo: Bhayankar robbed the bank.
Santhosh: Sheroo did not rob the bank.
Bhayankar: Santhosh is telling the truth.
Chola: Sheroo is telling the truth.
Bhala: Exactly one of us is telling the truth.

Chulbul Pandey just received evidence that Bhala is telling the truth. Then which of these statement is true?

(A) Sheroo robbed the bank.
(B) Bhayankar is telling the truth.
(C) Both Santhosh and Chola robbed the bank.
(D) Sheroo did not rob the bank.

Directions for questions 9 to 11: These questions are based on the following information.

Truth-teller: A person who always speaks the truth.
Liar: A person who always lies.
Alternator: A person who alternates between truth and lie, in any order.

9. Who among the above three kinds of person can make the following statement – 'I am not an alternator'?

(A) A truth-teller
(B) A liar
(C) An alternator
(D) Cannot be determined

10. Who among the above three kinds of person can make the following statement – 'I am not a truth-teller?'

(A) A truth-teller
(B) A truth-teller or a liar
(C) A liar or an alternator
(D) An alternator

11. Who among the above three kinds of persons can make the following statement – 'I am a truth-teller?'

I. A truth-teller
II. A liar
III. An alternator

(A) Only I
(B) Only I and III
(C) Only II and III
(D) Any one of I, II, III

Directions for questions 12 to 14: These questions are based on the following information.

A group of three people, namely Mohit, Nitin and Jayesh gave one statement each. There is one person who speaks the truth, one who tells lies and another whose statement cannot be classified as either true or false. Following are the statements made by them:

Mohit: I am not a liar.
Jayesh: I am a Liar.
Nitin: I neither speak the truth nor do I lie.

12. What is the name of the person whose statement can be classified as neither true nor as false?

(A) Mohit (B) Jayesh
(C) Nitin (D) Cannot be determined

13. Who tells lies?

(A) Jayesh (B) Mohit
(C) Nitin D) Cannot be determined

14. What is the nature of the statement given by Mohit?

(A) True
(B) False
(C) Cannot be classified as true or false
(D) Cannot be determined

Directions for questions 15 to 17: These questions are based on the following information.

There are four people, namely A, B, C and D each of whom plays exactly one game from a variety of sports, like Cricket, Football, Table-Tennis and Tennis. No game is played by two people. Each person gives two replies to any question asked to them. At least one person among them always speaks the truth and at least one person always tells lies. There is at least one person who always alternates between the truth and lie in any order.

When asked about the names of the people and the respective games played by them, following were their replies:

A: I play Cricket. C plays Cricket.
B: I play Tennis. D plays Tennis.

C: A plays Table-Tennis. B plays Cricket.
D: C plays Football. I play Table-Tennis.

It is also known that D plays Tennis and a definite arrangement can be obtained from the statements given by each person.

15. Who among the following plays Cricket?
(A) A (B) B
(C) C (D) D

16. Who among the following always speaks the truth?
(A) A (B) B
(C) C (D) D

17. Who are the two people who always alternate between the truth and lie?
(A) A and D (B) B and C
(C) D and B (D) A and C

Directions for questions 18 to 20: These questions are based on the following information.

In a country, there are three categories of people, such as truth-tellers, liars and alternators. Praveen met three people Honey, Bunny, and Cherry from that country. Each of the three people belongs to a different category. When asked about the details of the cites in the country, each of them made two statements.

Honey: City X is 30 km to the north of city Y. I am a liar.
Bunny: City W is 50 km away to the west of city Z. City M is 50 km away to the south of city W.
Cherry: City Y is not to the west of city Z. Honey is a truth-teller.

18. In which direction is city X with respect to city M?
(A) North-east (B) North-west
(C) North (D) Cannot be determined

19. If the distance between city Y and city Z is 10 km, then how far is city W from city X?
(A) 40 km (B) 50 km
(C) $30\sqrt{5}$ km (D) $40\sqrt{5}$ km

20. Who among them is a truth-teller?
(A) Honey (B) Bunny
(C) Cherry (D) Either (B) or (C)

Directions for questions 21 to 24: These questions are based on the following information.

Mahesh met four siblings of a family. When he asked them about their ages, their replies were as follows.

Tablo: I am the oldest.
I am older than Hablo.
Gablo: Pablo is not the oldest.
My age is less than 20 years.
Hablo: Tablo is the youngest.
The age of each one of us is a perfect square.
Pablo: Hablo is the second oldest.

The difference between the ages of any two consecutive siblings is not more than 10 years.

Mahesh also knew that no two among them has the same age and that Pablo is younger than Gablo. Each of them made one true statement and one false statement.

21. Who is the oldest?
(A) Tablo (B) Gablo
(C) Hablo (D) Cannot be determined

22. What is the age of the third oldest?
(A) 4 (B) 15
(C) 9 (D) 20

23. If Pablo is 16 years old, then what is the age of Tablo?
(A) 25 (B) 15
(C) 4 (D) 9

24. Who is the youngest?
(A) Tablo (C) Hablo
(B) Pablo (D) Cannot be determined

Directions for questions 25 to 27: These questions are based on the following information.

While travelling in a train, I met four people, each one of them belongs to a different state and they are from Uttar Pradesh (UP), Madhya Pradesh (MP), Tamil Nadu (TN) and Andhra Pradesh (AP). When I asked them about the state to which they belonged, each one of them made two statements. At least one person among them is a truth-teller (who always speaks the truth). At least one person among them is a liar (who always lies). At least one among them is an alternator (who alternates between the truth and lie in any order). Their replies were as follows.

Puneet: I am from AP.
Velu is from UP.
Velu: Navin is from MP.
Rajni is from AP.
Navin: I am from TN.
Puneet is from TN.
Rajni: I am from MP.
Velu is from MP.

It is also known that Puneet is from TN.

25. How many true statements are made by the four together?
(A) 3 (B) 4
(C) 5 (D) 3 or 4

26. The person from MP is a/an
(A) Truth-teller (B) Liar
(C) Alternator (D) Either (A) or (B)

27. Who are the two people who made the same number of true statements?
(A) Rajni and Navin (B) Puneet and Velu
(C) Velu and Rajni (D) Puneet and Navin

Directions for questions 28 to 30: These questions are based on the following information.

There is a group of three people, namely Ramu, Raman and Rajan-hailing from a different city, like Delhi, Mumbai and Chennai. Each person always gives two replies to any question asked. Out of these three, one person always speaks the truth, one always lies and the third one always alternates between truth and lie, in any order. When each was asked 'Which city do you belong to?', the following were their replies:

Ramu: I am from Delhi. Raman is from Mumbai.
Raman: I am from Delhi. Rajan is from Chennai.
Rajan: Ramu is from Mumbai. Raman is from Delhi.
Based on the above, answer the following questions.

28. Who among the three must be from Chennai?
(A) Ramu (B) Raman
(C) Rajan (D) Cannot be determined

29. To which city does Raman belong?
(A) Delhi (B) Mumbai
(C) Chennai (D) Chennai or Delhi

30. If there are exactly two people who always tell the truth, and the third person either always lies or alternates between truth and lie, then which of the following statements must be false?
(A) Rajan is not from Mumbai.
(B) Ramu is not from Delhi.
(C) Rajan is not from Chennai.
(D) Raman is from Delhi.

Directions for questions 31 to 33: These questions are based on the data given below.

To save our solar system from the attacks of the ETs from other galaxies, the representatives of all nine planets gathered at the 'Galaxy Hall' for a meeting. While entering the hall, each alien (representative of each planet) had to show his ID card to Mr. Gurkha, the gatekeeper. But three aliens, namely Eena, Meena and Deeka forgot their ID cards at the hotel. When asked, who represented which planet, the following were their replies.

Eena: Deeka is from Mars. Meena is from Saturn.
Meena: Eena is from Jupiter. Deeka is not from Saturn.
Deeka: Meena is from Saturn. I am from Jupiter.

It was known that exactly one amongst them belonged to the planet Jupiter, another belonged to the planet Saturn and the third belonged to the planet Mars. It was also known that each of them made at least one true statement.

31. Who is from Saturn?
(A) Eena (B) Meena
(C) Deeka (D) Cannot be determined

32. Which planet is Eena from?
(A) Mars (B) Jupiter
(C) Saturn (D) Cannot be determined

33. Which of following statements can never be true?
(A) Each of Eena and Meena always spoke the truth.
(B) Each of Eena and Meena spoke one truth and one lie.
(C) Deeka always spoke the truth.
(D) The first statement given by each person was always false.

Directions for questions 34 to 36: These questions are based on the following information.

I went to a bank, where I met three employees A, B and C of that bank. When I asked them 'Who is the manager?', their replies were as follows.

A : I am the manager.
B is a clerk.
C is a peon.
B : C is the manager.
I am not a peon.
A is a clerk.
C : Exactly one of my statements is false.
A is not a peon.
B makes exactly one false statement.

One among these three employees is a truth-teller. One of them is the manager, one is a clerk and the other is a peon. Each one of them is one among truth-teller, liar and an alternator.

Truth-teller is one who always speaks truth; alternator is a person who alternates between truth and lie and liar is a person who always lies.

34. Who is the truth-teller?
(A) B (B) C
(C) A (D) Cannot be determined

35. What is the designation of C?
(A) Manager (B) Clerk
(C) Peon (D) Cannot be determined

36. Who is a liar?
(A) C (B) A
(C) B (D) None of these

Directions for questions 37 to 40: These questions are based on the following information.

A group of three people, namely Achu, Babo and Chiki went to a stationery shop. Each of the three bought a different item from among Eraser, Pen and Pencil, each of which is of a different colour among Green, Red and Blue. Their friend Disha asked them 'What did you buy from the stationery shop?' Their replies were as follows.

Achu: I did not buy an eraser.
I bought a Red coloured item.
Babo bought a pencil.
Babo: I bought a pen.
Chiki bought a Green coloured item.
Achu bought a pencil.

Chiki: Babo bought an eraser.
I did not buy a pencil.
Achu bought a Green coloured item.

Each one of them is a truth-teller or a liar or an alternator. Truth-teller is one who always speaks truth; alternator is a person, who alternates between truth and lie and liar is a person who always lies. Disha knows that Babo bought a pencil.

37. If Achu is a truth-teller, then which item is in Red?
(A) Pen (B) Pencil
(C) Eraser (D) Cannot be determined

38. If Babo is an alternator, then who bought the Green coloured item?
(A) Achu (B) Babo
(C) Chiki (D) Cannot be determined

39. Which of the following statements is/are true?
(i) Achu is a truth-teller.
(ii) Babo is an alternator.
(iii) Chiki is a liar.
(A) Only (i) (B) (i) and (ii)
(C) (ii) and (iii) (D) None of these

40. If in all six false statements were made, then Chiki bought which coloured item?
(A) Red (B) Blue
(C) Green (D) Green or Blue

Exercise-2

Directions for questions 1 and 2: Select the correct alternative from the given choices.

1. There are three Pundits named Dwivedi, Trivedi and Chaturvedi sitting in a row from left to right in some order, consisting of three seats, such as extreme left, centre and extreme right. Each person gives two replies to any question asked to them, at least one of which is true. There is exactly one person who always speaks the truth. When asked about their respective positions in the row, the following were their replies:

Dwivedi: I sat at the extreme left end.
Trivedi sat at the centre.
Trivedi: Dwivedi sat between me and Chaturvedi.
I sat at the extreme right end.
Chaturvedi: I did not sit at the extreme left end.
Dwivedi did not sit at the extreme right end.

It is also known that a definite arrangement can be obtained by assessing their statements. What is the order in which they sat from the extreme left end to the extreme right end of the row?
(A) Dwivedi, Trivedi, Chaturvedi
(B) Chaturvedi, Trivedi, Dwivedi
(C) Dwivedi, Chaturvedi, Trivedi
(D) Trivedi, Dwivedi, Chaturvedi

2. Which of the following can be inferred from the given information?
I. Dwivedi's two statements are true.
II. Trivedi's second statement is false.
III. Chaturvedi's first statement is false.
(A) Only I
(B) Only I and III
(C) Only II and III
(D) None of the statements can be inferred.

Directions for questions 3 to 5: These questions are based on the following information.

A group of five people, namely Rahul, Ajay, Sandeep, Dhanush and Madhav are sitting in a row facing North. When their friend Charan called them, each of them made a statement about their seating positions.

Rahul: Sandeep is sitting two places away to the right of me.
Sandeep: I am sitting in the middle of the row.
Ajay: Madhav is sitting to the right of Sandeep.
Dhanush: Rahul is sitting two places away to the right of me.
Madhav: I am not at any of the ends.

Charan knows that on any day, exactly one of his five friends lie while others speak truth.

3. Who among them made a false statement?
(A) Rahul (B) Sandeep
(C) Dhanush (D) Cannot be determined

4. Who is sitting at the right end of the row?
(A) Rahul (B) Ajay
(C) Dhanush (D) Cannot be determined

5. Who is sitting in the middle of the row?
(A) Sandeep (B) Rahul
(C) Madhav (D) Cannot be determined

Directions for questions 6 to 9: These questions are based on the following information.

While going on a road, I met three people, namely Mona, Roma and Koma. Each of them belongs to a different profession among Engineer, Doctor and Professor and each of them owns a different car, such as Swift, Indigo and Micra. Each of them made three statements as given below.

Mona: Roma is a Doctor.
I am an Engineer.
Koma owns Micra.
Roma: I am not a Professor.
Mona owns Swift.
Koma does not own Indigo.
Koma: Mona is not a Professor.
I am an Engineer.
Roma does not own Indigo.

Among the three people, one of them is a truth-teller who always speak truth; one is a lair, who always lies and the other person is an alternator, who alternates between truth and lie, in any order.

6. Who owns a Swift?
(A) Mona (B) Roma
(C) Koma (D) Cannot be determined

7. Who is an Engineer?
(A) Mona (B) Roma
(C) Koma (D) Cannot be determined

8. Who is the alternator?
(A) Roma (B) Koma
(C) Mona (D) Either (A) or (B)

9. Who is the liar?
(A) Mona (B) Koma
(C) Roma (D) Either (B) or (C)

Directions for questions 10 to 12: These questions are based on the following information.

A group of four people, namely Chibi, Cakora, Ceasar and Chaila have accounts in a different social networking site. One of their friends asked them, 'Who is on WhatsApp?' Their replies were as follows.

Chibi: I am on WhatsApp.
Chaila is on Facebook.
Ceasar is on Twitter.
Cakora is on Instagram.
Cakora: Chibi is not on Facebook.
Chaila is on Twitter.
I am not on WhatsApp.
Ceasar is on neither Facebook nor Instagram.
Ceasar: I am on either WhatsApp or Facebook.
Chibi is on Twitter.
Chaila is not on WhatsApp.
Cakora is not on Facebook.
Chaila: Cakora is not on Twitter.
I am on WhatsApp.
If Cakora is on Facebook, then only Chibi is on Instagram.
Ceasar is on Facebook.

Among these four people, one of them is a truth-teller who always speaks truth; one is a liar, who always lies; one is an alternator, who alternates between truth and lie and the remaining one is any one of these three (i.e., truth teller, liar and alternator).

10. Who is a truth-teller?
(A) Chibi (B) Cakora
(C) Ceasar (D) Chaila

11. Who is on Twitter?
(A) Chibi (B) Cakora
(C) Ceasar (D) Chaila

12. Liar is on
(A) Instagram (B) WhatsApp
(C) Twitter (D) Facebook

Directions for questions 13 to 17: These questions are based on the following information.

Four people Pavan, Naveen, Madan and Sravan are the top four rankers in each of the subjects, such as Maths, Physics, Chemistry and Commerce, not necessarily in the same order. No person got the same rank in any two subjects. When asked about their ranks in each of these subjects, they made the following statements.

Pavan: Madan is the fourth ranker in Chemistry.
Sravan is the fourth ranker in Physics.
Naveen is the first ranker in Maths.
Naveen: I am the first ranker in Commerce.
Sravan is the first ranker in Chemistry.
Madan is the first ranker in Physics.
Madan : I am the first ranker in Commerce.
Sravan is the fourth ranker in Chemistry.
Pavan is the third ranker in Maths.
Sravan : Pavan is the third ranker in Commerce.
I am the fourth ranker in Maths.
Naveen is the second ranker in Physics.

It is known that, each of them made a true and a false statement alternately and in total, they made equal numbers of true and false statements.

13. Who is the third ranker in Chemistry?
(A) Pavan (B) Naveen
(C) Madan (D) Cannot be determined

14. What is the rank of Sravan in Physics?
(A) 4 (B) 3
(C) 2 (D) Cannot be determined

15. In which subject did Naveen get a better rank than Madan but a worse rank than Pavan?
(A) Maths (B) Commerce
(C) Physics (D) Chemistry

16. What is the rank of Naveen in Commerce?
(A) 2 (B) 3
(C) 4 (D) 1

17. In which subject did Pavan get a worse rank than both Naveen and Sravan?
(A) Maths (B) Physics
(C) Chemistry (D) Commerce

Directions for questions 18 to 22: These questions are based on the following information.

Four boys Abhay, Bharat, Chandu, and David are inhabitants of an island, each studying in a different class among VII, VIII, IX and X, not necessarily in the same order. On that island, each person belongs to one of the categories: Truth-tellers (who always speak the truth), liars (who always lie) and alternators (who alternate between true and false statements, in any order). When asked about their studies and categories, they made the following statements.

Abhay : David is not a truth-teller.
Chandu is not studying in IX.
I am studying in VII.
Bharat: Chandu is not a truth-teller.
Abhay is studying in VIII.
David is not studying in IX.
Chandu: Bharat is studying in VIII.
Bharat is a liar.
Abhay is not studying in X.
David: Abhay is not an alternator.
Bharat is studying in X.
Chandu is not studying in VIII.

18. Who is studying in Class X?
(A) Abhay (B) Bharat
(C) Chandu (D) Cannot be determined

19. Who among them is an alternator?
(A) Only Abhay (B) Only Bharat
(C) Only Chandu (D) Only David

20. How many of Abhay's statements is/are true?
(A) 3 (B) 2
(C) 1 (D) 0

21. In which class did David study?
(A) X (B) IX
(C) VIII (D) VII

22. What is the difference between the total number of true and false statements?
(A) 4 (B) 2
(C) 0 (D) Cannot be determined

Directions for questions 23 to 25: These questions are based on the data given below.

On True Lies island, there are four categories of people namely Trues, who always speak the truth; Liars, who always lie; Altrues, whose first statement is true and make alternate true and false statements and Allies, whose first statement is false and make alternate false and true statements.

A person from True Villa who visited the True Lies island has to make a telephone call to True Villa. He comes across a group of four people, where each member of the group belongs to a different category. He asks them about the availability of telephone with them. Each person has a badge attached to his shirt with the name of a category to which he does not belong. The following are the statements made by each of them. The category on their badges is given in brackets.

A (Trues):
I. Allies have telephones.
II. I have a telephone.
B (Liars):
I. I belong to Trues.
II. I do not have a telephone.
C (Altrues):
I. I do not have a telephone.
II. Only one of us has a telephone.
D (Allies):
I. The Liars have telephones.
II. I belong to Altrues.

In any category, either each member has a telephone or none has a telephone.

23. Who belong to the Trues category?
(A) A (B) B (C) C (D) D

24. Which of the following is true?
(A) B has a telephone.
(B) C has a telephone.
(C) Both B and C have telephones.
(D) Neither B nor C has a telephone.

25. How many categories have a telephone?
(A) 0 (B) 1 (C) 2 (D) 3

Directions for questions 26 to 28: These questions are based on the data given below.

John, James, Jack and Jeromy are compared with each other in terms of height, weight, age and wealth. Each of them gives three statements to any question, such that the three statements given by each person are alternately true and false in any order. The first statement made by exactly two people is false. When asked about the characteristic possessed by each of them, the following were their replies:

John: I am the tallest.
Jack is the heaviest.
James is the richest.
Jack: Jeromy is the shortest.
I am the youngest.
John is the second tallest.
Jeromy: James is the lightest.
Jack is the poorest.
John is the eldest.
James: I am the tallest.
Jack is the lightest.
Jeromy is the second youngest.

It is also known that no person gets the same rank (or position) in any two of the four comparisons and no comparison has two persons having the same rank.

26. Who among the following is the second heaviest?
(A) John (B) Jack
(C) Jeromy (D) James

27. Who is elder, wealthier, heavier, but shorter than James?
I. Jack
II. Jeromy
III. John
(A) Only I (B) Only II
(C) Only III (D) II and III

28. How many people weigh more than James?
(A) Zero (B) One
(C) Two (D) Three

Directions for questions 29 to 31: These questions are based on the following information.

Alex, Bhavna and Charan are standing, not necessarily in that order but in different positions in a queue of 10 people. The numbering in the queue starts with position 1 at the beginning to position 10 at the end of the queue.

When asked about their positions in the queue, they gave the following replies:

Alex: Charan is three places ahead of me.

The number of people behind Bhavna is one more than the number of people ahead of Charan.

If I interchange my position with Charan, I would be in position seven.

Bhavna: I am fourth from the end of the queue.

The sum of the numbers of our positions is a unit multiple of 5.

I am exactly between Alex and Charan.

Charan: All of Alex's statements are false.

If I interchange my position with Alex, I would be in position seven.

Bhavna's first and second statements are true.

It is known that exactly two of the three people alternate between truth and lie in any order and Charan is one of them.

29. What is the position of Bhavna with respect to Alex?
(A) Immediately behind Alex.
(B) Two positions behind Alex.
(C) Three positions ahead of Alex.
(D) Cannot be determined

30. Which of the following statements is true?
I. Alex is in position seven.
II. All the statements of Bhavna are false.
III. Alex alternates between true and false statements in that order.
(A) Only II (B) Only I and II
(C) Only I and III (D) I, II and III

31. Which of the following additional conditions, if true, gives the exact positions of the three people?
(A) Bhavna is not behind Alex.
(B) Bhavna is immediately behind Alex.
(C) Charan is not ahead of Bhavna.
(D) None of the above

Directions for questions 32 to 34: These questions are based on the following information.

P, Q and R when asked a question give three statements as reply in the following manner.

P – always replies in only one type of statements, such as in truth or lie.

Q – never replies in the same type of statements as P.

R – is neither consistent in all his statement types nor alternates between the two types of statements.

At the bus – stop, I asked 'Which bus goes to the airport?' Their replies were as follows:

P: Take the north – bound bus.
The next bus arrives in 15 minutes.
It takes 45 minutes to reach the airport.

Q: The north – bound bus comes from the airport.
You have to wait for 20 minutes for the bus.
It takes 30 minutes to reach the airport.

R: Take the south – bound bus.
You have to wait for another quarter of an hour for the bus.

It takes anywhere between 1 hour to 1 hour 30 minutes to reach the airport.

32. Which of the following represents the reply that R gave?
(A) Truth – Truth – Lie
(B) Lie – Truth – Truth
(C) Lie – Lie –Truth
(D) Truth – Lie – Lie

33. Which of the following is definitely true?
I. P always lies.
II. Q always lies.
III. The north – bound bus goes to the airport.
(A) Only I (B) Only II
(C) Only I and II (D) Only II and III

34. How long does it take before I reach the airport from the bus-stop?
(A) 45 minutes
(B) 50 minutes
(C) Between 1 hour and 1 hour 30 minutes
(D) 30 minutes

Directions for questions 35 to 37: These questions are based on the data given below.

On the eve of Army Day Parade, I met five Army men, namely Ranjeet, Ranmeet, Ranpreet, Randheer and Ranveer each of whom had exactly one different rank from amongst Lieutenant, Captain, Colonel, Major and Brigadier, not nec-

essarily in the same order. Each of these people always gave three replies to any question asked to them. Except one person, all the other four speak at least one true statement. Except one person, all the other four tell at least one lie. Exactly one person among them alternates between the truth and lie, in any order. When I asked them about their respective ranks, following were their replies:

Ranjeet:	Ranmeet is the Brigadier. Ranpreet is the Major. Ranveer is the Colonel.
Ranmeet:	Randheer is the Major. Ranjeet is the Captain. Ranpreet is the Lieutenant.
Ranpreet:	Ranjeet is the Colonel. Randheer is the Brigadier. Ranmeet is the Captain.
Randheer:	Ranveer is the Lieutenant. Ranjeet is the Major. Ranpreet is the Captain.
Ranveer:	Ranmeet is the Colonel. Ranpreet is the Major. I am the Lieutenant.

Only one definite arrangement exists based on their statements, which gives out their ranks.

35. Who among the following always makes one true statement and two false statement but does not alternate between truth and lie?

(A) Ranjeet (B) Ranpreet
(C) Randheer (D) Ranmeet

36. What is the rank of the person who alternates between the truth and lie, in any order?

(A) Brigadier (B) Captain
(C) Major (D) Colonel

37. Match the following:

Army men	Ranks
(i) Ranjeet	(A) Lieutenant
(ii) Ranmeet	(B) Captain
(iii) Ranpreet	(C) Colonel
(iv) Randheer	(D) Major
(v) Ranveer	(E) Brigadier

(A) (i) – (a) (B) (i) – (b)
(ii) – (b) (ii) – (c)
(iii) – (c) (iii) – (e)
(iv) – (d) (iv) – (a)
(v) – (e) (v) – (d)

(C) (i) – (c) (D) (i) – (c)
(ii) – (e) (ii) – (b)
(iii) – (d) (iii) – (d)
(iv) – (b) (iv) – (e)
(v) – (a) (v) – (a)

Directions for questions 38 to 40: There questions are based on the following information.

In a family, there are four members, namely Bingo, Tingo, Mingo and Pingo. Each member of that family belongs to one of the following category, such as truth-tellers (who always speaks truth), liars (who always lies) and the alternators (who alternates among truth and lie, in any order). They made the following statements when they are asked about their professions.

Bingo:	I am a truth-teller. I am the Manager. Tingo is the Chartered Accountant.
Mingo:	I am a truth-teller. I am the Engineer. Professor is an alternator.
Tingo:	I am a truth-teller. I am the Professor. Pingo is the Engineer.
Pingo:	I am an alternator. I am the Professor. Bingo is a liar.

It is also known that their professions are one among Manager, Engineer, Chartered Accountant and Professor (may not be in that order). And no two people are of the same profession.

38. If Tingo is the Manager, then who is the Chartered Accountant?

(A) Bingo
(B) Mingo
(C) Pingo
(D) Either (A) or (B)

39. If there is only one Liar and he is not Bingo, then who is the Engineer?

(A) Pingo
(B) Bingo
(C) Mingo
(D) Cannot be determined

40. From which of the given conditions, we will get a complete idea about them?

I. There are exactly two liars.
II. There are exactly two alternators.
III. There is no truth-teller.

(A) Only I
(B) Only II
(C) Any two of the above three
(D) Only III

Exercise-3

Directions for questions 1 to 3: These questions are based on the information given below.

A group of four friends, namely A, B, C and D sit around a square table not necessarily in the same order. Exactly one person sits on each side and everyone is opposite to exactly one person. Each person makes two statements for any question asked to him. It was known that there is exactly one person who always speaks the truth and exactly one person who alternates between truth and false. When asked about their respective positions around the table, the following were their replies:

A: D sits opposite to me. C sits to the left of D.
B: A sits to my left. D sits to the right of C.
C: B sits to my right. D sits to my left.
D: C sits opposite to me. B sits to my right.

It was also known that a definite arrangement can be obtained by assessing their statements.

1. Who always speaks the truth?
(A) A (B) B
(C) C (D) D

2. Who among them are liars?
(A) A and B (B) C and D
(C) A and D (D) Cannot be determined

3. Who sits opposite to D?
(A) A (B) B
(C) C (D) Cannot be determined

Directions for questions 4 to 6: These questions are based on the information given below.

Among the four members of a family K, L, M and N, there is one couple, their son and their daughter. When asked about their relationships, the following were their replies.

K: N is my husband.
M is my daughter.
L: K is my mother.
M is my son.
M: K and L are of the same gender.
L is my sister.
N: L is of the same gender as I.
M is my son.

It was also known that only one of them always speaks the truth.

4. Among the four, who cannot be the truth-teller?
(A) K (B) L
(C) M (D) Cannot be determined

5. Among them, if there are two people who always tell lies, then who always speaks the truth?
(A) K (B) M
(C) N (D) Cannot be determined

6. Among them, if there are two people who always alternate between the truth and lies, then who speaks the truth always?
(A) K (B) L
(C) M (D) Cannot be determined

Directions for questions 7 to 10: These questions are based on the information given below.

There is a group of four players, namely Abhinav, Bipash, Chandar and Danny, each of them hailing from different cities, like Hyderabad, Mumbai, Delhi and Kolkata. Each of them plays a different game among Chess, Badminton, Tennis and Bridge and they are of different heights. Each of them gives three statements to any question such that the three statements given by each person are alternately true and false in any order. The second statement made by exactly two people is true and Abhinav is one of them. When asked about them, the following were their replies.

Abhinav: Bipash is from Delhi.
Chandar plays Chess.
Danny is not the tallest.
Bipash: Abhinav is from Kolkata.
Chandar is not the shortest.
Danny plays Badminton.
Chandar: Abhinav is the 2nd tallest.
Bipash plays Tennis.
Danny is from Delhi.
Danny: Abhinav plays Chess.
Bipash is from Mumbai.
Chandar is not from Hyderabad.

7. Who is from Delhi?
(A) Abhinav (B) Bipash
(C) Chandar (D) Danny

8. Who is the Chess player?
(A) Abhinav (B) Bipash
(C) Chandar (D) Cannot be determined

9. Who is the shortest person?
(A) The Badminton player.
(B) The Chess player.
(C) The person from Delhi.
(D) The person from Kolkata.

10. Which two persons' second statements are true?
(A) Abhinav, Bipash
(B) Abhinav, Chander
(C) Abhinav, Danny
(D) Cannot be determined

Directions for questions 11 to 15: These questions are based on the following information.

A group of five people, namely Amar, Bharat, Chandu, Dinesh and Eswar are of different heights, weights and ages. It is also known that each of them speaks truth and lie in alternate fashion. Five people are ranked from 1 to 5 according to the decreasing order of their heights, weights and ages. No person is ranked the same in any two parameters. The following are the statements made by four people.

Amar: Bharat is the 3rd tallest.
Dinesh is the 3rd youngest.
Eswar is the lightest.

Bharath: Chandu is the tallest.
Amar is the 3rd oldest.
Eswar is the oldest.

Chandu: Bharath is 2nd youngest.
Bharath is the 2nd tallest.
Amar is the 3rd heaviest.

Dinesh: Eswar is the shortest.
Bharath is 4th lightest.
Amar is the 2nd tallest.

11. Who among them is the tallest?
(A) Chandu (B) Dinesh
(C) Bharath (D) Amar

12. Who among them is the oldest?
(A) Amar (B) Dinesh
(C) Eswar (D) Chandu

13. Who among them is the lightest?
(A) Eswar (B) Dinesh
(C) Bharath (D) Chandu

14. Who among them is the 2nd shortest?
(A) Dinesh (B) Amar
(C) Bharath (D) Eswar

15. Who among them is the 3rd youngest?
(A) Dinesh (B) Eswar
(C) Chandu (D) Bharath

Directions for questions 16 to 19: These questions are based on the following information.

Three people Gretta, Fischer and Schindler are talking about their heights. It is known that each of them is of a different height. Each of them belongs to one of the three categories, truth-tellers (who always speak truth), liars (who always tell lies) and the alternators (who alternately make a true and a false statement). They made the following statements.

Gretta: I am the tallest.
I always speak truth.
Fischer always lies.

Fischer: I am not the tallest.
Gretta is a liar.
Schindler is the shortest.

Schindler: Gretta is a liar.
I am not an alternator.
I am not the shortest.

16. Who is/are truth teller(s)?
(A) Gretta or Fischer (B) Schindler
(C) None of them (D) Cannot be determined

17. Who is the tallest?
(A) Fischer (B) Schindler
(C) Gretta (D) Cannot be determined

18. How many true statements have they together made?
(A) Four (B) Five
(C) Three (D) Three or four

19. Who is/are alternator(s)?
(A) Schindler and Gretta
(B) Fisher and Schindler
(C) Fisher
(D) Schindler

Directions for questions 20 to 23: These questions are based on the following information.

Four very naughty siblings Pringle, Qusac, Robert and Swank are going to meet their father's childhood friend who is meeting them after 30 years. Their father's friend doesn't have any information about these siblings. Each of them wrote the following two statements on a piece of paper. They mentioned only the first letter of their respective names on the paper so that the friend cannot find out the gender by name.

P: I have two sisters and a brother.
S is my brother.

Q: Both the statements of S are false.
R is my brother.

R: One statement of P is true and the other one is false.
I am S's sister.

S: I have two brothers and a sister.
Q is my sister.

It is known that exactly one person among them made two true statements and that person is not R, and exactly one person made both false statements.

20. Who definitely made one true and one false statement?
(A) Pringle (B) Qusac
(C) Robert (D) Swank

21. Who is/are definitely male?
(A) Pringle and Robert
(B) Swank
(C) Swank and Pringle
(D) Robert and Qusac

22. Who made two false statements?
(A) Pringle (B) Qusac
(C) Robert (D) Qusac or Swank

23. Which of the following is true?
(A) Swank's second statement is false.
(B) Robert's second statement is true.
(C) Qusac's first statement is true.
(D) Pringle's second statement is true.

Directions for questions 24 and 25: These questions are based on the following information.

Karuna and Sharmila are studying in the same class. Their teacher came to know that today is the birthday of either Karuna or Sharmila, but not of both.

The teacher asked them whose birthday is it today? They made the following statements.

Karuna: Today it is not my birthday.
Today it is Sharmila's birthday.
Sharmila: Both the statements of Karuna are false.
It is not the birthday of any one of us.

It is known that each of their statements is either true or false.

24. If Sharmila's first statement is false, whose birthday is on that day?
(A) Karuna's
(B) Sharmila's
(C) Both of them
(D) Cannot be determined

25. Which of the following is true?
(A) Karuna did not make even one true statement.
(B) Either both the statements of Karuna are true or both are false.
(C) Sharmila's second statement is definitely true.
(D) Neither Karuna nor Sharmila made two false statements.

ANSWER KEYS

Exercise-1

1. (B)	8. (A)	15. (B)	22. (C)	29. (B)	36. (D)
2. (A)	9. (D)	16. (C)	23. (D)	30. (C)	37. (A)
3. (C)	10. (D)	17. (C)	24. (D)	31. (B)	38. (C)
4. (C)	11. (D)	18. (D)	25. (B)	32. (D)	39. (D)
5. (B)	12. (B)	19. (B)	26. (C)	33. (D)	40. (A)
6. (D)	13. (C)	20. (B)	27. (D)	34. (C)	
7. (B)	14. (A)	21. (B)	28. (C)	35. (C)	

Exercise-2

1. (C)	8. (A)	15. (D)	22. (A)	29. (D)	36. (D)
2. (D)	9. (A)	16. (A)	23. (B)	30. (B)	37. (D)
3. (C)	10. (B)	17. (D)	24. (B)	31. (B)	38. (C)
4. (D)	11. (D)	18. (C)	25. (B)	32. (D)	39. (C)
5. (A)	12. (A)	19. (D)	26. (C)	33. (A)	40. (C)
6. (A)	13. (B)	20. (A)	27. (B)	34. (B)	
7. (C)	14. (C)	21. (B)	28. (C)	35. (C)	

Exercise-3

1. (B)	5. (C)	9. (B)	13. (D)	17. (A)	21. (B)	24. (B)
2. (B)	6. (A)	10. (C)	14. (B)	18. (D)	22. (D)	25. (B)
3. (B)	7. (D)	11. (A)	15. (A)	19. (C)	23. (D)	
4. (B)	8. (C)	12. (C)	16. (D)	20. (C)		

SOLUTIONS

EXERCISE-1

1. Amit makes the statement, 'I am a liar'. If Amit is a truth-teller, he would never call himself a liar. Also, if Amit is a liar, he would never admit that he is a liar. Hence, Amit is an alternator and his statement is False. Ashok's statement 'I am not a truth-teller'. If Ashok is a truth-teller, he would not tell otherwise. If Ashok is a liar, then his statement can imply that his statements is either a lie or cannot be classified as a truth or lie. But a liar would not admit that he is a liar. Hence, Ashok is an alternator and his statement is true. Azad's statement – I neither make a true statement nor makes a false statement. If Azad is a truth –teller, then he would not claim that he does not make true statements.
Hence, Azad could either be a liar or an alternator.
If Azad is a liar, his statement is false and if he is an Alternator, his statement is true. Thus, only Ashok's statement is definitely true.

2. Let us analyse the statements given by A, B and C as below.
A: 'I am not a Liar'.
If A is the truth-teller, then this statement given by him is true, hence, A must be the truth-teller.
B: 'C is not a liar'.
If B is the truth-teller, then C must be a truth-teller. But we cannot have two truth-tellers. Hence, B cannot be a truth-teller. B is a liar.
C: 'B is a truth-teller'.
If C is the truth-teller, then B is also a truth-teller which means there are two truth-tellers. As it is given that exactly one person among them is a truth-teller, hence, C cannot be a truth-teller. C is a liar.
. We find that A is a truth-teller and B and C are liars.

3. Turn by turn, we should assume each person to be the truth-teller and then analyse the arrangement.
(i) Assuming Anand to be the truth-teller: If Anand is the truth-teller, then Bharat must be the liar, which means that C must be the alternator. As Bharat is a liar, both his statements must be false (Bharat's first statement is 'I am not the Liar' which is false as he is a Liar and his 2nd statement that 'Chandu is the truth-teller' is false, because as per Anand, Chandu is the alternator). Hence, Chandu is the alternator, whose first statement is true and second is false.
(ii) Assuming Bharat to be the truth-teller: If both the statements given by Bharat are true, then both Bharat and Chandu must be the truth-tellers, which is not possible – as there is exactly one truth-teller among these three people.
(iii) Assuming that Chandu is the truth-teller: If both the statements given by Chandu are true, then even Bharat becomes the truth-teller, which is not desired.
Hence, Anand is the truth-teller, which means that Chandu must be the alternator.

4. ('✓' means cheated; '"' means did not cheat)
(i) Assuming Aalu always spoke the truth:

	I	II	Cheated
Aalu	T	T	"
Kach	F	F	✓
Bhalu	T	F	"

In this case only Kachalu cheated. Hence, (2) is possible.
(ii) Assuming Kachalu always spoke the truth:

	I	II	Cheated
Aalu	F	F	✓
Kach	T	T	"
Bhalu	F	T	✓

In this case, only Aalu and Bhalu cheated. Hence, (1) can be true.
(ii) Assuming Bhalu always spoke the truth:

	I	II	Cheated
Aalu			
Kach			?
Bhalu	T	T	"

Both the statements made by Bhalu contradict each other. Hence, Bhalu can never be the person who always spoke the truth.

5. (T ➔ True; F ➔ False)
(i) Assuming that Sameer is the truth-teller: we get the following arrangement:

	Statement I	Statement II		
Sameer	T	T	Truth-teller	Winner
Sameep	F	F	Liar	2nd runner-up
Sumer	F	T	Alt.	1st runner-up

(ii) Assuming Sameep is the truth-teller, we get the following arrangement:

	Statement I	Statement II	
Sameer	F	T	2nd runner-up
Sameep	T	T	Winner
Sumer	F	F	1st runner-up

(iii) Assuming Sumer is the truth-teller, we get the following arrangement:

	Statement I	Statement II		
Sameer	F	T	Alternator	1st runner-up
Sameep	F	F	Liar	2nd runner-up
Sumer	T	T	Truth-teller	Winner

Hence, either Sameer or Sumer can be the 1st runner-up, but not Sameep.

6. If A always speaks the truth, then B is 'the Good', A is 'the Ugly'. Hence, C is 'the Bad'; which also means that B is also the truth-teller. Hence, neither A nor B is the truth-teller. Therefore, C must be the truth-teller, which gives us the following arrangement.
A ➔ the Good
C ➔ the Bad
B ➔ the Ugly

7. Each among John, Johny and Janardan is an alternator. Let John's first statement be true and second be false.

	I	II	Medal
John	T	F	Gold
Johny	F	F	Silver
Janardan	T	F	Bronze

Hence, Johny is not an alternator, which means our initial assumption was false.
Let John's first statement be false and second be true:

	I	II	Medal
John	F	T	Silver
Johny	T	F	Bronze
Janardan	F	T	Gold

Hence, Janardan ➔ Gold medal
John ➔ Silver medal
Johny ➔ Bronze medal

8. Since Bhala is telling the truth, there is exactly one among the five who is telling the truth and it has to be Bhala. The rest of them are lying.
We have the following:

Suspect	Statement	Implication
Sheroo	F	Bhayankar did not rob the bank.
Santhosh	F	Sheroo robbed the bank.
Bhayankar	F	Santhosh is lying Sheroo robbed the bank.
Chola	F	Bhayankar did not rob the bank.
Bhala	T	

Hence, it can be inferred by Chulbul Pandey that Sheroo robbed the bank.

9. 'I am not an alternator' could be the statement of a truth-teller. Can it be a statement of a liar? If so, the statement for a liar this statement would be correct / true, which a liar would not make. Hence, it cannot be the statement of a liar. It can surely be that of an alternator when that particular statement is false and either his /her prior or later statement is true. Thus, both (A) and (C) are possible.

10. Refer to the explanation given for Ashok's statement in question 1.
Here, the person is an alternator.

11. 'I am a truth-teller' can be the statement of
– a truth-teller since he never lies.
(or)
– a liar since he always lies
(or)
– an alternator since he alternates in this fashion: Truth, Lie, Truth, Lie… (or) Lie, Truth, Lie, Truth etc.
Hence, any one of I, II, III is possible.

Solutions for questions 12 to 14: The statement given by Jayesh is 'I am a Liar'. If Jayesh always speaks the truth, he will not call himself a liar. Similarly, if Jayesh is a liar, then he will not speak the truth by admitting that he is a liar. Hence, Jayesh is the person whose statement is neither true nor false. Then, Nitin's statement must be false, as only one person whose statement cannot be classified as true and false and that is Jayesh. Hence, Mohit always speaks the truth. Therefore,
Mohit ➔ Always speaks the truth.
Jayesh ➔ Neither speaks the truth nor tells lies.
Nitin ➔ Always tells lies.

12. Jayesh is the one whose statement cannot be classified as either true or false.

13. Nitin always tells lies.

14. Mohit always tells the truth.

Solutions for questions 15 to 17: It is known that D plays Tennis, which means that the 2nd statement made by B must be true, whereas the 2nd statement made by D must be false. As A says that he and C both play cricket, A cannot be the person who always speaks the truth, as each person plays exactly one game and exactly one game is played by each person. This means only C can always speak the truth, as there must be at least one person who always speaks the truth.

We take this as the basis and get the arrangement as given below:

	I	II	Game played
A	F	F	Table-tennis
B	F	T	Cricket
C	T	T	Football
D	T	F	Tennis

15. B plays Cricket.

16. C always speaks the truth.

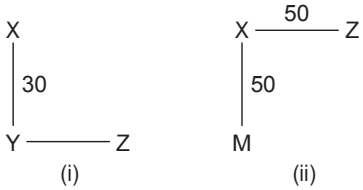
17. D and B alternate between truth and lie.

Solutions for questions 18 to 20: From, the second statement made by Honey, it can be said that Honey is an alternator and the second statement must be false and first statement must be true.

Now, from the second statement made by Cherry, it can be said that Cherry is a liar. So, Bunny is a truth-teller.

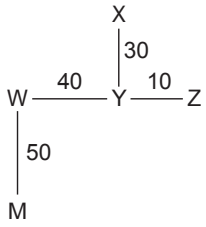
	I	II
Honey	T	F
Bunny	T	T
Cherry	F	F

. The representation of cites is as follow.



18. City X can be in North-east, North-west or North with respect to city M.

19. Under the condition, the representation of cites is as follows.



. The distance between X and W is $\sqrt{30^2 + 40^2}$ = 50 km.

20. Bunny is a truth-teller.

Solutions for questions 21 to 24: First let us assume that the first statement of Tablo is true, then the second statement must be false. But in this case the second statement also becomes true, as Tablo is the oldest.

So, the first statement of Tablo is false and the second statement is true.

Therefore, Tablo is not the oldest and Tablo will be either the second or the third oldest.

So, the first statement of Hablo, i.e., Tablo is the youngest is false.

. The second statement of Hablo, i.e., the age of each one among them is a perfect square is true.

As Tablo is older than Hablo, Hablo will be either the third or the fourth oldest.

The first statement of Pablo, i.e., Hablo is the second oldest is false.

. The second statement of Pablo, i.e., the difference between the ages of any two consecutive siblings is not more than 10 years is true.

Their ages can be among 1, 4, 9, 16 and 25.

It is given that Pablo is younger than Gablo.

The first statement of Gablo is true, i.e., Pablo is not the oldest.

That means, his second statement is false, i.e., Gablo's age is not less than 20 years.

. Gablo's age is 25 years.

The age of the second and the third oldest are 16 and 9 years, respectively.

The youngest child can be either one or four years old.

The above discussion is represented in the following table.

	I Statement	II Statement	Remarks	
Tablo	F	T	Not the oldest	Second or third oldest
Gablo	T	F	Oldest	Age 25 years
Hablo	F	T	Not the oldest or the second oldest	Third or the fourth oldest
Pablo	F	T	Not the oldest	Second, third or fourth oldest

21. Gablo is the oldest.

22. The third oldest is 9 years old.

23. Given, Pablo is 16 years old.
Hence, he is the second oldest.
In this case, Tablo has to be the third oldest.
∴ Tablo is 9 years old.

24. The youngest is either Pablo or Hablo.

Solutions for questions 25 to 27: Given that Puneet is from TN.

∴ The first statement of Puneet, i.e., Puneet is from AP is false.

The first statement of Navin is false and the second statement of Navin is true.

It is also given that there should be at least one person whose both statements are true.

That person cannot be Rajini as both the statements of Rajni cannot be true simultaneously.

∴ Velu's both the statements are true.
Navin is from MP.
Rajini is from AP.
Velu is from UP.
∴ Puneet's second statement is true.
Thus, both the statements of Rajni are false.
The final table is as follows:

Name	Place	1st Statement	2nd Statement
Puneet	TN	F	T
Velu	UP	T	T
Navin	MP	F	T
Rajni	AP	F	F

25. There are four true statements.

26. The person from MP is an alternator.

27. Puneet and Navin made same numbers of true statements.

Solutions for questions 28 to 30:

(i) Assuming Ramu always speaks the truth:

	I	II	City
Ramu	T	T	Delhi
Raman	F	T	Mumbai
Rajan	F	F	Chennai

This arrangement works out for answering the first two questions.

(ii) Assuming Raman always speaks the truth:

	I	II	City
Ramu	F	F	Mumbai
Raman	T	T	Delhi
Rajan	T	T	Chennai

(iii) Assuming Rajan always speaks the truth:

	I	II	City
Ramu	F	F	Mumbai
Raman	T	T	Delhi
Rajan	T	T	Chennai

Arrangement (ii) and (iii) help in answering the third question.

28. Rajan is from Chennai.

29. Raman belongs to Mumbai.

30. Rajan is not from Chennai is false.

Solutions for questions 31 to 33: Let us analyse the cases one by one for the person who always speaks the truth.

(T ➔ Truth; F ➔ False)

(i) Eena always speaks the truth:

	I	II	Planet
Eena	T	T	Jupiter
Meena	T	T	Saturn
Deeka	T	F	Mars

(ii) Deeka always speaks the truth:

	I	II	Planet
Eena	F	T	Mars
Meena	F	T	Saturn
Deeka	T	T	Jupiter

In the above two cases, Eena and Meena always speak the truth in case (i) and Deeka always speaks the truth in case (ii).

31. In either of the cases (i) or (ii), Meena is from Saturn.

32. In case (i), Eena is from Jupiter and in case (ii), Eena is from Mars. Hence, it cannot be determined.

33. (1) is true in case (i)
(2) is true in case (ii)
(3) is true in case (ii)
(4) is true in neither (i) nor (ii).

Solutions for questions 34 to 36: Let us assume, A is truth-teller, then

	Statements			
	I	II	III	Designation
A	T	T	T	Manager
B	F	T	F	Clerk
C	F	T	F	Peon

Let us assume, B is a truth-teller. Then, B's third statement is contradicting. Hence, B is not a truth-teller.
Let us assume, C is a truth-teller then C's first statement is contradicting. Hence, C is not a truth-teller.

34. A is the truth-teller.

35. C is a peon.

36. None of these

Solutions for questions 37 to 40: Achu's third statement is true since Babo bought a pencil. Hence, Babo's first and third statement and Chiki's first statement are false. Chiki's second statement is true. Hence, Chiki's third statement should be false. Now, Babo's second statement is either true or false and Achu's first statement should be true since Achu is either a truth-teller or an alternator. Hence, the possible cases are as follows.

(i)

	Statements				
Name	**I**	**II**	**III**	**Item**	**Colour**
Achu	T	T/F	T	Pen	Red/Blue
Chiki	F	T	F	Eraser	Green

	Statements				
Name	**I**	**II**	**III**	**Item**	**Colour**
Babo	F	T	F	Pencil	Blue/Red
Chiki	F	T	F	Eraser	Green

(ii)

	Statements				
Names	**I**	**II**	**III**	**Item**	**Colour**
Achu	T	T/F	T	Pen	Red/Blue
Babo	F	F	F	Pencil	Green
Chiki	F	T	F	Eraser	Blue/Red

37. If Achu is a truth-teller, then the Pen is in Red colour.

38. If Babo is an alternator, then Chiki bought Green coloured item.

39. None of the statements is true.

40. If a total of six false statements are made, then Achu should be an alternator, Babo should be a liar. Hence, Chiki bought a Red coloured item.

EXERCISE-2

Solutions for questions 1 and 2:

1. Let Dwivedi be the truth-teller:

	I	II	Position
Dwivedi	T	T	Extreme left
Trivedi	F	F	Centre
Chaturvedi	T	T	Extreme right

In this case, we get two truth-tellers (Dwivedi and Chaturvedi) and one liar (Trivedi) which violates the given conditions.
Let Trivedi be the truth-teller:

	I	II	Position
Dwivedi	F	F	Centre
Trivedi	T	T	Extreme right
Chaturvedi	F	T	Extreme left

Hence, Dwivedi's both statements are false, which is against the conditions given. Hence, Chaturvedi must be the truth-teller, in which case we get the following arrangements.

Case (i):

	I	II	Position
Dwivedi	T	F	Extreme left
Trivedi	F	T	Extreme right
Chaturvedi	T	T	Centre

Case (ii):

	I	II	Position
Dwivedi	T	T	Extreme left
Trivedi	F	F	Centre
Chaturvedi	T	T	Extreme right

Case (iii)

	I	II	Position
Dwivedi	F	F	Centre
Trivedi	T	F	Extreme left
Chaturvedi	T	T	Extreme right

In case (ii) and case (iii), both statements of Trivedi and Dwivedi, respectively are false. This is against the given condition.
Hence, the correct order from extreme left to extreme right is Dwivedi, Chaturvedi and Trivedi.

2. Based on the explanation to the previous questions, we have only one possible arrangement:

	I	II	Position
Dwivedi	T	F	Extreme left
Trivedi	F	T	Extreme right
Chaturvedi	T	T	Centre

Hence, none of the statements can be inferred.

Solutions for questions 3 to 5: The statement made by Rahul, Sandeep and Dhanush cannot be true at the same time. If the statement made by Rahul and Dhanush are true, then Rahul will be sitting in the middle of the row and so, the statement made by Sandeep will be false.

And the statements made by Ajay and Madhav are true. If the statements made by Rahul and Dhanush are true, then Sandeep will be at the right end and Sandeep's statement will be false.

Now, the statement made by Ajay must be false, but Ajay's statement is true.

∴ Sandeep's statement must be true and one among Rahul and Ajay must have made a false statement.

Now, from the statements made by Sandeep, Ajay and Madhav, the arrangement of the persons will be as follows.

_____ _____ Sandeep Madhav _____

From the above arrangement the statement made by Dhanush must be false.
∴ The final arrangement will be as follows.

Rahul Dhanush/Ajay Sandeep Madhav Ajay/Dhanush

3. Dhanush made a false statement.

4. Either Ajay or Dhanush is sitting at the right end of the row.

5. Sandeep is sitting in the middle of the row.

Solutions for questions 6 to 9:

Case I: Let Mona be a truth-teller.
Now, Mona is an Engineer, Rama is a Doctor. So, Koma must be a Professor. Koma owns Micra.
Now, the first statement made by Rama must be true. So, Rama must be an alternator. Hence, her second statement must be false and third statement must be true.
∴ Mona owns Indigo and Rama must own Swift.
Koma must be a liar.
But, her third statement is true.
Hence, case I is invalid.

Case II: Let Rama be a truth-teller. Then Mona owns swift, Rama owns Indigo and Koma owns Micra.
Now, Mona's third statement is true and Koma's third statement is false.
So, Mona must be an alternator and Koma must be a liar, which is not possible because if Koma is a liar Mona is a truth teller.
Hence, case II is invalid.

Case III: Let Koma be the truth-teller, then the first two statements made by Mona must be false and so she must be a liar and Roma must be an alternator.

	Professor	Car	Category
Mona	Doctor	Swift	Liar
Roma	Professor	Micra	Alternator
Koma	Engineer	Indigo	Truth-teller

6. Mona owns Swift.

7. Koma is an engineer.

8. Roma is the alternator.

9. Mona is a liar.

Solutions for questions 10 to 12: Let us assume, Chibi is a truth-teller, then Cakora is none among the truth-teller, alternator and liar. Hence, Chibi is not a truth-teller.

Let us assume that Cakora is a truth-teller, then

	Statements				
Name	I	II	III	IV	
Chibi	F	F	F	F	Instagram
Cakora	T	T	T	T	Facebook
Ceasar	T	F	T	F	WhatsApp
Chaila	T	F	T	F	Twitter

Let us assume that Ceasar is a truth-teller, then Cakora is none among the truth-teller, alternator and liar. Hence, Ceasar is not a truth-teller. Let us assume that Chaila is a truth-teller, then Chibi is none among the truth-teller alternator and liar. Hence, Chaila is not a truth-teller.

10. Cakora is the truth-teller.

11. Chaila is on Twitter.

12. The liar is on Instagram.

Solutions for questions 13 to 17: As they made equal number of true and false statements, for two of them, the first statements are true and for the other two, the first statements are false.

Let us assume that Pavan's first statement is false. Therefore, his statements must be false, true, false in that order. Thus his 2nd statement being true, Sravan is the fourth rank-

er in Physics. Now, from Madan's 2nd statement, Sravan being the fourth ranker in Chemistry must be false. Therefore, the remaining 2 statements of Madan must be true. Sravan's 2nd statement, that he is the fourth ranker in Maths must be false, which means Sravan's remaining 2 statements are true. But Sravan's 1st statement and Madan's 3rd statement cannot be true simultaneously. So, our assumption that Pavan's first statement being false was wrong.

So, Pavan's first statement is true. Pavan's statements are true, false and true. Madan is the fourth ranker in Chemistry and Naveen is the first ranker in Maths. Madan's 2nd statement is false, which proves that Madan's other 2 statements are true. Madan's statements are true, false, true. So, Madan is the first ranker in Commerce and Pavan is the third ranker in Maths.

Naveen's first statement as well as Sravan's first statements are false. So, the statements made by Naveen and Sravan must be of the type: False, true and false.

	Maths	Physics	Chemistry	Commerce
Pavan	3	1		
Naveen	1			
Madan			4	1
Sravan	4		1	

From the above table it can be concluded that Madan is the second ranker in Maths and the third ranker in Physics.

In Chemistry, Naveen is the third ranker and Pavan is the second ranker.

In Commerce, Pavan is the fourth ranker, Sravan is the third ranker and Naveen is the second ranker.

∴ In Physics, Naveen is the fourth ranker and Sravan is the second ranker.

	Maths	Physics	Chemistry	Commerce
Pavan	3	1	2	4
Naveen	1	4	3	2
Madan	2	3	4	1
Sravan	4	2	1	3

13. Naveen is the third ranker in Chemistry.

14. Sravan is the second ranker in Physics.

15. Naveen got better rank than Madan only in Chemistry.

16. Naveen got second rank in Commerce.

17. In Commerce, Pavan got worse rank than both Naveen and Sravan.

Solutions for questions 18 to 22: Let the first statement of Abhay be false.

David is a truth-teller.

∴ Bharath is studying in Class X.

Also, Abhay must not be an alternator which implies that Abhay is a liar.

Chandu is studying in Class IX.

As Abhay is studying in Class VII is false, Abhay is studying in Class VIII and David is studying in Class VII.

But the above results are contradicting the first and the third statements of Chandu, the first being true and the third being a lie.

∴ Abhay's first and third statements are true.

Abhay is studying in Class VII.

Chandu's third and first statements are true.

Bharath is studying in Class VIII.

David's third and first statements are true and second statement is false.

∴ David is an alternator.

Abhay is not an alternator.

∴ Abhay is a truth-teller.

Chandu is not studying in Class IX.

Chandu is studying in Class X and David is studying in Class IX.

∴ Bharath's second and third statements are false.

Bharath is a liar.

Chandu's second statement is also true. The final arrangement is as follows.

	I	II	III	Studying
Abhay	T	T	T	VII
Bharath	F	F	F	VIII
Chandu	T	T	T	X
David	T	F	T	IX

18. Chandu is studying in Class X.

19. Only David is an alternator.

20. Abhay made three true statements.

21. David is studying in Class IX.

22. Required difference = 8 – 4 = 4.

Solutions for questions 23 to 25: It is given that no person belongs to the category that is mentioned on his badge.

Consider the second statement made by D. If it is true, then his second statement should be false (which is a contradiction). Therefore, his second statement should be false and he belongs neither to Altures nor to Allies.

He belongs to Liars. Therefore, his first statement should be false. Hence, Liars do not have a telephone.

Consider the first statement of A as false. This implies that Allies do not have a telephone and that A belongs to Allies. Now the second statement cannot be true as it leads to contradiction.

Therefore, A belongs to Altrues (As D belongs to Liars and A does not belong to Trues or Allies) and Allies have telephone.

Now B and C belong to Trues and Allies not necessarily in the same order. Therefore, the second statement of each of B and C should be true. As B does not have telephone, he cannot belong to Allies. Therefore, he belongs to Trues and C belongs to Allies.

	I	II
A	T	F
B	T	T
C	F	T
D	F	F

23. B belongs to Trues.

24. As C belongs to Allies, he has a telephone.

25. Only one category has telephone, i.e., Allies.

Solutions for questions 26 to 28: Here, the only way the arrangement works is by assuming that the three statements given by each of John and Jeromy must be False, True, False.

Then we get the following arrangement.

	I	II	III
John	F	T	F
Jack	T	F	T
Jeromy	F	T	F
James	T	F	T

As each pattern is followed by exactly two people, the statements given by Jack and James must be in the order of True, False and True.

Then, the final arrangement as per the individual rankings is as given below:

	Height	Weight	Age	Wealth
John	2	4	1	3
Jack	3	1	2	4
Jeromy	4	2	3	1
James	1	3	4	2

Hence, the questions can be answered based on the above table.

26. Jeromy is the second heaviest.

27. Jeromy is the desired person.

28. James is the third heaviest, which means there are two people who weigh more than James.

Solutions for questions 29 to 31: It can be clearly inferred that Bhavna's second statement cannot be true because sum of three different numbers starting with 1 cannot be a unit multiple of 5. It is possible only when two numbers are equal – 1 + 1 + 3 or 1 + 2 + 2 – which is a violation that all the three people are in different positions.

We have the following about Bhavna's statements and the impact on Charan's statements:

	I	II	III
Alex			
Bhavna		F	
Charan	F	T	F

This is because Charan alternates between truth and lie statements in any order.

Now, Charan's IInd statement (True) Alex is currently is position seven.

So, Alex's IIIrd statement would become false because Alex is already in position seven, implying he would not be in position seven after interchanging position with Charan.

This also implies that Bhavna's Ist statement is false since the fourth position from the end of the queue would be the seventh position from the beginning and Alex is already in position 7.

So, we have the following:

	I	II	III	Positions
Alex			F	7
Bhavna	F	F		
Charan	F	T	f	

Now, Bhavna cannot alternate between true and lie statements. So, Alex must be the second person to alternate between true and lie statements.

So, the final arrangement is as follows.

	I	II	III	Positions
Alex	F	T	F	7
Bhavna	F	F	F	?
Charan	F	T	F	?

The positions of Bhavna and Charan cannot be uniquely determined as illustrated below.

Position	(i)	(ii)	(iii)	(iv)	(v)
1				B	C
2	C		B		
3					
4		B			
5					

Position	(i)	(ii)	(iii)	(iv)	(v)
6		C			
7	A	A	A	A	
8	B		C		
9				C	B
10					

29. The position of Bhavana with respect to Alex cannot be uniquely determined.

30. I – Is true.
II – Is true.
III – Is false since Alex alternates in the order as false, true, false.

31. Choice (B) gives us a unique arrangement as shown earlier in case (i).

Solutions for questions 32 to 34: If P always speaks the truth, then Q always lies R.

If P always lies R, then Q always speaks the truth.

In either case, R cannot be speaking all truths or all lies.

R cannot alternate between truth and lies either.

So, we have the following:

Case (i)

	I	II	III
P	T	T	T
Q	F	F	F
R	F	T	f

Case (ii)

	I	II	III
P	F	F	F
Q	T	T	T
R	T	F	LF

In case (i), R becomes an alternator which violates the given condition.

Hence, case (ii) in the correct arrangement and the south – bound bus goes to the airport.

32. R replies in the manner: Truth – lie – lie

33. Only statement I is true.

34. (20 minutes to wait for the bus) + (30 minutes of travel time) = 50 minutes to reach the airport.

Solutions for questions 35 to 37: Let us rename the five army personnel as below:

Ranveer ➔ Veer
Ranjeet ➔ Jeet
Randheer ➔ Dheer
Ranmeet ➔ Meet
Ranpreet ➔ Preet

It is known that except one person (who must be a Liar whose all 3 statements are all false) each of the other four spoke at least one true statement. Also, except one person (who must be the truth-teller whose all 3 statements must be true) each of the other four tells at least one lie, i.e., one false statement.

Also, exactly one person always alternated between the truth and lie (an alternator) in any order – (True False True) or (False True False).

This means that there must be two people, each of whom speaks at least one true and at least one false statement, but none of them is an alternator. Let us assume each person to be a truth-teller and find a definite arrangement.

Let Ranjeet be the truth-teller.

	I	II	III	Ranks
Jeet	T	T	T	Lieut./Capt.
Meet	F	?	F	Brigadier
Preet	F	F	F	Major
Dheer	F	F	F	Capt./Lieut.
Veer	F	T	F	Colonel

In this arrangement, both Preet and Dheer tell lies (all 3 statements are false), which violates the conditions as there is exactly one liar among them. By similar approach, when we assume that Ranpreet always speaks the truth, then we get the following arrangement.

	I	II	III	Ranks
Jeet	F	?	F	Colonel
Meet	F	F	?	Captain
Preet	T	T	T	Major /Lieut.
Dheer	?	F	F	Brigadier
Veer	F	?	?	Lieut./Major

Now, either Veer or Jeet is the alternator, Veer cannot be the alternator, because if his last statement is false (which means that Veer is not the Lieutenant but he is the Major), then his second statement must be true (i.e., Preet is Major), which is not possible, as exactly one person between Preet and Veer must be the Major.

Hence, Jeet must be the Alternator and his second statement must be true.

Now, we rearrange the above deductions as below.

	I	II	III	Ranks
Jeet	F	T	F	Colonel
Meet	F	F	F	Captain
Preet	T	T	T	Major
Dheer	T	F	F	Brigadier
Veer	F	T	T	Lieutenant

Based on this arrangement (which is the only definite arrangement), we answer the questions as below.

35. First statement given by Randheer is true and the rest are false.

36. Ranjeet, the Colonel, alternates between the truth and lie, in the order lie – truth – lie.

37. From the table, choice (D) gives the correct order.

Solutions for questions 38 to 40: From the given statement it is clear that Pingo cannot be the truth-teller. (As truth-teller cannot say that, I am an alternator).

He can be either an alternator or a liar.

If Pingo is the Professor, then his first statement is contradicting.

Hence, he cannot be the Professor.

If Bingo is a truth-teller, then Tingo's second statement must be false.

Tingo's first statement cannot be true. Therefore, Tingo must be a liar.

Now, Bingo is the Manager, Tingo is the Chartered Accountant (CA) and Pingo is not the Engineer. Therefore, Pingo must be a Professor, which is not possible.

∴ Bingo is not a truth-teller.

If Mingo is the Engineer, we have two possibilities, they are:

Case (A1):

Professor	Name	I	II	III
CA	B	F	F	F
Engineer	M	T	T	T
Professor	T	F	T	F
Manager	P	T	F	T

Case (A2):

Professor	Name	I	II	III
Manager	B	F	T	F
Engineer	M	T	T	T
Professor	T	F	T	F
CA	P	F	F	F

If Tingo is a truth-teller, then we get two possible cases, they are:

Case (B1):

Profession	Name	I	II	III
Manager	B	F	T	F
CA	M	F	F	F
Professor	T	T	T	T
Engineer	P	F	F	F

Case (B2):

Profession	Name	I	II	III
CA	B	F	F	F
Manager	M	F	F	F
Professor	T	T	T	T
Engineer	P	T	F	T

It is also possible that there is no truth-teller, but all of them cannot be liars, there must be at least an alternator (according to the statements of Pingo), i.e., if Pingo is a liar, then Bingo cannot be a liar and vice versa.

If Bingo is an alternator, we have one possibility:

Case (C):

Profession	Name	I	II	III
Manager	B	F	T	F
Professor	M	F	F	F
Engineer	T	F	F	F
CA	P	F	F	F

If only Pingo is an alternator, we have two possibilities:

Case (D1):

Profession	Name	I	II	III
Not Manager	B	F	F	F
Not Engineer	M	F	F	F
Manager/Engineer	T	F	F	F
Manager/CA	P	T	F	T

If Mingo is an alternator, then we get the following:

Case (D2):

Profession	Name	I	II	III
Professor	B	F	F	F
Engineer	M	F	T	F
Manager	T	F	F	F
CA	P	T	F	T

38. In case D2, Tingo is the Manager. Pingo is the Chartered Accountant. In case D1, if Tingo is the Manager, then Pingo will be the Chartered Accountant.

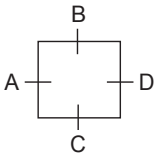
39. Here, Pingo's III statement is false and hence, his first statement is also false. So, Pingo is a liar. As no other is liar, the II statements of all others must be true.
∴ Mingo is the Engineer. This is case A2.

40. If we take any two of the statements, we will get case D2.

EXERCISE-3

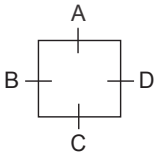
Solutions for questions 1 to 3:

Case (i):
Let us assume that A speaks the truth.
The arrangement is:



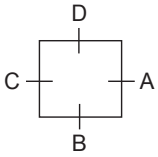
	I	II	
A	T	T	Truth-teller
B	F	T	Alternator
C	F	F	Liar
D	F	T	Alternator

Case (ii):
Let us assume that B is the truth-teller, then the arrangement is:



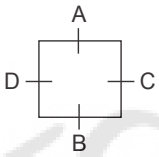
	I	II	
A	F	T	Alternator
B	T	T	Truth-teller
C	F	F	Liar
D	F	F	Liar

Case (iii):
Let us assume that C is the truth-teller, then the arrangement is:



	I	II	
A	F	F	Liar
B	F	F	Liar
C	T	T	Truth-teller
D	F	F	Liar

Case (iv):
Let us assume that D is the truth-teller, then the arrangement is:



	I	II	
A	F	F	Liar
B	F	F	Liar
C	F	F	Liar
D	F	F	Truth-teller

As it was given that there is exactly one person who alternates between the truth and lies, the arrangement in case (ii) is the valid one.

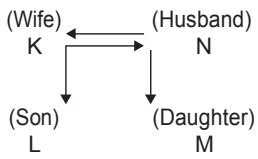
1. B is the truth-teller.

2. C and D are the liars.

3. B sits opposite to D.

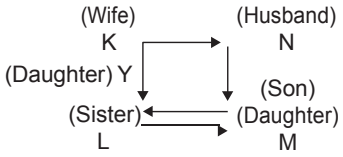
Solutions for questions 4 to 6: Among the four members, there is one couple, their son and their daughter. The statements given by L is definitely false because, according to his statements there are three generations. So, L cannot be the truth-teller.

Case (i):
Let us assume that K is the truth-teller, then



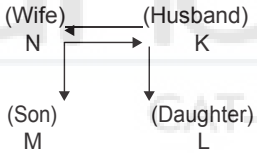
	I	II	
K	T	T	Truth-teller
L	T	F	Alternator
M	F	F	Liar
N	T	F	Alternator

Case (ii):
Let us assume that M is the truth-teller, then the arrangement is as follows.



	I	II	
K	T	F	Alternator
L	T	F	Alternator
M	T	T	Truth-teller
N	F	T	Alternator

Case (iii):
Let us assume that N is the truth-teller.



	I	II	
K	F	F	Liar
L	F	F	Liar
M	F	T	Alternator
N	T	T	Truth-teller

4. L can never be the truth-teller.

5. In case (iii), N is the truth-teller, and K and L are the liars.

6. In case (ii), N and L are the alternators and K is the truth-teller.

Solutions for questions 7 to 10: It is given that each of the four people alternates between truth and lies in any order and that the second statement of exactly two people, one of them being Abhinav is true. This implies that the first and the last statement of each of these two people is false. Hence, from Abhinav's statements, which are in the order of false, true and false, we know the following.

Bipash is not from Delhi.
Chandar plays Chess.
Danny is the tallest.
Now, with the above information, let us check the first statement of each of the other three people.
From the above information, the truth or falsity in the first statement of Bipash and Chandar cannot be found out. But we know that Danny's first statement is false. Hence, the second statement of Danny is true. Since, there are only two people, whose second statement is true, we get the following information.
Abhinav: Bipash is from Delhi - False
Chandar plays Chess – True Chandar – Chess
Danny is not the tallest – False Danny – Tallest
Bipash: Abhinav is from Kolkata – True
Abhinav – Kolkata
Chandar is not the shortest – False
Chandar – Shortest
Danny plays badminton – True
Danny – Badminton
Chandar: Abhinav is the 2nd tallest – True
Abhinav – 2nd tallest
Bipash plays Tennis – False
Bipash does not play Tennis
Danny is from Delhi – True Danny – Delhi
Danny: Abhinav plays Chess – False
Bipash is from Mumbai – True Bipash - Mumbai
Chandar is not from Hyderabad - False
Chandar – Hyderabad
From the above information, we get the following arrangement.

7. Danny is from Delhi.

8. Chandar is the Chess player.

9. The person who plays Chess is the shortest.

10. The second statement made by Abhinav and Danny are true.

Solutions for questions 11 to 15: From the given data:
As Amar and Dinesh belong to same group, their last statements cannot be simultaneously true.
Hence, their 2nd statements must be true.
Similarly, Bharath and Chandu's second statements are false.
The final table of heights and weights is as follows.

	Height	Weight	Age
1st	Chandu	Dinesh	Eswar
2nd	Dinesh	Bharath	Chandu
3rd	Eswar	Amar	Dinesh
4th	Amar	Eswar	Bharath
5th	Bharath	Chandu	Amar

11. Chandu is the tallest.

12. Eswar is the oldest.

13. Chandu is the lightest.

14. Amar is the 2nd shortest.

15. Dinesh is the 3rd youngest.

Solutions for questions 16 to 19: Schindler said 'I am not an alternator'. From this, we can conclude that he is either a truth-teller or an alternator.

Case (i): Schindler is a truth-teller.

Since all the statements of Schindler are true, we can conclude from his statements that (a) Gretta is a liar and (b) he is not the shortest. Considering that Gretta is a liar, we can conclude that Gretta is not the tallest and that Fischer is not a liar. From the facts derived so far, we can conclude that Fischer's second statement is true and the third one is false. Hence, he must be an alternator. Thus, his first statement is false. This implies that Fischer is the tallest.

Since Schindler is not the shortest, he must be the second tallest and Gretta the shortest. Thus, the final arrangement is as follows.

Tallest	Fischer	Alternator
2nd tallest	Schindler	Truth-teller
Shortest	Gretta	Liar

Case (ii): Schindler is an alternator. In this case, his first and the third statements are true and the second one is false. From his statements, we get the same facts as we derived above. As a result, all other information that we have derived will also be the same except that Schindler is an alternator.

Tallest	Fischer	Alternator
2nd tallest	Schindler	Alternator
Shortest	Gretta	Liar

16. Either Schindler is the truth-teller or none of them is a truth-teller.

17. Fischer is the tallest.

18. They together made either three or four true statements.

19. Fischer is definitely an alternator.C)

Solutions for questions 20 to 23:

Case (i): Both the statements of P are true.

Facts from P's statements: S is male, Q and R are females.

Hence, R's first statement is false and the second one is true. S's second statement is true and the first one is false. Now, whether P is male or female, the above deductions hold good.

Thus, in this case, both the statements of Q are false. Each of R and S made one true statement and one false statement.

Case (ii): Both the statements of Q are true.

Facts from Q's statements: R is male and both the statements of S are false.

Facts from S's statements: Q is male and S has three brothers or three sisters or two sisters and a brother.

Hence, for each of P and R, one statement should be true and the other one is false. Clearly, P's first statement is false. Hence, his second statement is true, which implies that S is also male. Now, R's first statement is true and second one is true. Since Q and R are males and the first statement S is false, P should also be male.

Thus, in this case, both the statements of S are false. Each of R and P made one true statement and one false statement. All of P, Q, R and S are male.

Case (iii): Both the statements of S are true.

Facts from S's statements: Q is female and both P and R are males.

In such case, Q's first statement is false and the second one is true. R's second statement is false. Now R's first statement cannot be true, because in such case there will be three people for each of whom one statement is true and the other one is false. Hence, R's second statement must also be false. This means that either both the statements of P are true or both are false. But in both the cases, the given data is violated. Hence, S cannot be the one with both true statements. Thus cases (i) and (ii) are valid.

20. R definitely made one true and one false statement.

21. Swank definitely is male.

22. Either Qusac or Swank made two false statements.

23. Statement (D) is true.

Solutions for questions 24 and 25: It is given that it is the birthday of one of the two. Hence, Sharmila's second statement is false.

Let Sharmila's first statement be true or false.

Case (i): Sharmila's first statement is true.

It implies that Karuna is lying. Hence, it is Karuna's birthday but not Sharmila's.

Case(ii): Sharmila's first statement is false.

It implies that either both the statements of Karuna are true or one of them is true and the other one is false.

If the first statement of Karuna is true and the second one is false, it implies it is not the birthday of any one of them. If the first statement is false and the second one is true, then it is the birthday of both of them. But both the cases violate the given information. Thus, it can be concluded that both the statements of Karuna must be true. Hence, it is the birthday of Sharmila.

24. If Sharmila's first statement is false, it would be Sharmila's birthday.

25. Statement (B) is true.

7 Venn Diagrams

Chapter

Learning Objectives

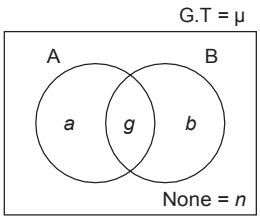
In this chapter, you will:

- Understand the concept of Venn diagrams – the need for representing sets in a graphical manner and properties of a set.
- Understand the use of Venn diagrams to explain the logical relationships between two or more sets.
- Learn how to interpret the statements (such as 'at least', 'at most', 'exactly', 'A or B but not C', 'A and B but not C' etc.) given in the questions and how to assign values to each category of variables within a Venn diagram.
- Gain knowledge of how to deal with Venn diagrams having two, three and four sets.

❒ Introduction

A **Venn Diagram** is a diagrammatical representation of two or more sets/groups, which may/may not have some common elements (like women and athletes – some women may also be athletes), using geometric shapes to represent each set. Venn diagrams illustrate a logical relationship between the sets. In the theory given below we illustrate Venn diagrams with two, three and four sets.

Venn Diagrams Involving two Variables

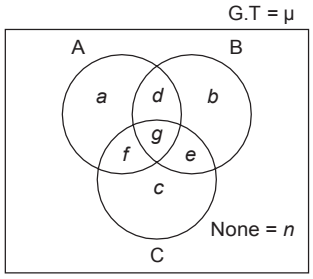


In the above diagram, A and B represent two different sets and the various regions can be referred to as given below.

$A = a + g$; $B = b + g$

Only A = a; Only B = b
Exactly one set = $a + b$
A and B = g; Only A and B = g
Exactly two sets = g
At least one set = Exactly one + Exactly two
$= a + b + g = T$
Grand total (G.T = μ) = $a + b + g + n = T + n$
A + B = $a + b + 2g = T + g$
A or B = $a + b + g = T$
Does not belongs to A = $b + n$
Does not belongs to B = $a + n$

Venn Diagram with three Variables



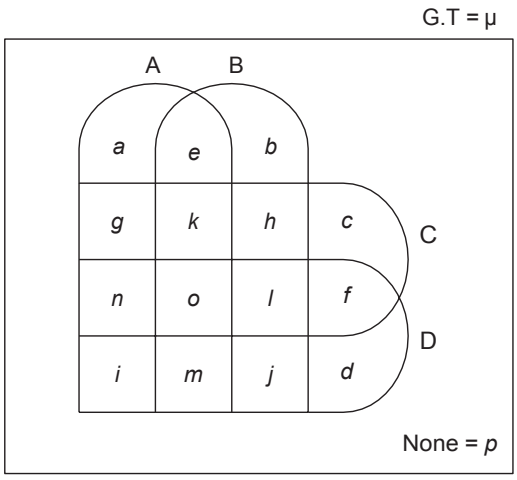
Here A, B and C are three different sets and the various regions can be referred to as given below.

A = a + d + g + f ; Only A = a
B = b + d + g + e ; Only B = b
C = c + f + g + e ; Only C = c
Exactly one set = a + b + c
A and B = d + g; B and also C = e + g; C as well as A = f + g
Only A and B = d ; A and B but not C = d
Only B and C = e ; B and C but not A = e
Only C and A = f ; C and A but not B = f
Exactly two sets = d + e + f
A, B and C = All the three = Only A, B and C = g;
Exactly three sets = g
None among A, B and C = n
At least one set = Exactly one + Exactly two + Exactly three = a + b + c + d + e + f + g = μ − n
At least two sets = Exactly two + Exactly three = d + e + f + g
At least three sets = Exactly three = g
At most one sets = Exactly one + None = a + b + c + n
At most two sets = Exactly two + Exactly one + None = d + e + f + a + b + c + n = μ − g
At most three sets = Exactly three + Exactly two + Exactly one + None = g + d + e + f + a + b + c + n = μ
A + B + C = a + b + c + 2(d + e + f) + 3g
= Exactly one + 2 (Exactly two) + 3 (Exactly three)
= (Exactly one + Exactly two + Exactly three) + Exactly two + 2 (Exactly three)
= At least one + Exactly two + 2 (Exactly three)
= At least one + (Exactly two + Exactly three) + Exactly three
= At least one + At least two + At least three
Does not belong to A = b + e + c + n
A or B or C = a + b + c + d + e + f + g = At least one.
A or B = a + b + d + e + f + g
A or B but not C = a + d + b
Neither A nor B = c + n
(A and B) or C = d + c + f + g + e
A and (B or C) = d + g + f

Venn Diagram Involving Four Variables

Here, A, B, C and D are four different sets and the various regions can be referred to as given below.

A = a + e + g + k + n + o + i + m; Only A = a
B = b + e + h + k + l + o + j + m; Only B = b
C = c + f + h + l + k + o + g + n; Only C = c
D = d + f + j + l + m + o + i + n; Only D = d



Exactly one set = a + b + c + d
A and B = e + k + o + m; Only A and B = e
A and C = g + k + o + n; Only A and C = g
A and D = n + o + i + m; Only A and D = i
B and C = k + h + o + l; Only B and C = h
B and D = m + j + o + l; Only B and D = j
C and D = n + o + l + f ; Only C and D = f
Exactly two sets = e + f + g + h + i + j
A, B and C = k + o ; Only A, B and C = k
B, C and D = l + o; Only B, C and D = l
A, B and D = m + o; Only A, B and D = m
A, C and D = n + o; Only A, C and D = n
Exactly three sets = k + l + m + n
A, B, C and D = All the four = Exactly four set = o;
None among A, B, C and D = p

Note

Note the following for a n-set Venn diagram:

Name of the region (pocket of intersection of the sets)	Number of regions (pockets of intersections of the sets)	For a 5-set situation
Exactly 1, X	${}^nC_1$	5
Exactly 2, Y	${}^nC_2$	10
Exactly 3, Z	${}^nC_3$	10
Exactly 4, A	${}^nC_4$	5
Exactly 5, B	${}^nC_5$	1
None, N	${}^nC_0$	1
Total number of regions	2^n	32

Solved Examples

Directions for questions 7.01 to 7.04: These questions are based on the information given below.

The class teacher has posed two questions A and B to the 160 students of her class. 65 students could not answer question A, 80 students could not answer question B and 40 students answered both the questions.

7.01: How many students could not answer any of the two questions?
(A) 30 (B) 25
(C) 40 (D) 15

7.02: How many students answered only question A?
(A) 95 (B) 60
(C) 50 (D) 55

7.03: How many students could not answer exactly one question?
(A) 130 (B) 55
(C) 95 (D) 11

7.04: The number of students who answered only question B is what percentage of the number of students who answered question B?
(A) 50% (B) 60%
(C) 25% (D) $33\frac{1}{3}$ %

Solution for questions 7.01 to 7.04

Total number of students = 160

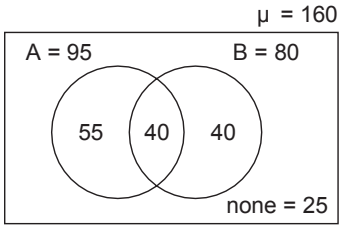
65 could not answer A

$\Rightarrow$ 160 - 65 = 5 answered question A.

80 could not answer B $\Rightarrow$ 160 - 80 = 80 answered question B.

40 students answered both the questions.

Venn diagram based on the above data is as follows.



$\Rightarrow$ 25 students could answer neither of the questions.

7.01: 25 students could not answer any of the two questions. Hence, the correct option is (B)

7.02: 55 students answered only A. Hence, the correct option is (D)

7.03: 40 + 55 = 95 students could not answer exactly one question. Hence, the correct option is (C)

7.04: 40 students answered only B.

Required % = $\frac{40}{80} \times 100 = 50\%$

Hence, the correct option is (A).

Directions for questions 7.05 to 7.08: These questions are based on the following data.

In a colony, the residents read different newspaper, among The Hindu. The Times of India and Dainik Bhaskar. It is known that 52% of the residents read at most one newspaper. 42% of the residents read The Times of India or Dainik Bhaskar but not The Hindu. 54% of the residents read The Times of India. 24% of the residents read both The Hindu and The Times of India. 36% of the residents read exactly two newspapers. 10% of the residents read only The Hindu and Dainik Bhaskar. The number of residents, who read all the three newspapers is twice the number of residents who read none of these newspapers. 2,800 residents read only the Times of India and Dainik Bhaskar.

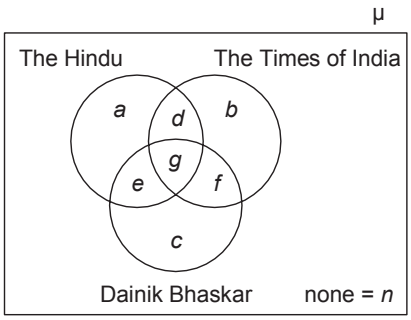
7.05: How many residents read only The Hindu?
(A) 4000 (B) 600
(C) 3200 (D) 3400

7.06: How many residents do not read any of the newspapers?
(A) 1800 (B) 1600
(C) 1450 (D) 1200

7.07: How many residents read at least two newspapers?
(A) 9600 (B) 8000
(C) 8400 (D) 10200

7.08: How many residents are there in the colony?
(A) 22000 (B) 16000
(C) 20000 (D) 18000

Solution for questions 7.05 to 7.08: Let us represent the given information in a Venn diagram, as follows.



Given. 52 % of the residents read at most one newspaper,

$$a + b + c - n = 52\% \quad (1)$$

42 % of the residents read Times of India or Dainik Bhaskar but do not read Hindu.

$$f + b + c = 42\% \quad (2)$$

54% of the residents read The Times of India

$$d + b + g + f = 54\% \quad (3)$$

24% of the residents read both the Hindu and The Times of India.

$$d + g = 24\% \quad (4)$$

35% of the residents read exactly two newspapers,

$$d + e + f = 36\% \quad (5)$$

10% of the residents read only The Hindu and Dainik Bhaskar

$$e = 10\% \quad (6)$$

The number of residents who read all the three newspapers is twice the number of people who read none

$$g = 2n \quad (7)$$

2800 residents read only the Times of India and Dainik Bhaskar.

$$f = 2800 \quad (8)$$

By subtracting eqn (4) from (3), we get

$$b + f = 30\% \quad (9)$$

By subtracting eqn (9) from (2), we get

$$c = 12\% \quad (10)$$

From equation (1) and (5), we get

$$a + b + c + n + d + e + f = 88\%$$

$$\therefore \quad g = 100 - 88 = 12\%$$

Thus, $n = 6\%$

From equation (4), we get $d = 12\%$

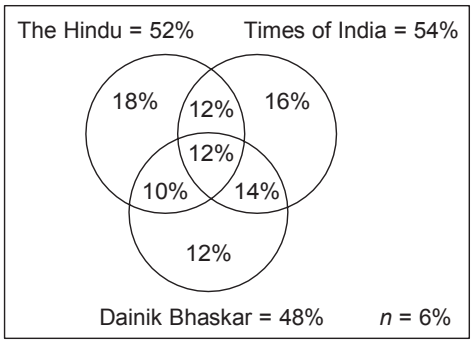
From eqn. (5), we get

$$f = 14\%$$

From eqn. (2), we get

$$b = 16\%$$

∴The final diagram is as follows



Given

$$f = 14\% \text{ of total} = 2600$$

∴ Total no. of residents in the colony

$$= \frac{2800 \times 100}{14} = 20000$$

7.05: 18% of the residents read only Hindu.

$$\frac{2800 \times 6}{100} = 3600$$

Hence, the correct option is (B).

7.06: 6% of the residents do not read any of the news papers.

$$\frac{20000 \times 6}{100} = 1200$$

7.07: Residents who read at least two newspapers = (Residents who read exactly two + exactly three)

$$d + e + f + g = (12 + 12 + 10 + 14)\% = 48\%$$

$$\therefore \quad \frac{20000 \times 48}{100} = 9600$$

Hence, the correct option is (A).

7.08: Total number of residents = 100%
20,000 people are there in the colony.
Hence, the correct option is (C).

Directions for questions 7.09 to 7.12: These questions are based on the information given below.

A survey was conducted among some people It was found that 330 people watch Discovery channel, 330 people watch Star World, 315 people watch BBC and 285 people watch Star News. The number of people who watch each combination of exactly three channels is 40. The number of people, who watch only Discovery channel and BBC is 50. 80 people watch only Discovery channel, 100 people watch only Star World, 90 people watch only BBC and 70 people watch only Star News. 30 people watch only BBC and Star News, while

10 people watch ail the four channels. Each person watches at least one channel.

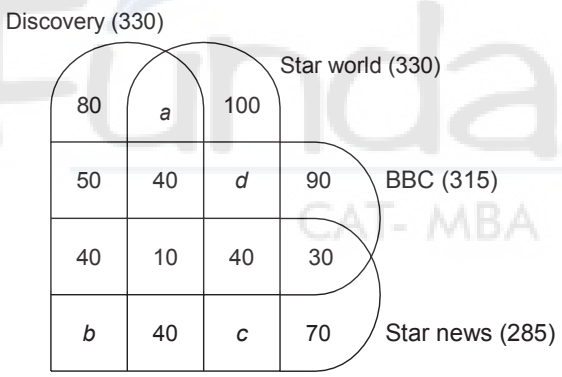
7.09: How many people watch only Discovery channel and Star World?
(A) 140 (B) 50
(C) 180 (D) 230

7.10. How many people watch BBC but not Discovery channel?
(A) 240 (B) 320
(C) 150 (D) 175

7.11. How many people watch exactly two channels?
(A) 200 (B) 220
(C) 310 (D) 180

7.12. How many people took part in the survey?
(A) 1000
(B) 1260
(C) 710
(D) Cannot be determined

Directions for questions 7.09 to 7.12: From the given information, we have the following venn diagram.



$50 + 40 + d + 90 + 40 + 10 + 40 + 30 = 315$

$\Rightarrow \quad d = 315 - 300$

$d = 15$

$a + b + b\ 80 + 40 + 40 + 10 + 40 = 330$

$\Rightarrow \quad a + b = 70 \qquad (1)$

Similarly,

$a + c + 100 + 40 + 10 + 40 + 40 + 15 = 330.$

$\Rightarrow \quad a + c = 85 \qquad (2)$

and

$b + c + 40 + 10 + 40 + 30 + 70 + 40 = 285$

$\Rightarrow \quad b + c = 55 \qquad (3)$

By adding equations (1), (2) and (3), we get

$2(a + b + c) = 210$

$\Rightarrow \quad a + b + c = 105 \qquad (4)$

From equation (4) and (1), we get

$c = 35$

Similarly,

$b = 20$

$a = 50.$

7.09: People watch only Discovery and Star World = $a = 50$.

7.10: 90 + 30 + 40 + 15 =175 people watch BBC but do not watch Discovery.

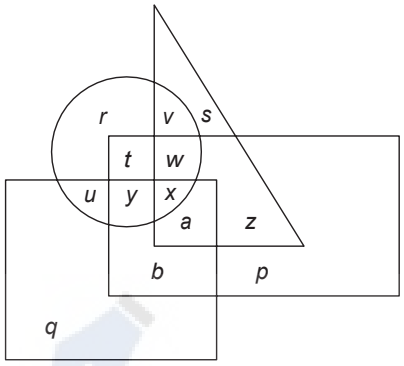
7.11: 50 + 50 + 15 +30 + 20 = 200 people watch exactly two channels.

7.12: 710 many people took part in the survey.

Exercise-1

Directions for questions 1 to 5: These questions are based on the following diagram.

In the following diagram, the circle represents all the people who like Maaza, the square represents all the people who like Thumbs Up, the Triangle represents all the people who like Mirinda and the Rectangle represents all the people who like Coca-Cola.



1. Which of the following represents the people who like Coca-Cola and Thumbs Up?
(A) r (B) u
(C) b (D) q

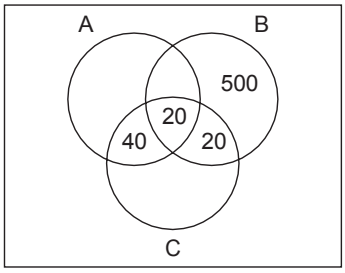
2. Which of the following represents the people who like Mirinda but not Thumbs Up?
(A) v, s, w, x (B) v, s, z, a
(C) v, w, x, a (D) None of these

3. Which of the following represents the people who like Maaza and Thumbs Up?
(A) u, t, w (B) v, w, x
(C) b, a, x (D) u, y, x

4. Which of the following represents the people who like both Maaza and Mirinda but not any of the other two?
(A) y (B) v
(C) u (D) None of these

5. Which of the following represents the people who like Mirinda, Maaza, Coca-Cola but not Thumbs Up?
(A) b (B) r
(C) s (D) w

Directions for questions 6 to 10: The following Venn diagram represents the 1200 employees of a company. Each of the employees is a member of at least one of three clubs, such as A, B and C. Using the given data, answer the questions that follow.



Total member of Club A = 420
Total member of Club B = 590
Total member of Club C = 340

6. How many employees are member of Club C only?
(A) 250 (B) 240
(C) 180 (D) 260

7. How many employees are member of both Club A and Club B?
(A) 50 (B) 80
(C) 70 (D) 60

8. How many employees are not member of Club B?
(A) 340 (B) 610
(C) 630 (D) 290

9. How many employees are member of Club A or Club C?
(A) 850 (B) 700
(C) 975 (D) 675

10. How many employees are member of exactly two clubs?
(A) 110 (B) 130
(C) 98 (D) 78

Directions for questions 11 to 15: These questions are based on the following information.

In a class of 150 students, 45 take History, 65 take Geography and 10 take both History and Geography.

11. How many students take only Geography?
(A) 45 (B) 10
(C) 55 (D) 65

12. How many students take only History?
(A) 65 (B) 35
(C) 10 (D) 45

13. How many do not take either History or Geography?
(A) 10 (B) 35
(C) 100 (D) 140

14. How many students take at least one subject?
(A) 10 (B) 90
(C) 50 (D) 100

15. How many students do not take any of the two subjects?
(A) 90 (B) 10
(C) 50 (D) 100

Directions for questions 16 to 18: These questions are based on the following information.

In a class of 150 students, 50 students passed in Mathematics, 40 students failed only in Chemistry and 20 students failed in both the subjects.

16. How many students passed in both the subjects?
(A) 20 (B) 15
(C) 10 (D) 16

17. How many students passed exactly in one subject?
(A) 25 (B) 120
(C) 140 (D) 145

18. How many students failed in at least one of the subjects?
(A) 130 (B) 125
(C) 145 (D) 140

Directions for questions 19 to 23: These questions are based on the following information.

In a survey conducted among 200 mobile phone using families, it was found that 140 use Panasonic, 120 use Nokia and 143 use Siemens. 95 use both Panasonic and Nokia, 85 use both Nokia and Siemens and 93 use both Panasonic and Siemens. 70 families use mobile phones of all the three companies.

19. How many families use mobilephones of only Siemens?
(A) 50 (B) 35
(C) 70 (D) 143

20. How many families use mobilephones of both Panasonic and Nokia but not Siemens?
(A) 25 (B) 57
(C) 165 (D) 95

21. How many families use mobilephones of exactly one company?
(A) 63 (B) 67
(C) 70 (D) 200

22. How many families use neither Panasonic nor Siemens?
(A) 40 (B) 120
(C) 110 (D) 10

23. How many families use none of the mobile phones?
(A) 10 (B) 70
(C) 0 (D) Cannot be determined

Directions for questions 24 to 28: Study the following data and the table to answer the questions that follow.

A survey was conducted among 100 students in a class who read detective novels written by Conan Doyle or Agatha Christie or both. Due to some recording error in the computer most of the figures were missing. The following table shows the remaining data.

	Doyle	Christie	Both	Total
Male				
Female	40			
Total		70		100

Further it is known that
(A) 37% of the students read both Doyle and Christie.
(B) The ratio of males to females is 1 : 1.
(C) 50% of the females read books of both the authors.

24. How many males read books by both the authors?
(A) 10 (B) 12
(C) 37 (D) 45

25. How many students read books by only Christie?
(A) 70 (B) 10
(C) 33 (D) 23

26. How many females read books by only Doyle?
(A) 25 (B) 40
(C) 35 (D) 15

27. How many students do not read books by both the authors?
(A) 12 (B) 27
(C) 37 (D) 63

28. How many males read books by Doyle?
(A) 27 (B) 67
(C) 12 (D) 15

Directions for questions 29 to 33: These questions are based on the following information.

Out of 200 people who attended a birthday party 120 had cool drink, 100 had ice cream, 80 had cake and 10 had none of these three. 100 people had exactly one of the three items.

29. How many people had exactly two of the three items?
(A) 70 (B) 80
(C) 110 (D) 85

30. If 20 people had only cool drink and ice cream, then how many people had only cake?
(A) 12 (B) 18
(C) 20 (D) 10

31. If 15 people who had only cool drink, had cake also and 5 people who had only ice cream and cake had cool drink also, then how many people had at least two of the three?
(A) 135 (B) 105
(C) 78 (D) 119

32. If 30 people had only ice cream, then how many people had at least one of cake and cool drink but not ice cream?
(A) 105 (B) 98
(C) 87 (D) 90

33. What is the maximum possible number of people who had only cool drink?
(A) 90 (B) 87
(C) 118 (D) 120

Directions for questions 34 to 37: These questions are based on the following information.

A total of 800 people participated in a consumer survey. The survey was conducted to get an idea about the popularity of the four soaps, such as Dove, Pears, Lux and Liril. Each participant liked at least one of the four products. The number of people who liked Liril is 450, those who liked Lux is 270 and those who liked Dove is 325. 100 liked only Pears, 50 liked only Lux and 90 liked only Liril. 50 liked only Dove and Pears, 60 liked only Dove and Lux, 90 liked only Dove and Liril, 30 liked only Pears and Lux, 120 liked only Pears and Liril, 60 liked only Lux and Liril. 20 liked only Dove, Pears and Lux, 15 liked only Dove, Lux and Liril, 25 liked only Pears, Lux and Liril.

34. How many people liked Dove and Pears but not Lux?
(A) 50 (B) 90
(C) 100 (D) 70

35. How many people liked at least two products?
(A) 480 (B) 560
(C) 600 (D) 520

36. How many people liked neither Dove nor Pears?
(A) 200 (B) 250
(C) 180 (D) 150

37. How many people liked either Lux or Liril?
(A) 590 (B) 630
(C) 570 (D) 610

Directions for questions 38 to 40: These questions are based on the following information.

Each of 780 bags contains at least one of raisins, almonds and peanuts. 375 bags contain raisins and 315 bags contain almonds. 75 bags contain both raisins and almonds, 90 bags contain both raisins and peanuts, 45 bags contain both almonds and peanuts.

38. Find the maximum possible number of bags which contain exactly two of raisins, almonds and peanuts.
(A) 240 (B) 180
(C) 210 (D) 150

39. Find the minimum possible number of bags which contain either peanuts or almonds.
(A) 525 (B) 620
(C) 640 (D) 600

40. If the number of bags which contain exactly two of raisins, almonds and peanuts is four times the number of bags which contain all the three, then how many bags contain only raisins?
(A) 210 (B) 240
(C) 270 (D) 180

Exercise-2

Directions for questions 1 to 4: These questions are based on the following information.

In a colony, 30 families read both The Hindu and Indian Express. 40 families read neither of these two news papers. 40% of the families read The Hindu and 55% of the families read Indian Express.

1. How many families are there in the colony?
(A) 150 (B) 200
(C) 160 (D) 250

2. How many families read at least one of the newspapers?
(A) 110 (B) 120
(C) 65 (D) 160

3. What percentage of the total number of families read at most one newspaper?
(A) 60% (B) 30%
(C) 70% (D) 85%

4. What percentage of the total number of families read The Hindu only?
(A) 25% (B) 30%
(C) 10% (D) 15%

Directions for questions 5 to 8: These questions are based on the following information.

In a class, 60% of the students passed in Finance. Among those passed in Finance, $33\frac{1}{3}$ passed in Marketing. 150 students failed in both the subjects. 1/3rd of the students who passed in Marketing failed in Finance.

5. How many students are there in the class?
(A) 350 (B) 660
(C) 550 (D) 500

6. What percentage of the students failed in Finance only?
(A) 40% (B) 30%
(C) 50% (D) 10%

7. All the students who failed in at least one subject are given grace marks and it was found that the number of students who failed in both the subjects is decreased by 60% and the number of students who failed in exactly one subject went up by 20%. How many students passed in both the subjects?
(A) 120 (B) 140
(C) 80 (D) 60

8. After all the students who failed in exactly one subject have taken a re-exam in the subject in which they failed it was found that the number of students who passed in both the subjects increased by 60. What is the least value for the percentage of students in the class who failed only in Marketing?
(A) 20% (B) 28%
(C) 38% (D) 40%

Directions for questions 9 to 13: These questions are based on the following information.

Among all the students of a school half of the students learn exactly one martial art, such as Kung Fu, Karate and Judo. Half of the students who learn Karate do not learn any other martial art. The number of students who learn all the three martial arts is equal to 50/3% of those who learn exactly two among the three martial arts and is equal to 1/3rd of those who learn none of the three martial arts.

9. If 50 students learn all the three arts, then how many students learn exactly one of the three arts?
(A) 480 (B) 500
(C) 700 (D) 550

10. If 30 students learn none of the three arts, then what is the maximum possible number of students who learn Karate?
(A) 95 (B) 85
(C) 120 (D) 140

11. If there are 500 students in the school, then what is the maximum possible number of students who learn Kung Fu?
(A) 400 (B) 350
(C) 300 (D) 275

12. If 90 students learn exactly two of the three martial arts, then how many students are there in the school?
(A) 360 (B) 220
(C) 200 (D) 300

13. If out of 600 students of the school, 150 students learn Karate, then how many students learn only Kung Fu and Judo?
(A) 135 (B) 165
(C) 210 (D) 180

Directions for questions 14 to 16: These questions are based on the following table.

	number of magazine readers						Total including non-readers	
	Business World		Business Times		Both			
age group	male	Female	male	Female	male	Female	male	Female
< 15 years	145	65	155	65	50	30	260	115
15–34 years	175	125	105	85	40	50	265	190
≥ 35 years	115	135	120	100	35	45	215	195

14. How many males in 15–34 years age group do not read any of the 2 magazines?
(A) 15 (B) 45
(C) 75 (D) 25

15. Approximately, what percentage of the BT readers are above 15 years of age?
(A) 75% (B) 45%
(C) 65% (D) 80%

16. What percentage of females, who read neither BT nor BW are below 15 years of age?
(A) 30% (B) 60%
(C) 40% (D) 20%

Directions for questions 17 to 20: These questions are based on the following information.

A group of 1000 students at a summer camp are engaged in at least two of the activities, such as painting, swimming, dancing, singing or karate. It is further known that the number of students engaged in every combination of exactly two activities is three times the number of students who are engaged in every combination of exactly three activities. Also, the number of students engaged in all the five activities is a third of that engaged in exactly four activities. The number of students engaged in every combination of exactly four activities is the same.

17. If the number of students engaged in all the five activities is 100, then the number of students engaged in only painting and karate is
(A) 150 (B) 45
(C) 450 (D) Cannot be determined

18. If the number of students engaged in exactly three activities is 1.5 times the number of students engaged in all the five activities, then which of the following is true?

(A) The number of students engaged in only swimming, dancing and painting is 15.

(B) The number of students engaged in all the five activities is 100.

(C) Both (A) and (B)

(D) Neither (A) nor (B)

19. If the number of students enrolled in painting, swimming, dancing, singing and karate are 750, 800, 400, 900 and 600 respectively, then which of the following is definitely false?

(A) The number of students engaged in only painting, dancing, singing and karate is 90.

(B) The number of students engaged in exactly two activities is 300.

(C) The number of students engaged in exactly three activities is lesser than that engaged in only dancing, singing, swimming and karate.

(D) The number of students engaged in all the five activities is 150.

20. In the previous question, if the number of students engaged in painting is not known then which of the following can be that value?

(A) 270 (B) 90

(C) 360 (D) 120

Directions for questions 21 to 24: These questions are based on the following data.

A survey of 300 respondents showed that 135 of them read Business India, 125 read Business Today and 115 read Business World. Further, 42 of the respondents read Business India and Business Today, 48 read Business Today and Business World, 43 read Business India and Business World and 30 of the respondents read all the three magazines.

21. How many respondents read Business India or Business World?

(A) 199 (B) 272

(C) 207 (D) 175

22. If seven of the respondents who were previously reading only Business India now start reading a second magazine also and five of the respondents who were previously reading only Business India now stop even that, then how many respondents read Business India now?

(A) 75 (B) 132

(C) 142 (D) 130

23. If 15 respondents who were reading Business India stop reading Business India and instead start reading Business Today, then what is the maximum number of respondents who will now be reading only Business India?

(A) 120 (B) 65

(C) 78 (D) 93

24. If 16 of the respondents, who were reading Business Today, stop reading Business Today and instead start reading Business World, then what is the maximum number of respondents who will now be reading Business India and Business World?

(A) 59 (B) 55

(C) 75 (D) 63

Directions for questions 25 to 27: These questions are based on the following data.

In a colony, a survey was conducted regarding the ownership of three different types of vehicles, such as car, scooter and bicycle.

- The number of residents owning all three vehicles is the same as those owning none.
- The number of residents owning any two out of the three vehicles is the same as those owning any other two which in turn is the same as those owning none of the three.
- The number of residents owning scooters alone is the same as those owning cars alone and each in turn is twice those owning bicycles alone.
- Half the number of residents who own a bicycle also own at least one of the other two vehicles.

25. If the number of residents who own only bicycles is 150, then what is the total number of residents in the colony?

(A) 500 (B) 1000

(C) 750 (D) 1250

26. If 15 residents do not own any of the three vehicles, then how many residents are there in the colony?

(A) 100 (B) 200

(C) 500 (D) 300

27. What percentage of the residents own a scooter or a car but not a bicycle?

(A) 65% (B) 55%

(C) 75% (D) 45%

Directions for questions 28 to 30: These questions are based on the following information.

Among the 450 employees of a company 195 are members of Club A. 175 are members of Club B and 185 are members of Club C. 55 are members of clubs A and B. 40 are members of clubs B and C. 45 are members of clubs A and C. 25 employees are members of all the three clubs.

28. If 10 employees who are members of Club A take the membership of Club B also and 15 employees who are members of Club A withdraw from it and take the membership of Club C, then how many employees have membership of Club A?

(A) 120 (B) 140

(C) 180 (D) 145

29. If 50 employees who are members of Club B withdraw from it and take the membership of Club C, then what is the maximum possible number of employees that are members of clubs A and C?
(A) 60 (B) 62
(C) 58 (D) 75

30. If 20 employees who have the membership of Club A withdraw from it and take the membership of Club C, then what is the least possible number of employees who are members of clubs B and A?
(A) 20 (B) 10
(C) 15 (D) 35

Directions for questions 31 to 33: These questions are based on the following data.

In a college library, four different business newspapers, such as Economic Times (ET), Business Standard (BS), Business Line (BL) and Financial Express (FE) are available. All students visit the library regularly but 20% of them do not read any business newspaper.

The four newspapers given in the above order are read by 230, 180, 180 and 220 students, respectively. The number of students reading exactly 2 newspapers for any two newspapers is 20. There are 30 students who read all the four newspapers but there is nobody who reads exactly three out of the four newspapers.

31. How many students do not read any newspaper at all?
(A) 75 (B) 100
(C) 225 (D) 150

32. What percentage of the people reading Business Standard also read at least one other newspaper?
(A) 35% (B) 55%
(C) 50% (D) 65%

33. If all the students in the college including those who do not read any newspaper read at least one newspaper, (out of the four newspapers above) which he is not reading at present, then what is the least number of students reading all the four newspapers?
(A) 60 (B) 25
(C) 15 (D) 30

Directions for questions 34 to 36: These questions are based on the following information.

Each of N students participated in at least one of the track events, such as in high jump, long jump and 100 m dash. 27 students participated in high jump, 27 students participated in long jump and 52 students participated in 100 m dash.

34. The number of students who participated in exactly one of the three events is 51, find the maximum possible number of students who participated in exactly two of the three events.
(A) 22 (B) 30
(C) 34 (D) 26

35. The number of students who participated in exactly one of the three events is atleast equal to that who participated in exactly two of three events which is atleast equal to that of those who participated in all the three events. Find the maximum possible number of students who participated in all the three events.
(A) 16 (B) 18
(C) 17 (D) 19

36. If the number of students who participated in at least two of the three events is 26, then find the minimum possible value of N.
(A) 50 (B) 54
(C) 52 (D) 46

Directions for questions 37 to 40: These questions are based on the following information.

A group of 100 students participated in at least one of the following events. The events are 100 m dash, 200 m dash, 400 m dash and 800 m dash. 40 students participated in each of the 100 m dash, 200 m dash, 400 m dash and 800 m dash. An equal number of students participated in only the 100 m dash, only the 200 m dash, only the 400 m dash and only the 800 m dash. An equal number of students participated in each pair of 100 m dash, 200 m dash, 400 m dash and 800 m dash. An equal number of students also participated in each combination of three of the events. 15 students participated in all the four 100 m dash, 200 m dash, 400 m dash and 800 m dash.

37. Find the maximum possible number of students who participated in only the 400 m dash.
(A) 20 (B) 25
(C) 15 (D) 30

38. Find the maximum possible number of students who participated in all the three 100 m dash, 200 m dash and 400 m dash.
(A) 27 (B) 19
(C) 23 (D) 29

39. If 16 students participated in only the 100 m dash, find the number of students who participated in the 100 m dash and at least one other.
(A) 24 (B) 20
(C) 16 (D) 28

40. Using the information in the previous question, find the maximum possible number of students who participated in only the 100 m dash and 200 m dash.
(A) 1 (B) 2
(C) 3 (D) 4

Exercise-3

Directions for questions 1 to 3: These questions are based on the following data.

A group of people went for a pilgrimage tour, out of 245 pilgrims, 105 visited Badrinath, 95 visited Kedarnath and 95 visited Somnath. Fifteen of them visited all three shrines, while 190 visited exactly one of the three shrines. The number of pilgrims who visited exactly two out of the three shrines is three times as many as those who have not visited any one of the three shrines.

1. If the number of pilgrims who have visited at least one of the two shrines Kedarnath and Somnath is 165, then how many pilgrims visited only Kedarnath and Somnath?
(A) 20 (B) 30
(C) 10 (D) 15

2. If 180 pilgrims visited at least one of the two shrines Kedarnath or Badrinath, then how many pilgrims visited only Somnath?
(A) 55 (B) 40
(C) 35 (D) 60

3. If there is nobody who visited only Badrinath and Somnath, then how many people visited only Kedarnath?
(A) 90 (B) 80
(C) 70 (D) 50

Directions for questions 4 to 7: These questions are based on the following information.

Each of the students, who are residents of Kalpana Chawla Bhawan, likes at least one among the four different brands of cool drinks, such as Coca-Cola, Thumbs Up, Limca and Sprite. 65 students like Thumbs Up and Coca-Cola. 77 students like Sprite and Thumbs Up. 73 students like Coca-Cola and Limca. 76 students like Limca and Thumbs Up. 74 students like Sprite and Coca-Cola. There are 67 students who like exactly one brand. The number of students who like only Limca, Thumbs Up and Coca-Cola is same as the number of students who like only Sprite, Thumbs Up and Coca-Cola. The number of students who like Sprite, Limca and Thumbs Up but not Coca-Cola is same as the number of students who like Sprite, Limca and Coca-Cola but not Thumbs Up. The number of students, who like only Coca-Cola and Sprite is 14. The number of students who like only Sprite and Limca and only Thumbs Up and Coca-Cola are 10 and 15, respectively. The sum of the number of students who like Thumbs Up, the number of students who like Coca-Cola, the number of students who like Sprite and the number of students who like Limca is 557.

4. How many students like both Sprite and Limca but not all the four?
(A) 60 (B) 50
(C) 55 (D) 44

5. What is the total number of students?
(A) 247 (B) 250
(C) 235 (D) 252

6. How many students like only Coca-Cola and Limca?
(A) 16 (B) 17
(C) 13 (D) 15

7. If 25 students like only Thumbs Up or only Sprite, then how many like Coca-Cola or Limca?
(A) 42 (B) 208
(C) 152 (D) 210

Directions for questions 8 to 12: These questions are based on the following information.

A survey was conducted among a group of football fans to know how many of them like the football teams Barcelona, Liverpool, Real Madrid, Manchester United and Bayern Munich.

(i) 57 out of the 125 fans who like Real Madrid also like Manchester United.
(ii) 10 fans like exactly three clubs. 10 fans like only Liverpool.
(iv) It is known that no one who likes Barcelona likes Real Madrid or Manchester United.
(v) The number of fans who like Bayern Munich and Barcelona is the same as those who like only Real Madrid and Manchester United and 4 more than those who like Barcelona and Liverpool.
(vi) The number of fans who like Bayern Munich and Manchester United is the same as that who like only Liverpool and Real Madrid, which in turn is one third of those who like only Real Madrid.
(vii) The number of fans who like Barcelona, Bayern Munich, Manchester United and Liverpool are 112, 75, 88 and 92, respectively.
(viii) No one who likes Bayern Munich likes Liverpool or Real Madrid.

8. How many like exactly two clubs?
(A) 183 (B) 152
(C) 137 (D) 154

9. How many like only Bayern Munich or only Barcelona?
(A) 45 (B) 51
(C) 33 (D) Cannot be determined

10. How many like the club Manchester United but not Liverpool?
(A) 66 (B) 72
(C) 81 (D) 71

11. How many like exactly one club?
(A) 102 (B) 94
(C) 123 (D) 96

12. Among the Barcelona fans, how many like at least two more clubs?
(A) 90 (B) 57
(C) 64 (D) None

Directions for questions 13 to 16: These questions are based on the following data.

In a class, 30% of the students gave their names to participate in the NSS and 75% to participate in the NCC. Three students participate in neither of these, where two and six students wanted to participate in both.

13. How many students are there in the class?
(A) 100 (B) 75
(C) 60 (D) 80

14. What percentage of students wants to participate only in the NSS?
(A) 30% (B) 25%
(C) 15% (D) 20%

15. What percentage of students wants to participate in only one programme either in NSS or NCC?
(A) 85% (B) 90%
(C) 75% (D) 20%

16. How many students want to participate in at least one programme?
(A) 97 (B) 87
(C) 147 (D) 57

Directions for questions 17 to 20: These questions are based on the following data.

In a school, 60% of the students passed in English and 25% of the students who passed in English passed in the foreign language also, whereas 66 ⅔ % of the students who passed in the foreign language failed in English. Twenty students failed in both English and the foreign language.

17. What is the total strength of the school?
(A) 250 (B) 150
(C) 200 (D) 100

18. What per cent of the students passed in exactly one of the two subjects, such as in English and the foreign language?
(A) 15% (B) 65%
(C) 45% (D) 75%

19. The students who failed in exactly one subject are allowed to take a re-exam and it was found that the number of students who passed in both the subjects increased by 20%. What is the least value for the percentage of students in the school who pass only in English?
(A) 42% (B) 46%
(C) 34% (D) 28%

20. All the students who failed in one or more subjects are given grace marks and it was found that the number of students passing in exactly one subject went up by 4 and the number of students who failed in both the subjects dropped by 40%. What per cent of the school now pass in both subjects?
(A) 40% (B) 15%
(C) 12% (D) 17%

Directions for questions 21 to 25: These questions are based on the following data.

There are three trade unions Viram, Vishram and Be-kam and 3600 workers in a company. Becoming a member of a trade union is optional. A worker can be a member of more than one of the three trade unions also.

There are 500 workers who are members of at least two trade unions while Vishram has 1400 members. There are 100 workers who are members of only Viram and Be-kam, whereas 200 Vishram members also are Be-kam members; 550 workers are members of only Be-kam where as 20% of Viram members are members of exactly one more union. An eighth of all the workers in the company are members of exactly two unions.

21. How many workers are members of all the three unions?
(A) 150 (B) 75
(C) 50 (D) 100

22. How many workers are not members of any union?
(A) 100 (B) 200
(C) 300 (D) 400

23. How many workers are members of only Viram or only Be-kam?
(A) 3200 (B) 2700
(C) 1400 (D) 1700

24. If 10 workers give up their Be-kam membership and take up Vishram membership, then how many workers will now have membership of all the three unions?
(A) 40 (B) 50
(C) 60 (D) 45

25. How many workers are members of Vishram but not members of Be-kam?
(A) 400 (B) 800
(C) 1200 (D) 1600

Answer Keys

exercise-1

1. (C)	8. (B)	15. (C)	22. (D)	29. (A)	36. (A)
2. (D)	9. (B)	16. (C)	23. (C)	30. (D)	37. (D)
3. (D)	10. (A)	17. (B)	24. (B)	31. (B)	38. (C)
4. (B)	11. (C)	18. (D)	25. (C)	32. (D)	39. (A)
5. (D)	12. (B)	19. (B)	26. (D)	33. (A)	40. (B)
6. (D)	13. (D)	20. (A)	27. (D)	34. (B)	
7. (C)	14. (D)	21. (B)	28. (A)	35. (A)	

exercise-2

1. (B)	8. (B)	15. (C)	22. (D)	29. (C)	36. (B)
2. (D)	9. (B)	16. (A)	23. (C)	30. (D)	37. (B)
3. (C)	10. (D)	17. (B)	24. (B)	31. (D)	38. (C)
4. (A)	11. (A)	18. (C)	25. (B)	32. (C)	39. (A)
5. (D)	12. (D)	19. (C)	26. (D)	33. (D)	40. (C)
6. (D)	13. (A)	20. (A)	27. (A)	34. (D)	
7. (B)	14. (D)	21. (C)	28. (C)	35. (C)	

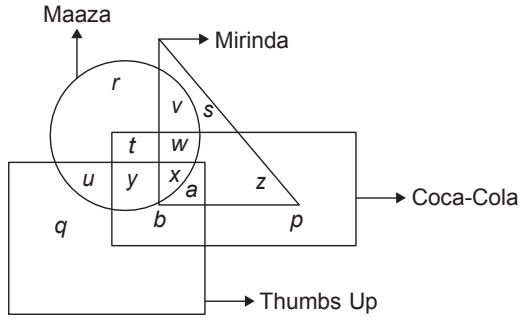
exercise-3

1. (C)	5. (D)	9. (C)	13. (C)	17. (C)	21. (C)	24. (B)
2. (A)	6. (C)	10. (A)	14. (D)	18. (D)	22. (D)	25. (C)
3. (D)	7. (D)	11. (D)	15. (A)	19. (A)	23. (D)	
4. (A)	8. (A)	12. (D)	16. (D)	20. (D)		

SOLUTIONS

Exercise-I

Solutions for questions 1 to 5:



1. In the diagram, *b* represents the people who like only Coca – Cola and Thumbs Up.

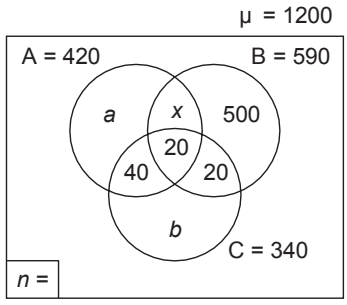
2. '*v*', '*s*', '*w*' and *z* are in the triangle but not in square. Hence, those represent the people who like Mirinda but not Thumbs Up.

3. *u*, *y*, *x* belongs to both circle and square. Hence, they like Maaza and Thumbs Up.

4. The letter '*v*' belongs to circle and triangle but neither to square nor rectangle. Hence, *v* represents the people who like Maaza and Mirinda but not the other 2.

5. *w* belongs to circle and rectangle but not square. Hence, *w* represents the people who like Maaza, Mirinda, Coca-Cola but not Thumbs Up.

Solutions for questions 6 to 10:



C = *b* + 40 + 20 + 20 = 340

⇒ *b* = 260

B = 500 + 20 + 20 + x = 590
$\Rightarrow x = 50$
A = a + x (= 50) + 40 + 20 = 420
$\Rightarrow a = 310$
n = 0 [given]

6. Number of employee that are member of Club C only = b = 260.

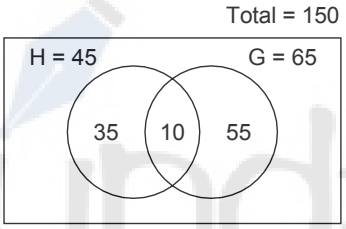
7. Number of members of Club A and B = x + 20 = 50 + 20 = 70.

8. a + 40 + b + n = 310 + 40 + 260 + 0 = 610 are not the members of Club B.

9. Members of Club A or Club C = a + x + 40 + 20 + b + 20 = 310 + 50 + 40 + 20 + 260 + 20 = 700.

10. x + 40 + 20 = 50 + 40 + 20 = 110 are the members of exactly two clubs.

Solutions for questions 11 to 15: As per the given data, we get the following diagram:



H → History G → Geography

11. 55 students take only Geography.

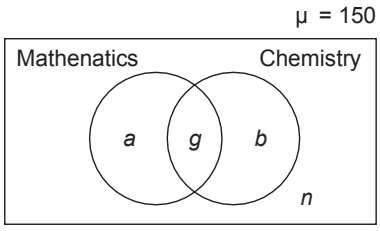
12. 35 students take only History.

13. 10 students take both History and Geography out of a total of 150 students. Hence, 150 − 10 = 140 students do not take either History or Geography.

14. 35 + 10 + 55 = 100 students take at least one subject.

15. (150 − 100) = 50 students take neither of the two subjects.

Solutions for questions 16 to 18: Let us represent the given information in the following Venn diagram.



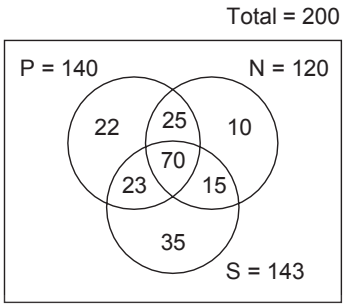
Given, a + g = 50.
The number of students who failed only in Chemistry = a = 40
$\Rightarrow g = 10$
n = 20
$\therefore b$ = 150 − (40 + 10 + 20) = 150 − 70 = 80
b = 80

16. The number of students who passed in both the subjects, g = 10.

17. The number of students who passed in exactly one subject, a + b = 40 + 80 = 120

18. The number of students who failed in at least one subject = a + b + n = 40 + 80 + 20 = 140 or μ − g = 150 − 10 = 140

Solutions for questions 19 to 23: From the given data, we get the following the diagram.



P → Panasonic
S → Siemens
N → Nokia

1. 22 families use only Panasonic phones.
2. 10 families use only Nokia phones.
3. 35 families use only Siemens phones.
4. 25 families use both Panasonic and Nokia but not Siemens.
5. 15 families use both Nokia and Siemens but not Panasonic.
6. 23 families use both Panasonic and Siemens but not Nokia.
7. All the 200 families use mobile-phones of at least one company.

19. 35 families use mobile phones of only Siemens.

20. 25 families use mobile phones of both Panasonic and Nokia but not Siemens (Region common to Panasonic and Nokia but not Siemens).

21. Exactly one company
= Only Panasonic + Only Nokia + Only Siemens
= 22 + 10 + 35 = 67 families

22. Neither Panasonic nor Siemens implies only Nokia.
So, 10 families use mobile phones of neither Panasonic nor Siemens.

23. All the families use mobile phones of at least one out of the three mentioned companies. So, there is no family which did not use any mobile phone.

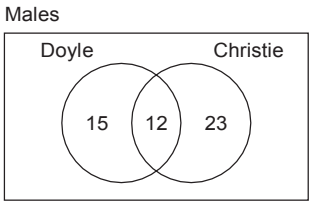
Solutions for questions 24 to 28: Given that 100 students were surveyed who read novels of Christie or Doyle or both.

From the given table we get the information that 40 females read Doyle and 70 students read Christie.

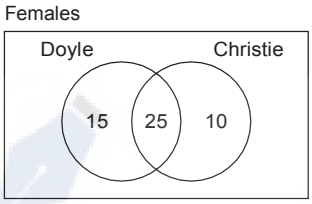
Further, we derive the following:

1. 37% of the total students read both, i.e., 37 students.
2. The ratio of males and females is 1 : 1, i.e., number of males = number of females = 50.
3. 50% of the females, i.e., 50% of 50 = 25 females read both.

With the above information, we get the following data:



So, Doyle = 27
Christie = 35
Both = 12



So, Doyle = 40
Christie = 35
Both = 25

Now after filling the gaps in the table, we get the following data:

	Doyle	Christie	Both	Total
Male	27	35	12	50
Female	40	35	25	50
Total	67	70	37	100

24. 12 males read the books by both the authors.

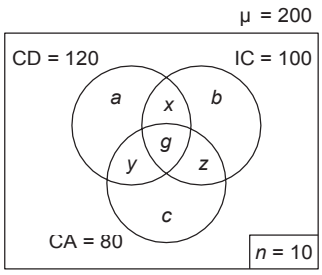
25. The number of students who read books by only Christie is 23 + 10 = 33.

26. 15 females read books by only Doyle.

27. 37 students read the books by both the authors. Hence, those who do not read both the books is 100 − 37 = 63.

28. 27 males read books by Doyle.

Solutions for questions 29 to 33: The given information can be represented in the following Venn diagram.



CD − Cool drink
IC − Ice Cream
CA − Cake
It is given that, $a + b + c = 100$
$a + b + c + x + y + z + g + n = \mu = 200$
$100 + (x + y + z) + g + 10 = 200$
$x + y + z + g = 90$ (A)
CD + IC + CA = $(a + b + c) + 2(x + y + z) + 3g = 300$
$\Rightarrow 2(x + y + z) + 3g = 200$ (B)
From (A) and (B), we get $g = 20$
$\therefore x + y + z = 70$

29. The number of people who had exactly two of the three = 70

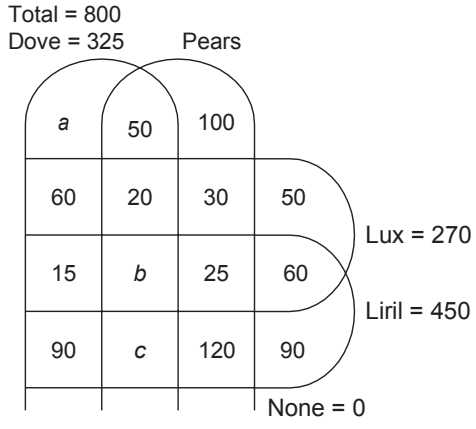
30. It is given that $x = 20$.
$\therefore y + z = 50$
The number of people who had only cake = 80 − 50 − 20 = 10

31. 15 people who had only cool drink had cake also, value of x reduces by 15 and value of y increases by 15.
5 people who had only ice cream and cake had cool drink also, i.e., value of z decreases by 5 and that of g increases by 5.
The number of people who had at least two of the three items = $x + y + z + g = x + (y + 15) + (z - 5) + (g + 5)$
$= x + y + z + g + 15 = 70 + 20 + 15 = 105$.

32. It is given that $b = 30$
$\Rightarrow x + z = IC - b - g = 100 - 30 - 20 = 50$
$y = 70 - (x + z) = 20$ as,
$a + b + c = 100$, $a + c = 100 - b = 70$
$\therefore a + c + y = 70 + 20 = 90$

33. What is the maximum possible value of a.
The value of a can be maximum when $x + y$ is minimum.
$x + y$ can be minimum when z is maximum.
As $g = 20$ and $y + g + z + c = 80$
$z_{max} = 60$ ($c_{min} = 0$)
As $x + y + z = 70$, $x_{min} + y_{min} = 10$
$a_{max} = CD - y_{min} - x_{min} - g = 120 - (10) - 20 = 90$.

Solutions for questions 34 to 37: The given data can be represented in the following diagram.



$b = 270 - (60 + 20 + 30 + 50 + 15 + 25 + 60) = 10$
$c = 450 - (15 + b + 25 + 60 + 90 + 120 + 90) = 40$
$a = 325 - (50 + 20 + b + c + 90 + 15 + 60) = 40$

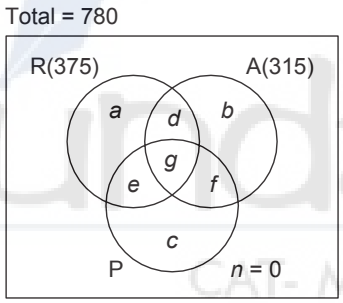
34. 50 people liked only Dove and Pears.
40 people liked only Dove, Pears and Liril.
50 + 40 = 90 people liked Dove and Pears but not Lux.

35. A total of 280, i.e., (40 + 100 + 50 + 90) people liked exactly one product. The remaining 520 people liked at least two products.

36. 50 people liked only Lux.
90 people liked only Liril.
60 people liked only Lux and Liril.
(50 + 90 + 60) = 200 people liked neither Dove nor Pears.

37. The number of people who liked Lux = 270
The number of people who liked Liril but not Lux
= 90 + 40 + 120 + 90 = 340
The number of people who liked either Lux or Liril
= 270 + 340 = 610

Solutions for questions 38 to 40:



$a + b + c + d + e + f + g = 780$
$d + g = 75$, $e + g = 90$, $f + g = 45$

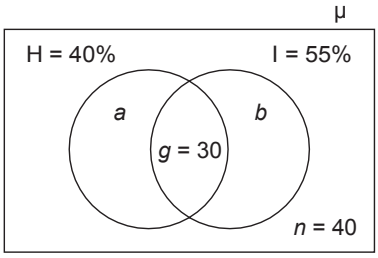
38. The number of bags which contain exactly two of raisins, almonds and peanuts = $d + e + f$.
Max $(d + e + f)$ = Max $(75 - g + 90 - g + 45 - g)$ = Max $(210 - g)$
$210 - g$ is maximum, when each of $75 - g$, $90 - g$, $45 - g$ is maximum, i.e., when g is 0.
The maximum possible number of bags which contain exactly two of raisins, almonds and peanuts is 210.

39. The number of bags which contain either peanuts or almonds = $315 + c + e$
$c = 78$ (R + A – 75) = 165
For Peanuts or Almonds to be minimum e must be minimum. Since $e + g = 90$, to get minimum value for e, should be maximum. g cannot be more than 45.
$\therefore e = 45$
The minimum possible number of bags which contain either peanuts or almonds = 315 + 165 + 45 = 525.

40. $d + e + f = 4g$
$75 - g + 90 - g + 45 - g = 4g$
$g = 30$
The number of bags which contain only raisins
$a = 375 - (d + e + g) = 375 - (75 - g + 90 - g + g) = 240$

Exercise-2

Solutions for questions 1 to 4: The given information can be represented in a Venn diagram as follows.



H – The Hindu
I – Indian Express
$a + g = 40\%$
$b + g = 55\%$
$a + b + 2g = 95\% \rightarrow$ (A)
$a + b + n + g = 100\% \rightarrow$ (B)
(B) – (A)
$\Rightarrow n - g = 5\%$
$\therefore 40 - 30 = 5\%$ of μ
$\Rightarrow \mu = 200$
$a = 50$, $b = 80$

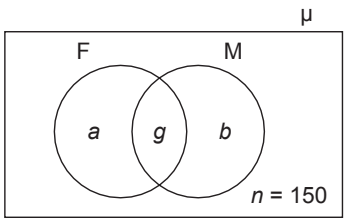
1. There are 200 families in the colony.

2. The number of families that read at least one of the news papers = $a + b + g = 50 + 80 + 30 = 160$.

3. The number of families that read at most one news paper = $a + b + n = 170 = 85\%$ of μ.

4. The number of families that read only Hindu, $a = 50 = 25\%$ of μ.

Solutions for questions 5 to 8:



F = Finance

M = Marketing

Let us represent the given information in the following Venn diagram.

Given, $n = 150$ and $F = \frac{6\mu}{10}$

$$g = \frac{1}{3} \times \frac{6\mu}{10} = \frac{2\mu}{10}$$

passed in marketing = M
out of them 1/3rd failed in Finance.
i.e., passed only in Marketing = b.
$\therefore b = \frac{1}{3}M \Rightarrow g = \frac{2}{3}M$
$\therefore g = 2b$

$$b = \frac{\mu}{10}$$

Among the students who passed in Finance, 33⅓% passed in Marketing also.

$$\therefore g = \frac{a+g}{3} \Rightarrow a = 2g \Rightarrow a = \frac{4\mu}{10}$$

$$a + b + g = \frac{4\mu}{10} + \frac{\mu}{10} + \frac{2\mu}{10} = \frac{7\mu}{10}$$

$a + b + g + n = \mu$

$$\frac{7\mu}{10} + 150 = \mu$$

$$\frac{3\mu}{10} = 150 \Rightarrow \mu = 500$$

$\therefore b = 50$, $a = 200$, $g = 100$, $n = 150$

5. There are 500 students in the class.

6. There are 200 students, who failed in Finance only.
$\therefore b = 50 = 10\%$ of μ

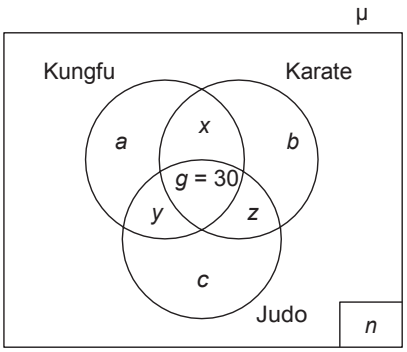
7. The students who failed in at least one subject are a, b and n.
n is decreased by 60%, i.e., these 60% of n passed in at least one of the subjects.

$$\therefore n = \frac{60 \times 150}{100} = 90$$

$a + b$ increased by 20%, i.e., these 20% = (50) is transferred from n.
$\therefore$ The remaining 40 (transferred from n) is added to g.
$g = 100 + 40 = 140$.

8. The number of students who failed in exactly one subject = $a + b$.
g is increased by 60. This 60 is transferred from a and b.
Failed only in Marketing, $a = 200$.
By transferring 60 from a alone, the value of a will be the least.
$\therefore a = 140$, i.e., 28% of μ

Solutions for questions 9 to 13: Let us represent the given information in the following Venn diagram.



It is given that half of the students learn exactly one martial art.

$$\therefore a + b + c = \frac{\mu}{2} \rightarrow (A)$$

Half of the students learning Karate are not learning any other martial art.
$\therefore b = x + g + z \rightarrow (B)$
The number of students learning all the three arts = $\frac{50}{3}$% of those who learn exactly two.

$$g = \frac{50}{3} \times \frac{x+y+z}{100} = \frac{x+y+z}{6} \Rightarrow x + y + z = 6g \rightarrow (C)$$

and also, it is given that $g = \frac{1}{3}n \Rightarrow n = 3g$

As $a + b + c = \frac{\mu}{2}$, $x + y + z + g + n = \frac{\mu}{2}$

$$6g + g + 3g = \frac{\mu}{2} \Rightarrow g = \frac{\mu}{20}, x + y + z = \frac{6\mu}{20}, n = \frac{3\mu}{20}$$

9. It is given that $g = 50 \Rightarrow \mu = 20 \times 50 = 1000$ and $a + b + c = \frac{1000}{2} = 500$

10. It is given that $n = 30 \Rightarrow \mu = 200$ then $(b + x + g + z)_{max} = ?$

$$x + y + z = \frac{6 \times 200}{20} = 60$$

$(x + z)_{max} = 60$, $g = \frac{\mu}{20} = 10$ ($\because y_{min} = 0$)

From (B), $b_{max} = (x + z)_{max} + g = 70$
The maximum possible number of students who learn Karate = 70 + 70 = 140.

11. The value of $a + x + y + g$ can be maximum, when a is maximum and x, b, c and z are minimum, i.e., $c = 0$, $z = 0$ but, b cannot be zero.
($\because b = x + g + z$)

$$g = \frac{\mu}{20} = 25, b_{min} = 25 \text{ and } x = 0$$

$$a + b + c = \frac{\mu}{2} = 250$$

$a_{max} + b_{min} + c_{min} = 250$
$a_{max} = 250 - 25 - 0 = 225$

$x + y + z = \frac{6\mu}{20} = \frac{6 \times 500}{20} = 150$

As $x = 0$ and $z = 0$, $y = 150$.

∴ The maximum possible number of students who learn Karate = $a + x + y + g = 225 + 0 + 150 + 25 = 400$.

12. It is given that $x + y + z = 90 \Rightarrow \frac{6\mu}{20} = 90 \Rightarrow \mu = 300$.

13. It is given that $\mu = 600$

$b + x + z + g = 150$

$\Rightarrow x + z + g = 75$ and $b = 75 \Rightarrow x + z + \frac{\mu}{20} = 75$

$\Rightarrow x + z = 75 - 30 = 45$ and we have $x + y + z = \frac{6\mu}{20} = 180$

$\therefore y = 180 - 45 = 135$

14. From the 15 – 34 years age category in the table:
Number of males who do not read either BW or BT
= 265 – [175 + 105 – 40] = 25

15. Total BT readers = Total males + Females reading BT = 380 + 250 = 630.
Number of BT readers over 15 years = 225 + 185 = 410
∴ The percentage of BT readers over 15 years

$$= \frac{410}{630} \times 100 = 65\%$$

16. Females who do not read any of the 2 magazines
in < 15 years group = 115 – [65 + 65 – 130] = 15
15 – 34 years group = 190 – [125 + 85 – 50] = 30
> 35 years group = 195 – [135 + 100 – 45] = 5
∴ The percentage of females (below 15 years) who do not read any magazine

$$= \frac{15}{15+30+5} \times 100 = 30\%$$

Solutions for questions 17 to 20: This is a 5-set / variable Venn diagram puzzle, which can be solved without illustrating the sets – P, SW, D, S, K.

Let us assume that:

X denote – Number of students engaged in <u>exactly 1</u> activity.

Y denote – Number of students engaged in <u>exactly 2</u> activity.

Z denote – Number of students engaged in <u>exactly 3</u> activity.

A denote – Number of students engaged in <u>exactly 4</u> activity.

B denote – Number of students engaged in <u>exactly 5</u> activity.

Note the following for a n-set Venn diagram:

name of the region (pocket of intersection of the sets)	number of regions (pockets of intersections of the sets)	For a 5-set situation
Exactly 1, X	$^nC_1$	5
Exactly 2, Y	$^nC_2$	10
Exactly 3, Z	$^nC_3$	10
Exactly 4, A	$^nC_4$	5
Exactly 5, B	$^nC_5$	1
None, N	$^nC_0$	1
Total number of regions	2^n	32

note: $^nC_r = \frac{n!}{(n-r)!r!}$ and $^nC_r = {}^nC_{n-r}$

From the given information, we have the following:

$$X + Y + Z + A + B + N = 1000$$

Also, $X = N = 0$ (a)

$$\text{So, } Y + Z + A + B = 1000 \quad (1)$$

Also, it is given that:

$$Y = 3Z \quad (2)$$

Since there are 10 pockets of Y and the above Equation (2) is based on the given information that each of the pockets in Y is three times that of each of the pockets in Z.

This is possible only if all the pockets in Y are equal and all the pockets in Z are equal.

$$B = \frac{A}{3} \quad (3)$$

Substituting (2) and (3) in (1), we get

$$Z + B = 250 \quad (4)$$

17. B = 100 ⇒ From (4), Z = 150 and
From (2), Y = 450,
Hence, each pocket in Y is 45.

18. $Z = \frac{3}{2}B$ or $B = \frac{2}{3}Z$

⇒ From (4), Z = 150, B = 100 and
From (2) and (3), Y = 450, A = 300
Choice (A) — Any one pocket of Exactly 3 is true $= \frac{150}{10} = 15$
Choice (B) — is true.
Hence Both A and B are true

19. P = 750
SW = 800
D = 400
S = 900
K = 600
These numbers imply that
X + 2Y + 3Z + 4A + 5B = 3450

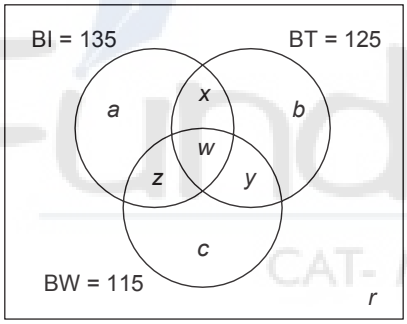
Or 9Z + 17B = 3450 → (5), From (a), (2) and (3)
Solving (4) and (5), we get
B = 150, Z = 100 and A = 450, Y = 300
Choice (A) — Any one pocket of Exactly 4 = $\frac{450}{5} = 90$
Choice (B) — Y = 300 is true.
Choice (C) — Z = 100 > 90 is false.
Choice (D) — B = 150 is true.

20. From (5) in the previous question,
$9Z + 17B = 2700 + x$;
$x \rightarrow$ Number of students
From (4), $Z + B = 250$ engaged in painting
Solving the above two equations,
$8B = 450 + x$

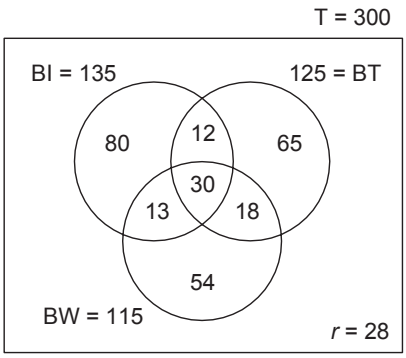
Or $B = \frac{1}{8}(450 + x)$

Hence, B is a multiple of 8.
So, from the choices only $x = 270$ satisfies.

Solutions for questions 21 to 24: Referring to the Venn diagrams given below, we derive the following:



Also, $w = 30$ (1)
$x + w = 42$ (2)
$y + w = 48$ (3)
$z + w = 43$ (4)
So, we get $x = 12$; $y = 18$; $z = 13$
Redrawing the diagram, we get:



Number of respondents reading at least one magazine
= 135 + (125 – 42) + (115 – 43 – 18) = 272.
Number of respondents reading none of the magazines
= T = 300 – 272 = 28.

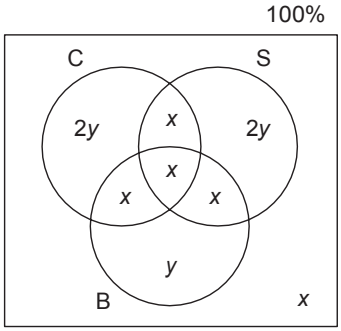
21. Business India or Business World is
80 + 12 + 13 + 30 + 54 + 18 = 207.

22. When 7 respondents reading Business India alone, start reading a second magazine also, it does not affect the number of respondents reading Business India because those 7 respondents read Business India plus one more magazine.
But, when 5 people who read Business India alone stop even reading that magazine, then the number of respondents reading Business India will come down by 5. Hence, the answer is 130.

23. The respondents, who shift from Business India to Business Today can be from those who were previously reading Business India alone or Business India and Business World alone. If we want the maximum number of respondents reading Business India alone (which was 80 initially) after the shift, the least number should shift from the category 'Business India alone', i.e., the maximum possible number should shift from the category 'Business India and Business World alone'. In this category, there are 13 respondents and maximum number of shifting means 13 respondents are shifting. Since the total number of respondents shifting is 15, at least 2 respondents reading Business India alone should shift. Hence, the maximum number of respondents reading Business India after the shift = 80 – 2 = 78.

24. By the similar logic which is explained in the above problem, the maximum number of respondents reading Business India and Business World will come if the maximum number of respondents reading Business India and Business Today alone shift and that is 12. So, the maximum number of respondents reading Business India and Business World = 43 + 12 = 55 (Because already, 30 + 13 = 43 respondents read Business India and Business World).

Solutions for questions 25 to 27:



The first three statements can be represented as shown in the diagram, and hence, $5x + 5y = 100$
(because we have taken x and y as percentages)
or $x + y = 20$ (1)
From the fourth condition, we get $(y + 3x) = B$
i.e., $y = 3x$ (2)

From equations (1) and (2), we get
$x = 5\%$ and $y = 15\%$

25. $y = 15\% = 150$.
Hence, total number % of residents

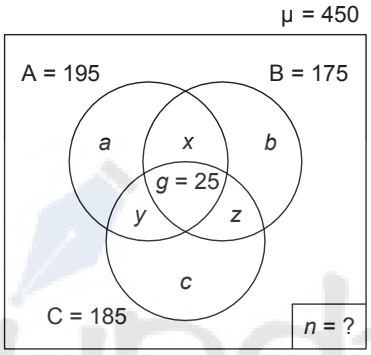
$$= x = \frac{150 \times 100}{15} = 1000$$

26. $x = 5\% = 15$

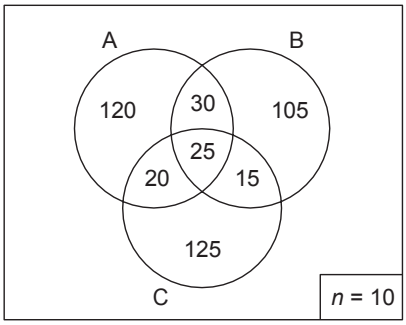
Hence, total $= \frac{15}{0.05} = 300$

27. $2y + 2y + x = 65\%$

Solutions for questions 28 to 30: The given data can be taken in the form of Venn diagram as follows.



Given, $x + g = 55 \Rightarrow x = 30$,
$z + g = 40 \Rightarrow z = 15$
$y + g = 45 \Rightarrow y = 20$
$\therefore A = a + x + y + g = 195$
$\Rightarrow a + 30 + 20 + 25 = 195 \Rightarrow a = 120$
Similarly, $b = 105$, $c = 125$ and $n = 10$
$\therefore$ The complete Venn diagram is as follows.



28. 10 employees of Club A did not withdraw from it, but 15 members of A withdrew from their membership.
$\therefore$ Members of Club A = 195 − 15 = 180.

29. These 50 can be taken from b or x. The value taken from b gets added to c and the value taken from x gets added to y.
$\therefore$ To maximize $y + g$, take 30 from x.
$y + g = 20 + 25 + 30 = 75$.

30. These 20 can be taken from a or x. The value taken from a is shifted to c and the value taken from x is shifted to z. To minimize the number of members of clubs A and B, take as much value as possible from x. The entire 20 can be taken from x.
$\therefore$The minimum possible number of employees who are members of clubs A and B = (x + g) − 20 = 35

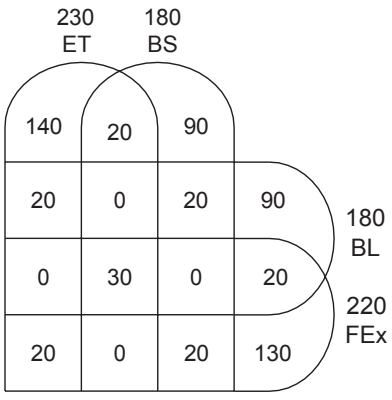
Solutions for questions 31 to 33: Out of the four newspapers, reading exactly two newspapers is possible in six different combinations.

(${}^4C_2 = 6$. They are ET – BS; ET – BL; ET – FE; BS – BL; BS – FE and BL – FE). Since each of these is 20 students, number of students reading exactly 2 newspapers = 6 × 20 = 120.

Also, there is nobody who reads exactly three out of the four newspapers. There are 30 students who read all the four newspapers.

To get the number of students reading one particular newspaper alone, we have to subtract 3 times 20 (because students reading two newspapers is 20 in number and for each newspaper, there will be three ways of pairing with one more newspaper) and 30 (which is the number of students reading all four newspapers).

Number of students reading only ET
= 230 – 3 × 20 – 30 = 140.
Number of students reading only BS
= 180 – 3 × 20 – 30 = 90.
Number of students reading only BL = 180 – 3 × 20 – 30 = 90.
Number of students reading only FE
= 220 – 3 × 20 – 30 = 130.
Total number of students reading exactly one newspaper = 140 + 90 + 90 + 130 = 450.
Total number of students reading at least one newspaper = 450 + 120 + 30 = 600.
This represents 80% of the total number of the students.
So, total number of students = 600/0.8 = 750
$\therefore$ Number of students who do not read any newspaper = 0.2 × 750 = 150
This set can be solved with the help of the following diagram.

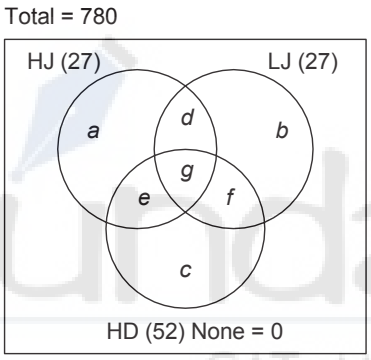


31. 150 students do not read any news paper.

32. Number of Business Standard students reading at least one more newspaper
= Exactly two newspapers + All four newspapers
= 3 × 20 + 30 = 90
As a percentage of all the students reading Business Standard, this is $\frac{90}{180} \times 100 = 50\%$

33. Least increase in the number of students who read all newspapers will come only if each student reads exactly one additional newspaper.
But, since the number of students who read exactly three newspapers is zero, there will not be any addition to the figure of 30 students who read all four newspapers.
Hence, the answer is 30.

Solutions for questions 34 to 36:

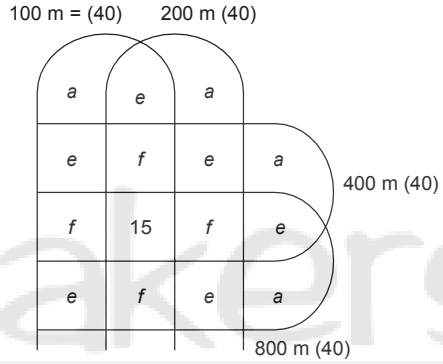


34. $a + b + c = 51$
$HJ + LJ + HD - 2(d + e + f) - 3g = 51$
$2(d + e + f) + 3g = 27 + 27 + 52 - 51 = 55$
$d + e + f$ is maximum when g is minimum.
When $g = 0$, $d + e + f$ is not an integer.
When g is 1, $d + e + f = 26$
∴ The maximum possible number of students who participated in exactly two of the three events is 26.

35. $a + b + c \geq d + e + f \geq g$
$27 + 27 + 52 - (2(d + e + f) + 3g) \geq d + e + f$ and $d + e + f \geq g$
$3(d + e + f + g) \leq 106$ and $d + e + f \geq g$
$d + e + f + g \leq 35\frac{1}{3}$ and $d + e + f \geq g$
$g + g \leq d + e + f + g \leq 35\frac{1}{3}$
$g \leq \frac{106}{6}$
As g is an integer, max(g) = 17
∴ The maximum possible number of students who participated in all the three events is 17.

36. $d + e + f + g = 26$
$n = 27 + 27 + 52 - (d + e + f + 2g) = 106 - (26 + g) = 80 - g$
N is minimum when g is maximum
Maximum value of g is 26.
∴ Minimum value of n = 54

Solutions for questions 37 to 40: 40 students participated in each of the 400 m dash and 800 m dash ----(1)
No participant of the 3000 m dash participated in the 100 m dash -----(2)
No participant of the 1500 m dash participated in the 200 m dash ----(3)
60 students participated in each of 1500 m dash and 3000 m dash----(4)
From (2), (3) and (4), 40 students participated in each of 100 m dash and 200 m dash------(5)
From (1), (5) and the given data, we obtain the diagram below.



37. $a + 3e + 3f + 15 = 40$
$a + 3(e + f) = 25$
Here, a is maximum when $e + f$ is minimum, i.e., 0
max(a) = 25
The maximum possible number of students who participated in only the 400 m dash is 25.

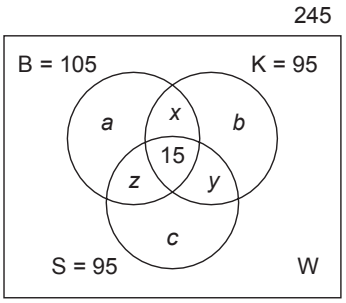
38. The number of students who participated in the 100 m dash, 200 m dash and 150 m dash = f + 15.
From the previous solution, $a + 3(e + f) = 25$
f is maximum when e and a are both minimum.
Min(e) = 0 and min(a) = 1
∴ Max(f) = 8
The maximum possible number of students who participated in the 100 m dash, 200 m dash and 400 m dash = 8 + 15 = 23.

39. 16 students participated in only the 100 m dash.
All the other students who participated in the 100 m dash participated in atleast one other.
24 students participated in the 100 m dash and atleast one other.

40. $16 + 3(e + f) + 15 = 40$
$e + f = 3$
Number of students who participated in only the 100 m dash and 200 m dash = e
Max(e) = 3

Exercise-3

Solutions for questions 1 to 3:



$x + y + z = 3w$, $a + b + c = 190$

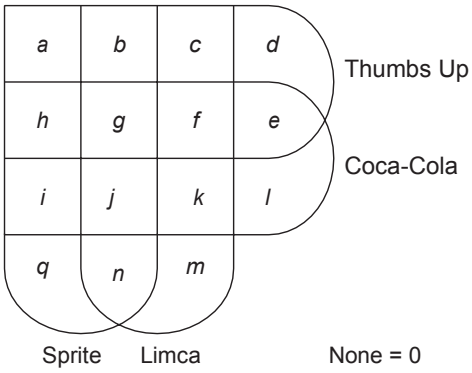
We have: $105 + \{95 - (x + 15)\} + \{95 - (y + z + 15\} + w = 245$
$\Rightarrow x + y + z - w = 20$
$2w = 20$
$\Rightarrow w = 10$
$x + y + z = 30$

1. $S + K - (S \cap K) = S \cup K$
$95 + 95 - p = 165$
Here, p = (only S and K) + (S, K and B) = $y + 15$
$p = 25$
Since S, K and B = 15, $y = 25 - 15 = 10$.

2. $105 + 95 - q = 180$
Here, $q = x + 15$ = (only B and K) + (S, K and B)
$q = 20$
Hence, $x = 20 - 15 = 5$
So, $y + z = 30 - 5 = 25$
Only Somnath = $95 - 15 - (y + z)$
$= 95 - 15 - 25 = 55$

3. Given $z = 0$
Only Kedarnath = $95 - 15 - x - y$
$= 95 - 15 - 30 = 50$

Solutions for questions 4 to 7:



The given information is as follows.
$h + g + f + e = 65$
$a + b + g + h = 77$
$g + f + j + k = 73$
$b + c + g + f = 76$
$h + g + i + j = 74$
It is also given that $h = f = x$ (assume)
$b = j = y$ (assume)
$\therefore$ The equations we can be written in the following way.

$g + 2x + e = 65$ **(i)**
$g + x + y + a = 77$ **(ii)**
$g + x + y + k = 73$ **(iii)**
$g + x + y + c = 76$ **(iv)**
$g + x + y + i = 74$ **(v)**

The other information given is:
Exactly 1 = $67 = d + l + m + q$
$i = 14$
$e = 15$
$n = 10$

Exactly 1 + 2 Exactly 2 + 3 Exactly 3 + 4 Exactly 4 = 557 **(vi)**

Now substituting the value of i in equation (v), we get:

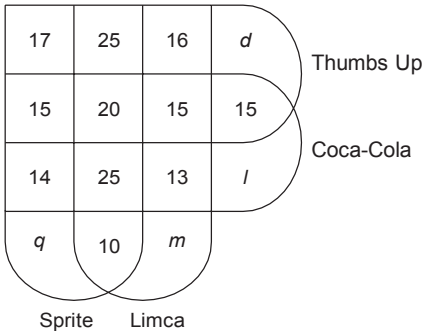
$g + x + y = 60$ **(vii)**

Now from (vii), substituting the value of $g + x + y$ in equation (ii), (iii) and (iv), respectively, we get
$a = 17$
$k = 13$
$c = 16$
$\therefore$ Exactly 2 = $17 + 14 + 10 + 13 + 15 + 16 = 85$
Exactly 3 = $2(x + y) = 2(60 - g)$.
Substituting the above values in equation (vi), we get:
$67 + 2 \times 85 + 3 \times 2\ (60 - g) + 4g = 557$
$\Rightarrow 67 + 170 + 360 - 6g + 4g = 557$
$\Rightarrow 597 - 557 = 2g$
$\Rightarrow g = 20$

Now substituting the values of e and g in equation (i), we get:
$20 + 2x + 15 = 65$
$\Rightarrow 2x = 30$
$\Rightarrow x = 15$
Now, from equation (vii), we get

$y = 60 - 15 - 20 = 25$

$\therefore$ The final Venn diagram will be as follows:



4. The number of students who like both Sprite and Limca but not all the four = 2y + n = 25 × 2 + 10 = 60.

5. The total number of students
= Exactly 1 + Exactly 2 + Exactly 3 + Exactly 4
= 67 + 85 +2(15 + 25) + 20
= 67 + 85 + 80 + 20 = 252

6. The number of students who like only Coca-Cola and Limca is 13.

7. Given, $d + q = 25$

$m + l = 67 - 25 = 42$

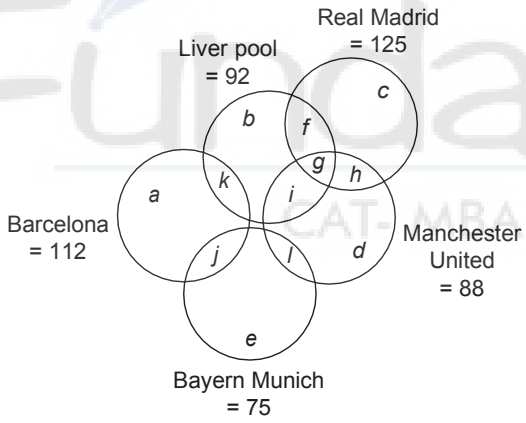
$\therefore$ The required number of students

$= 25 + 20 + 25 + 10 + m + 13 + 15 + 16 + 15 + 14 + 15 + l$

$= 168 + l + m$

$= 168 + 42 = 210$

Solutions for questions 8 to 12: From the given information it is clear that the set of people who like Barcelona has no intersection with Real Madrid or Manchester United. Similarly, the set of people who like Bayern Munich has no intersection with Liverpool or Real Madrid. Intersection between other sets of people is possible. Thus, we get the following Venn Diagram.



From (i), $h + g = 57$ and from (ii), $g = 10$ and $b = 10$
Hence, $h = 47$
From (ii), j = h= 47 and $j = k + 4$
Hence, $k = 43$
From (iv), $l = f = 1/3$ of c
It is given that Real Madrid = 125.
We know that $h = 47$ and $g = 10$.
Hence, $c + f = 68$.
Since, $f = 1/3$ of c, $f = 17$ and $c = 51$. Thus $l = 17$.
a = Barcelona - (j + k) = 22
e = Bayern Munich – (j + l) = 11
i = Liverpool – (b + f + g + k) = 12
d = Manchester United – (g + h + i + l) = 2

8. Exactly two clubs = $f + i + l + j + k$ = 183.

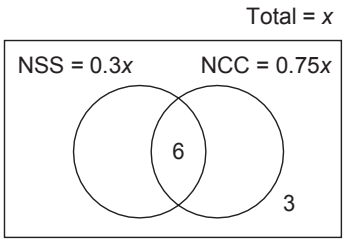
9. Only Bayern Munich or only Barcelona = a + e = 33

10. Manchester United but not Liverpool = $h + d + l$ = 66

11. Exactly one club = a + $b + c + d + e$ = 96

12. No one among the Barcelona fans likes at least two more clubs.

Solutions for questions 13 to 16:



If x is the total number of students in the class, then the number of students participating in NSS and NCC is $0.3x$ and $0.75x$, respectively.
Then, $\{0.3x + 0.75x - 6\} + 3 = x \Rightarrow 0.05x = 3 \Rightarrow x = 60$

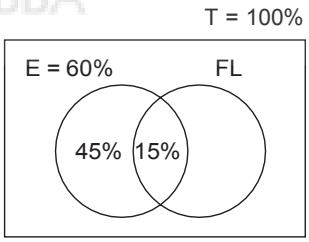
13. Total number of students = x = 60

14. Percentage of students who want to participate only in NSS = $30\% - \frac{6}{60} \times 100 = 20\%$

15. Only in one programme
= 20% only in NSS + 75% - 6/60 × 100
Only in NCC = 85%.

16. At least in one programme = Total − Number of students participated in neither of these two
⇒ 60 – 3 = 57

Solutions for questions 17 to 20:



- 25% of 60%, i.e., 15% of the school passed in both English and foreign language.
- Since 66 ⅔ % of the students who passed in foreign language failed in English, 33 ⅓ % of students who passed in foreign language passed in English also, i.e., ⅓ Foreign Language = 15%

⇒ Foreign language = 45%
So, we have only passed in (English) = 60 − 15 = 45%,
Only foreign language passed = 45 − 15 = 30%
Passed both in English and foreign language = 15%
A total of 90% passed in at least one of the subjects.
So, 10% failed in both.
Number of students in the school = $\frac{2}{0.10}$ = 200

17. 200

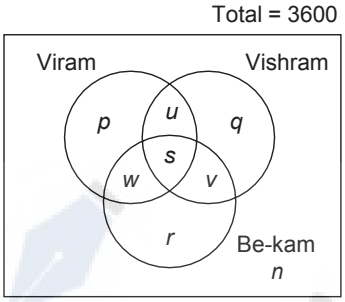
18. 45% + 30% = 75%

19. 20% of 15% = 3% increase in pass in both subjects.
Hence, the least value of pass only in English will come when all the new people who pass in both subjects are from the group which passed only in English.
45 – 3 = 42%

20. 40% of 20 students = 8 students. Out of this 4 students passed in exactly one subject. Hence, the remaining 4 students (which is 2% of the school strength) pass in both subjects.
So, pass in both the subjects = 15 + 2 = 17%.

Solutions for questions 21 to 25:

Representation of various segments as in the following diagram:



Members of at least two Unions = $u + v + w + s = 500$ (1)
Vishram members = $q + s + u + v = 1400$ (2)
Only Viram and Be-kam = $w = 100$ (3)
Vishram and Be - kam = $s + v = 200$ (4)
Only Be - kam = $r = 550$ (5)

Members of Viram who are members of only one more union = $w + u = 20\%$ of $(p + u + s + w)$ (6)
$u + v + w = \frac{1}{8}$ (Total workers) = 450. (7)
From (1), (3) and (4), $u = 200$.
From equation (2), we get
$q = 1400 - u - (s + v)$
$= 1400 - 200 - 200 = 1000.$
From (7), $v = 450 - 200 - 100 = 150$
From (4), $s = 200 - 150 = 50$
From (6), $p = 1150$
$n = 3600 - (p + q + r + s + u + v + w)$
$= 3600 - (1150 + 1000 + 550 + 50 + 200 + 150 + 100)$
$= 3600 - (3200) = 400$
Now, we have all figures and the questions can be answered.

21. $s = 50$.

22. $n = 400$.

23. $p + r = 1150 + 550 = 1700$.

24. Since 10 workers have given up their Be-kam membership and taken Vishram membership, it means these 10 workers were initially Be-kam members but not Vishram members, i.e., they must be a part of r or w. When they give up Be-kam and take up Vishram, they will move to q or u, respectively. So, s does not undergo any change at all. Hence, 50 is the answer.

25. $q + u = 1000 + 200 = 1200$

8 Cubes

Chapter

Learning Objectives

In this chapter, you will:

- Learn to visualize a cube and how to cut a cube across different axes.
- Be able to relate the number of cuts to the number of smaller cubes/pieces that arise.
- Understand the different colored faces which form a part of a bigger cube.
- Understand how to deal with questions based on folding and unfolding of a cube.
- Learn how to get a given number of pieces using minimum number of cuts and how to get maximum number of pieces using a given number of cuts.

A cube is a three-dimensional solid having 6 faces, 12 edges and 8 corners. All the edges of a cube are equal, and hence, all the faces are square in shape.

In competitive exams a few questions may be asked based on cubes.

The questions on cubes may belong to any one of the following categories.

1. A cube is cut by making certain specified number of cuts. The directions in which the cuts are made may or may not be given. We are to find the number of identical pieces resulting out of the given cuts.
2. The number of identical pieces, into which a cube is cut is given and we need to find the number of cuts.
3. A cube could be painted on all or some of its faces with the same colour or different colours and then cut into a certain specified number of identical pieces. Then questions of the form 'How many small cubes have 2 faces painted?'. 'How many smaller cubes have only one face painted?' could then be framed.

Solved Examples

Directions for questions 8.01 to 8.04: A cube is painted and cut into 343 smaller but identical pieces by the minimum possible number of cuts.

8.01: How many smaller pieces have exactly three painted faces?

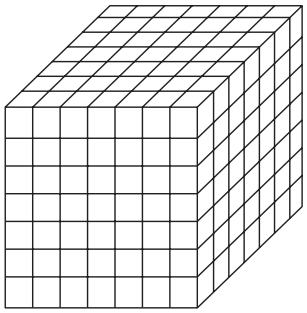
8.02: How many smaller pieces have exactly two painted faces?

8.03: How many smaller pieces have exactly one painted face?

8.04: How many smaller pieces have no painted face?

Solutions for questions 8.01 to 8.04: A cube's outer surface is painted and then it is cut into smaller pieces. Now the smaller pieces obtained have paint on some surfaces and the surfaces generated after the cut do not have any paint on them.

When a cube is cut into 343 smaller pieces by applying minimum number of cuts, it appears as follows



	The given cube 7 × 7 × 7 = 343	No. of smaller pieces which have	Generalisation $n \times n \times n$
1.	8 corner pieces	(i) exactly three painted surfaces	8 corner pieces
2.	5 pieces at each edge i.e. (7 - 2) × 12 edges = 60	(ii) exactly two painted surfaces	$(n - 2) \times 12$ $= 5 \times 12$
3.	25 pieces at the middle of each surface i.e. $(7 - 2)^2 \times 6$ surfaces = 150	(iii) exactly one painted surfaces	$(n - 2)^2 \times 6$ $= 5^2 \times 6$
4.	$5 \times 5 \times 5$ i.e., $(7 - 2)^3 = 125$	(iv) no painted surfaces	$(n - 2)^3 = 125$

Directions for questions 8.05 to 8.08: A cube is painted and cut into 210 smaller but identical pieces by making the minimum possible number of cuts.

8.05: How many smaller pieces have exactly three painted faces?

8.06: How many smaller pieces have exactly two painted faces?

8.07: How many smaller pieces have exactly one painted face?

8.08: How many smaller pieces have no painted face?

Solutions for questions 8.05 to 8.08: To cut a cube into 210 pieces i.e., 5, 6, 7 will be the number of pieces in each direction.

8.05: The number of pieces with exactly three painted surfaces is 8.

8.06: The number of pieces with exactly two painted surfaces:

For X-plane	4(5 - 2)+
For Y-plane	4(6 - 2)+
For Z-plane	4(7 - 2)+
Total =	48

8.07: The number of pieces with exactly one painted surface:

For X-Y plane	2(5 - 2)(6 - 2)+
For Y-Z plane	2(6 - 2)(7 - 2)+
For Z-X plane	2(7 - 2)(5 - 2)
Total =	94

8.08: The number of pieces having no painted face $= (5 - 2)(6 - 2)(7 - 2) = 60$

Directions for questions 8.09 to 8.14: A pair of opposite faces of a cube is painted is yellow, another pair of opposite faces, orange and the remaining two faces are painted white. The cube is then cut into 343 smaller but identical cubes.

8.09: How many of the smaller cubes have all the three colours on them?

8.10: How many of the smaller cubes have only white and orange on them?

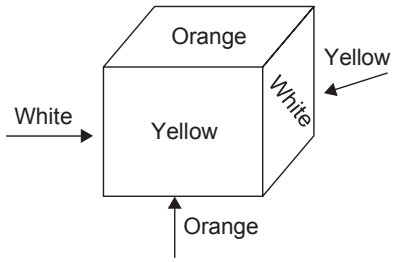
8.11: How many of the smaller cubes have exactly two colours on them?

8.12: How many of the smaller cubes have only white colour on them?

8.13: How many of the smaller cubes have exactly one colour on them?

8.14: How many of the smaller cubes have no colour on them?

Solutions for questions 8.09 to 8.14: The cube after cutting, has $7 \times 7 \times 7 = 343$ pieces. The patter of painting is as follows.



8.09: Since no two adjacent surfaces have the same colour, each corner piece has three painted faces and each face has a different colour. Hence the number of smaller cubes with all the three colours on them is 8.

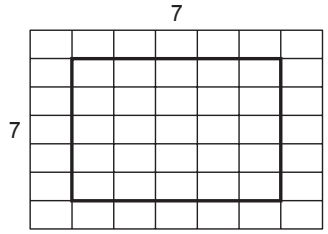
8.10: We find the smaller cubes with only white and orange colours on them at the edges which are common for white and orange surfaces. The number of smaller pieces with only white and orange on them is (white — orange edges) × 5 (at each edge) = 20.

Similarly, the number of small pieces with only white and yellow colours on them and those with only yellow and orange are 20 each.

8.11: The number of small pieces with exactly two colours is (20 + 20 + 20) = 60.

This can also obtained by applying the formula $(n - 2) \times 12$ i.e. $5 \times 12 = 60$.

8.12: We find that the smaller pieces with only white colour on them, are at the middle of the surfaces painted in white.



i.e. 5 × 5 = 25 pieces on one white surface × 2 = 50 pieces. Similarly, the number of small pieces with only blue colour and those with only yellow colour are 50 each.

8.13: The number of small pieces with exactly one colour is (50 + 50 + 50 = 150).

This car also be obtained by applying the formula $(n - 2)^2 \times 6$.

8.14: The number of small pieces with no colour on them is $(n - 2)^3$. i.e. $(7 - 2)^3 = 125$.

Exercise-1

Directions for questions 1 to 11: Select the correct alternative from the given choices.

1. What will be the maximum possible number of pieces when a cube is cut into 5 cuts?
(A) 18 (B) 6
(C) 25 (D) 5

2. What will be the maximum possible number of pieces when a cube is cut into 6 cuts?
(A) 37 (B) 36
(C) 42 (D) 27

3. What will be the maximum possible number of pieces when a cube is cut into 17 cuts?
(A) 250 (B) 160
(C) 270 (D) 294

4. What will be the maximum possible number of pieces when a cube is cut into 8 cuts?
(A) 36 (B) 48
(C) 45 (D) 40

5. What will be the maximum possible number of pieces when a cube is cut into 11 cuts?
(A) 100 (B) 90
(C) 84 (D) 54

6. What is the least possible number of cuts required to cut a cube into 80 identical pieces?
(A) 21 (B) 12
(C) 19 (D) 10

7. What is the number of ways in which two faces of a cuboid of dimensions 6 cm × 7 cm × 8 cm can be painted in green colour?
(A) 2 (B) 3
(C) 4 (D) 6

8. How many cubes of dimensions 1 cm × 1 cm × 1 cm are required to cover a cube of dimensions 7 cm × 7 cm × 7 cm completely?
(A) 169 (B) 294
(C) 386 (D) 488

9. How many cubes of dimensions 1 cm × 1 cm × 1 cm are required to cover a cuboid of dimensions 6 cm × 8 cm × 9 cm when it is placed at the corner of a room such that three faces of the cuboid are covered by two walls and the floor of the room?
(A) 288 (B) 261
(C) 198 (D) 448

10. 125 smaller cubes of dimensions 1 cm × 1 cm × 1 cm are stacked together to form a larger cube and then the cube is cut along two diagonals. How many of the smaller cubes are cut into smaller pieces?
(A) 10 (B) 25
(C) 45 (D) 50

11. 1000 smaller cubes of dimensions 1 cm × 1 cm × 1 cm are stacked together to form a larger cube and then the cube is cut along a diagonal. How many of the smaller cubes are cut into two pieces?
(A) 25 (B) 50
(C) 90 (D) 100

Directions for questions 12 to 14: These questions are based on the following information.
A large cube painted on all six faces is cut into 27 smaller but identical cubes.

12. How many of the smaller cubes have no faces painted at all?
(A) 0 (B) 1
(C) 3 (D) 4

13. How many of the smaller cubes have exactly one face painted?
(A) 3 (B) 6
(C) 12 (D) 15

14. How many of the smaller cubes have exactly two faces painted?
(A) 36 (B) 6
(C) 12 (D) 15

Directions for questions 15 to 17: These questions are based on the following information.
A large cube is painted on all six faces and then cut into a certain number of smaller but identical cubes. It was found that among the smaller cubes, there were eight cubes which had no face painted at all.

15. How many smaller cubes was the original large cube cut into?
(A) 27 (B) 48
(C) 64 (D) 125

16. How many small cubes have exactly one face painted?
(A) 12 (B) 24
(C) 16 (D) 32

17. How many small cubes have exactly two faces painted?
(A) 6 (B) 12
(C) 18 (D) 24

Directions for questions 18 to 20: These questions are based on the following information.

There is a cube in which one pair of adjacent faces is painted red, the second pair of adjacent faces is painted blue and a third pair of adjacent faces is painted green. This cube is now cut into 216 smaller but identical cubes.

18. How many small cubes are there with one face painted red?
(A) 64 (B) 81
(C) 60 (D) 120

19. How many small cubes are with both red and green on their faces?
(A) 8 (B) 12
(C) 16 (D) 32

20. How many small cubes are there showing only green or only blue on their faces?
(A) 64 (B) 72
(C) 81 (D) 96

Directions for questions 21 to 23: These questions are based on the following information.

A cube is painted in black and green, each on three faces such that any two faces with same colour are adjacent to each other. Now this cube is cut into 60 identical pieces using 2, 3 and 4 cuts parallel to different faces.

21. How many smaller pieces have exactly two faces painted in black?
(A) 5 (B) 9
(C) 18 (D) 27

22. How many smaller pieces have both the colours on them?
(A) 9 (B) 18
(C) 6 (D) 24

23. How many smaller pieces have no face painted?
(A) 6 (B) 9
(C) 11 (D) 1

Directions for questions 24 to 26: These questions are based on the following information.

Two opposite faces of a cube are painted in blue, another pair of opposite faces are painted green and the remaining faces are painted in red. The cube is now cut into 210 smaller but identical pieces using minimum possible number of cuts.

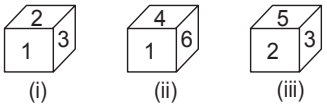
24. How many smaller pieces have exactly two colours on them?
(A) 48 (B) 36
(C) 24 (D) Cannot be determined

25. What is the maximum possible number of smaller piece, which have green and red colour on them?
(A) 20 (B) 24
(C) 26 (D) 28

26. What is the minimum possible number of pieces which have only blue colour on them?
(A) 24 (B) 12
(C) 30 (D) 60

Directions for questions 27 to 33: In each of the following questions, three different views of a cube are given. Based on these diagrams answer the following questions.

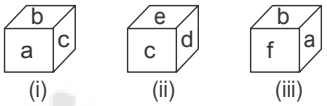
27. Which of the following statements is true?



(i) (ii) (iii)

(A) 3 is opposite to 6 (B) 5 is opposite to 4
(C) 4 is opposite to 3 (D) D is opposite to 2

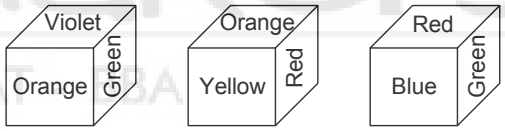
28. Which of the following indicates the correct pair of opposite faces?



(i) (ii) (iii)

(A) a – d (B) a – f
(C) f – e (D) b – d

29. Which colour is at the bottom of the second figure?



(i) (ii) (iii)

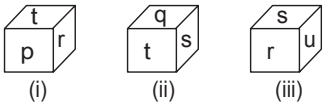
(A) Blue (B) Green
(C) Orange (D) Red

30. Which of the following are adjacent to Δ?

(i) (ii) (iii)

(A) *, # (B) ↑, #
(C) o, ↑ (D) o, #

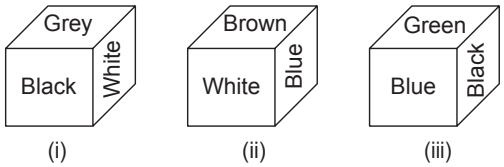
31. Which of the following are opposite to *r* and *t*, respectively?



(i) (ii) (iii)

(A) *u* and *q* (B) *p* and *s*
(C) *s* and *p* (D) *q* and *u*

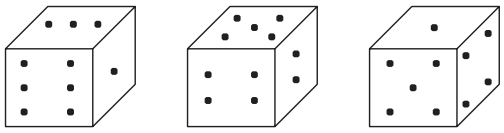
32. Which of the following is at the bottom of figure (i)?



(i) (ii) (iii)

(A) Blue (B) Green
(C) Black (D) Brown

33. What is the sum of the dots on the two faces which are adjacent to both the faces with two dots and five dots, if the number of dots on the six faces is 1, 2, 3, 4, 5 and 6, respectively?

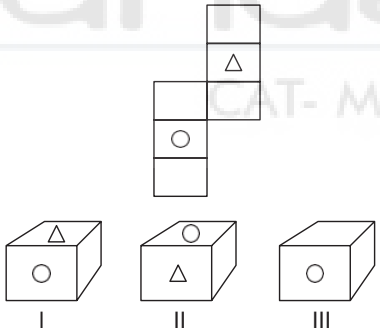


(i) (ii) (iii)

(A) 10 (B) 7
(C) 5 (D) 4

Directions for questions 34 and 35: In the following questions the figure is folded to form a box. Select from among the given alternatives, the box or boxes that can be formed by folding the figure.

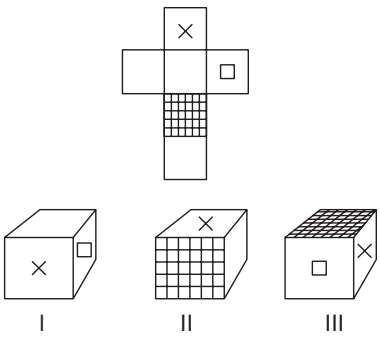
34.



I II III

(A) Only I (B) Only II
(C) Only I and II (D) Only III

35.

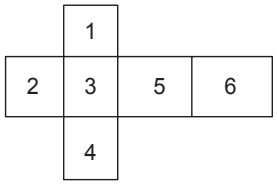


I II III

(A) Only I
(B) Both II and III
(C) Both I and III
(D) All of them

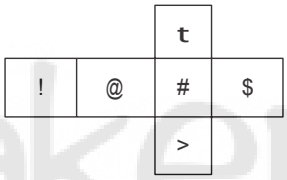
Directions for questions 36 to 40: Select the correct alternative from the given choices.

36. If the following figure is folded to form a cube, then what is the number on the face opposite to the face marked 3?



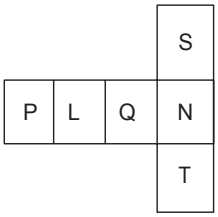
(A) 6 (B) 5
(C) 1 (D) 2

37. If the following figure is folded to form a cube, then what is the symbol on the face opposite to the face marked '@'?



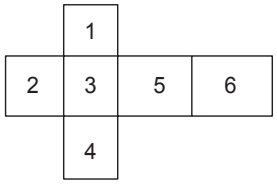
(A) ! (B) ↑
(C) > (D) $

38. If the following figure is folded to form a cube, what would be the letter on the face opposite to the face maked 'L'?



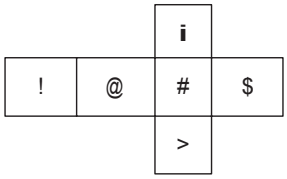
(A) Q (B) N
(C) T (D) S

39. If the following figure is folded to form a cube, then what is the number on the face opposite to the face marked 3?



(A) 6 (B) 5
(C) 1 (D) 2

40. If the following figure is folded to form a cube, then what is the symbol on the face opposite to the face marked '@'?



(A) ! (B) ↑
(C) > (D) $

Exercise-2

Directions for questions 1 and 2: Select the correct alternative from the given choices.

1. 216 small and identical cubes are placed together to form a big cube. What is the number of small cubes that get cut when the big cube is cut by one diagonal cut and two diagonal cuts, respectively?

(A) 64, 70 (B) 36, 70
(C) 36, 72 (D) 70, 64

2. 729 small and identical cubes are placed together to form a big cube. What is the number of small cubes that get cut by one diagonal cut and two diagonal cuts, respectively?

(A) 85, 150 (B) 81, 105
(C) 82, 162 (D) 81, 153

Directions for questions 3 to 7: These questions are based on the following information.

A cube is painted in such a way that a pair of adjacent faces is painted in green; a pair of opposite faces is painted in yellow and another pair of adjacent faces is painted in red. This cube is now cut into 125 small but identical cubes.

3. How many small cubes have exactly two faces painted in green?

(A) 10 (B) 7
(C) 5 (D) 8

4. How many small cubes have at least two different colours on their faces?

(A) 30 (B) 38
(C) 36 (D) 42

5. How many of the small cubes have exactly one colour on them?

(A) 60 (B) 45
(C) 54 (D) 15

6. How many of the small cubes do not have green colour but have yellow or red colours on them?

(A) 40 (B) 75
(C) 80 (D) 53

7. How many small cubes have exactly two painted faces and have exactly two colours on them?

(A) 36 (B) 30
(C) 24 (D) 34

Directions for questions 8 to 11: These questions are based on the following information.

One face of a cube is painted in green, two faces are painted in yellow and three faces are painted in white. This cube is now cut into 512 small but identical cubes.

8. What is the minimum possible number of small cubes that have two faces painted in yellow?

(A) 0 (B) 9
(C) 7 (D) 16

9. What is the maximum possible number of smaller cubes that have only green and yellow colours on them?

(A) 12 (B) 6
(C) 14 (D) 13

10. What is the maximum possible and the minimum possible number of small cubes, respectively that have exactly one colour on them?

(A) 241, 228 (B) 234, 228
(C) 241, 234 (D) 241, 226

11. What is the least possible number of small cubes that have at least two painted faces but have only white colour on them?

(A) 18 (B) 15
(C) 17 (D) 12

Directions for questions 12 to 16: These questions are based on the following information.

A cube is painted such that one of its faces is painted in black, one face is painted in white and one face is painted in red. The other three faces are left unpainted. The cube is now cut into 729 small and identical cubes.

12. What is the maximum possible number of small cubes that have all the three colours on them?

(A) 1 (B) 2
(C) 4 (D) 5

13. What is the minimum possible number of small cubes that have only black and white colours on them?
(A) 1 (B) 5
(C) 6 (D) 0

14. What is the minimum possible number of small cubes that have only red colour on them?
(A) 72 (B) 81
(C) 63 (D) 80

15. How many small cubes have white colour on them?
(A) 75 (B) 85
(C) 72 (D) 81

16. What is the minimum possible number of small cubes that have no colour on them?
(A) 343 (B) 512
(C) 504 (D) 269

Directions for questions 17 to 19: These questions are based on the following information.

A cube has all the six faces painted in six different colours, such as white, blue, red, yellow, green and pink in such a way that pink and green are on two opposite faces. The cube is placed on a table with the pink face touching the top of the table. Red is facing you, whereas white and blue faces are opposite to each other. The cube is cut into 120 identical pieces by making the least number of cuts possible where all the cuts are parallel to the faces of the cube. The least number of possible cuts are made in the horizontal direction and maximum number of possible cuts are made parallel to the red face.

17. How many small pieces have white colour on their faces?
(A) 36 (B) 42
(C) 30 (D) 24

18. How many small pieces have at least two different colours on their faces?
(A) 44 (B) 28
(C) 38 (D) 30

19. How many small pieces have no colour on their faces?
(A) 42 (B) 24
(C) 36 (D) 27

Directions for questions 20 to 22: These questions are based on the following information.

Two identical wooden cubes P and Q placed on a table facing you, have their faces painted as follows. One pair of opposite faces of cube P is painted with the same colour, i.e., red colour and another pair of opposite faces is painted blue. One of the remaining faces is painted yellow, whereas the other one is painted brown.

One pair of opposite faces of cube Q is painted blue. A second pair of opposite faces of Q are painted in such a way that the opposite face of brown is green. The other two opposite faces are painted black and yellow, respectively. In the following questions, 'two faces touch each other' implies that the complete area of one face touches the complete area of the second face.

20. The two cubes are placed next to each other on the table touching each other such that, whether the positions of P and Q are interchanged or left as they are, the two faces of P and Q touching each other are of the same colour. If the top faces of both P and Q have to be of the same colour, then which of the following must be true?
(A) The front faces of cube P and Q are red and yellow, respectively.
(B) The two faces of cube P and Q which are touching the table top are of brown and black colours, respectively.
(C) The front face of cube P is of red colour.
(D) The top faces of cubes P and Q are of red and yellow colours, respectively.

21. Q is placed on the top of P such that no blue face of eithere cube is horizontal. If brown and blue are the front faces of P and Q, respectively, then which of the following statements must be false?
(A) The faces of the two cubes touching each other are of red and green colour.
(B) The faces of two cubes which are touching each other are of red and brown colours.
(C) If blue and green are the colours on the right side faces of two cubes, respectively, then the left side faces of two cubes will be blue and brown, respectively.
(D) The faces of the two cubes which are touching each other are yellow and brown.

22. If cube Q is kept behind cube P in such a way, that the yellow face of P faces the brown face of cube Q and the faces touching the table are of red and black colours, then which faces of both the cubes have same colour?
(A) Top faces
(B) Top and bottom faces only.
(C) The faces to the left and the right only.
(D) Both top and front faces only.

Directions for questions 23 to 25: These questions are based on the following information.

Two colours, red and blue are used to paint a cube. Red is painted on three faces, each of which is adjacent to the other two and blue is painted on the remaining faces. Assume that one can see exactly three faces when the cube is kept on a plane.

23. What is the total number of ways in which the blue colour is not seen at all when the cube is kept on a table?
(A) 4 (B) 3
(C) 2 (D) 1

24. What is the total number of ways in which exactly one face painted blue is seen?
(A) 2 (B) 4
(C) 3 (D) 5

25. What is the total number of ways in which exactly two faces painted blue are seen?
(A) 3 (B) 2
(C) 5 (D) 1

Directions for questions 26 and 27: These questions are based on the following information.

Two faces of a cube are painted red, two faces are painted green and the remaining faces are painted blue. Now the cube is cut into 216 smaller but identical pieces with minimum possible number of cuts.

26. What is the minimum possible number of smaller pieces with exactly two different colours on them?
(A) 36 (B) 42
(C) 48 (D) 56

27. What is the maximum possible number of smaller pieces which have at most one colour on them?
(A) 160 (B) 172
(C) 198 (D) 208

Directions for questions 28 to 30: These questions are based on the following information.

Three different faces of a cube are painted in three different colours, such as red, green and blue. This cube is now cut into 216 smaller but identical cubes.

28. What are the least and the largest numbers of small cubes that have exactly one face painted?
(A) 75 and 86 (B) 64 and 81
(C) 64 and 72 (D) 75 and 84

29. What is the maximum number of small cubes that have one face painted green and one face blue and no other face painted?
(A) 2 (B) 4
(C) 6 (D) 8

30. What are the least and the maximum numbers of cubes that have no face painted at all?
(A) 125 and 130 (B) 120 and 125
(C) 115 and 120 (D) 100 and 125

Directions for questions 31 to 34: These questions are based on the following information.

Each face of a cube is painted in green, red or blue.

31. Totally in how many different ways can the cube be painted?
(A) 49 (B) 56
(C) 64 (D) 81

32. In how many different ways can the cube be painted with at least two faces blue?
(A) 24 (B) 30
(C) 34 (D) 42

33. In how many different was can the cube be painted such that all three colours are there on the cube?
(A) 32 (B) 29
(C) 25 (D) 30

34. In how many different ways can the cube be painted such that no two adjacent faces have the same colour?
(A) 3 (B) 1
(C) 2 (D) 4

Directions for questions 35 to 37: These questions are based on the following information.

A cube is painted red, blue and green in such a way that each face is painted with a single colour and each colour is painted on two adjacent faces. The cube is placed on a table and one can see exactly three faces of the cube.

35. What is the total number of distinct corners from where red and blue colours are visible?
(A) 5 (B) 4
(C) 6 (D) 8

36. What is the total number of ways in which all three colours can be seen?
(A) 2 (B) 3
(C) 1 (D) 5

37. What is the total number of distinct possible combinations of three colours that can be seen?
(A) 8 (B) 9
(C) 7 (D) 6

Directions for questions 38 to 40: These questions are based on the following information.

Each face of a die is marked with a different number from 1 to 6. The numbers on the faces of the die are marked in such a way that the sum of the numbers on any pair of opposite faces is seven. Two such dice are thrown. Assume that one can always see exactly three faces of each die.

38. What is the total number of distinguishably different ways in which the sum of the numbers on the visible faces of both the cubes together is 20?
(A) 2 (B) 6
(C) 3 (D) 5

39. What is the total number of distinguishably different ways in which the sum of numbers on visible faces is exactly 10 on at least one die?
(A) 12 (B) 17
(C) 15 (D) 19

40. What is the total number of ways in which a specified number is visible on both the dice?
(A) 32 (B) 16
(C) 14 (D) 18

Exercise-3

Directions for questions 1 to 3: These questions are based on the following information.

A large cube is painted on only three of its faces with three different colours, such as red green and black. This cube is now cut into 125 smaller but identical faces.

1. What is the minimum number of cubes that have no face painted?

2. What is the maximum number of cubes that have exactly two faces painted?

3. What is the minimum number of cubes (respectively) that have exactly one face painted?

Directions for questions 4 to 6: These questions are based on the following data.

The faces of the cuboid are painted with three different colours, such as black, red, and yellow such that each colour is painted on at least one face. Now 4, 5 and 6 cuts are made in three different directions.

4. What is the maximum possible number of smaller pieces that have only black on their faces?

5. What is the maximum possible number of smaller pieces that have only black and yellow painted on their faces?

6. What is the maximum number of smaller pieces with three colours painted on them, respectively?

Directions for questions 7 to 10: These questions are based on the following information.

A large cube is formed by stacking 64 smaller and identical cubes. These smaller cubes are numbered 1 to 64 in the following manner. The four cubes in the front row of the bottom layer are numbered 1 to 4 from left to right. The cubes in the second row of the bottom layer are numbered 5 to 8. This pattern of numbering continued till all the 16 cubes in the bottom layer are numbered. The numbering of the second layer is done in a similar fashion, by numbering the cubes in the front row from 17 to 20 from left to right. This pattern of numbering continues for all the layers from the bottom layer to the top layer

7. What is the sum of numbers on all the cubes in the front row of the bottom layer?

8. What is the sum of numbers on all the cubes in the left column of the front face?

9. What is the sum of the numbers on the cubes along the left column of the back layer?

10. What is the sum of the numbers on the cubes along the second row of the top layer?

Directions for questions 11 to 14: These questions are based on the following information.

A large cube is formed by stacking 125 smaller and identical cubes. These smaller cubes are numbered 1 to 125 in the following manner. The five cubes in the front row of the bottom layer are numbered 1 to 5 from left to right. The cubes in the second row of the bottom layer are numbered 6 to 10. This pattern of numbering continues till all the 25 cubes in the bottom layer are numbered. The numbering of the second layer is done in a similar fashion, by numbering the cubes in the front row from 26 to 30 from left to right. This pattern of numbering continues for all the layers from the bottom layer to top layer.

11. What is the sum of numbers on the cubes along the column which has its base in the cube which is second from the left end of the bottom row of the layer behind the front layer?

12. What is the sum of the numbers on the cubes along the diagonal from the cube at the left end of the front row of the top layer to the cube at the right end of the last row of the top layer?

13. What is the sum of the numbers on the cubes along the diagonal from the cube at the left end of the bottom row of the front face to the cube at the right end of the last row of the top layer?

14. What is the sum of the numbers on the cubes along the diagonal from the cube at the right end of the bottom row of the front layer to the cube at the left end of the top row of the back layer?

Directions for questions 15 to 18: These questions are based on the following information.

A large wooden cube is painted with three different colours such that opposite faces are painted with the same colour. The cube is now entirely cut into 455 small and identical pieces by making the lowest possible number of cuts on the cube. All the completely unpainted smaller pieces are thrown away.

15. What is the total number of cuts made on the larger cube?

16. What is the highest possible number of pieces that have exactly one face painted with a particular colour?

17. What is the highest possible number of pieces that have exactly two faces painted with a particular combination of colours?

18. What is the lowest possible number of pieces which are painted with exactly one combination of two colours?

Directions for questions 19 to 22: These questions are based on the following information.

A large cube is built using 216 identical cubes which are engraved with numbers 1 to 216. The large cube is built in the following pattern.

(i) The cubes are stacked to form a large cube.

(ii) The cubes engraved 1 to 6 are placed in a column, one behind the other such that the smallest number is to the front. The six cubes numbered 7 to 12 are placed in the second column to the right of the cubes in the first column such that the smallest number is in the front. The same pattern is followed until the bottom layer is completely built.

(iii) Each other layer is built in the same pattern as the bottom layer. In these layers, smaller cubes are placed starting with the smallest available number being placed on the left most cube on the front row of the previous layer.

(iv) After the large cube is built with 216 cubes, its five visible faces are painted in blue.

19. What is the sum of the numbers on the cubes that have three sides painted?

20. What is the sum of the numbers on the small cubes that are resting on the floor but have no sides painted?

21. The two end cubes of one of the edges on the front face of the large cube have three sides painted. What is the sum of the numbers on the cubes that form this edge?

22. What is the sum of the numbers on the cubes that form the diagonal that connects the two corner cubes having three sides painted?

Directions for questions 23 to 25: These questions are based on the following information.

A cube is painted with blue on two adjacent faces. One of the remaining faces is painted with red colour such that its opposite face remain unpainted. The remaining two faces are painted with green colour. Now the cube is cut into 512 smaller and identical cubes.

23. How many smaller cubes have exactly one of their faces painted?

24. How many smaller cubes have at most two faces painted?

25. How many smaller cubes have only one colour painted on them?

ANSWER KEYS

Exercise-1

1. (A)	8. (C)	15. (C)	22. (B)	29. (A)	36. (A)
2. (D)	9. (C)	16. (B)	23. (A)	30. (C)	37. (D)
3. (D)	10. (C)	17. (D)	24. (A)	31. (D)	38. (B)
4. (B)	11. (D)	18. (C)	25. (D)	32. (A)	39. (A)
5. (A)	12. (B)	19. (C)	26. (A)	33. (A)	40. (D)
6. (D)	13. (B)	20. (B)	27. (A)	34. (D)	
7. (D)	14. (C)	21. (B)	28. (D)	35. (A)	

Exercise-2

1. (C)	8. (A)	15. (D)	22. (C)	29. (C)	36. (A)
2. (D)	9. (D)	16. (C)	23. (D)	30. (B)	37. (C)
3. (C)	10. (A)	17. (D)	24. (C)	31. (B)	38. (D)
4. (B)	11. (D)	18. (A)	25. (A)	32. (C)	39. (C)
5. (A)	12. (A)	19. (B)	26. (B)	33. (B)	40. (B)
6. (D)	13. (D)	20. (C)	27. (B)	34. (B)	
7. (B)	14. (C)	21. (D)	28. (D)	35. (B)	

Exercise-3

1. 60	5. 32	9. 148	13. 315	17. 44	21. 1176	24. 508
2. 12	6. 8	10. 218	14. 315	18. 12	22. 1191	25. 218
3. 48	7. 10	11. 285	15. 22	19. 794	23. 204	
4. 90	8. 100	12. 565	16. 110	20. 296		

SOLUTIONS

EXERCISE-1

1. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
2, 2, 1	3 × 3 × 2 = 18

2. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
2, 2, 2	3 × 3 × 3 = 27

3. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
6, 6, 5	7 × 7 × 6 = 294

4. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
3, 3, 2	4 × 4 × 3 = 48

5. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
4, 4, 3	5 × 5 × 4 = 100

6. We get the least possible number of cuts when the given number of pieces is factorized in such a way that the factors are as equal as possible.
$80 = 4 \times 4 \times 5 \Rightarrow 3 + 3 + 4 = 10$ cuts
$\therefore$ 10 is the minimum possible number of cuts required to cut the cube into 80 identical pieces.

7. The two faces of a cube to be painted can be either adjacent or opposite to each other.
The number of ways in which two adjacent faces of a cuboid can be chosen is 3 ways.
The number of ways in which two opposite faces of a cuboid can be chosen is 3.
$\therefore$The total number of ways in which two faces of a cuboid to be painted in green colour = 3 + 3 = 6 ways.

8. After covering the cube of dimensions 7 cm × 7 cm × 7 cm, the dimension of the cube will be 9 cm × 9 cm × 9 cm.
$\therefore$ A total of $(9 \times 9 \times 9) - (7 \times 7 \times 7) = 729 - 343 = 386$.

9. The dimensions of 6 × 8 × 9 cube which is kept at corner of a room, after covering with 1 × 1 × 1 cubes will be 7 × 9 × 10.
$\therefore$A total of $(7 \times 9 \times 10) - (432) = 198$ are required.

10. $125 = 5 \times 5 \times 5$, here $n = 5$, which is odd.
When a cube is cut along two diagonals, the number of pieces that get cut = $2n^2 - n = 2 \times 5^2 - 5 = 45$ (as n is odd).

11. $1000 = 10 \times 10 \times 10$. Here $n = 10$.
When a cube is cut along a diagonal, the number of pieces that get cut = $n^2 = 10^2 = 100$

12. Cutting the large cube into 27 smaller cubes will give us a 3 × 3 × 3 configuration. Out of these, if we remove all the outer cubes to get the number of cubes not having any face painted at all, we have to remove one layer of cubes on each of the faces so that we are left with a 1 × 1 × 1 cube which is not painted at all. Hence, the answer is one cube.

13. The cubes which are not along any edge are the ones that have only one face painted. On each face of the original cube, if we do not count the faces along the edges, then we have only one face at the middle which is painted only on one face. Hence, for six faces of the original cube, we get six cubes that have only one face painted.

14. The cubes along the edges but not at the corners will have two faces painted. Along each edge, if we remove the corner cubes, there is one cube that has two faces painted. Hence, for 12 edges of the cube, there will be 12 cubes which have only two faces painted.

15. When a cube is painted and cut into n number of smaller pieces along each edge, the total number of smaller cubes that we get will be $n \times n \times n$. From these, if we remove the complete outer layer of the cubes on all faces, we will have all smaller cubes with paint on them removed and we will be left with $(n - 2) \times (n - 2) \times (n - 2)$ cubes. In this case, if the number of cubes that do not have any face painted is 8, it is a 2 × 2 × 2 cube. so, before painting, it must have been a 4 × 4 × 4 cube so the original cube was cut into 64 smaller cubes.

16. On each face of the original large cube, if we remove the outer row of cubes along all the four edges, the remaining 2 × 2 (= 4) cubes will have exactly one face painted. On all six faces together, there will be 24 cubes that will have exactly one face painted.

17. Along each edge, if we remove the corner cubes, the remaining cubes have two faces painted; since the original cube is cut into 4 × 4 × 4 cubes, on each edge, we will have 2 cubes with exactly two faces painted on all twelve edges we have 2 × 12 = 24 cubes.

18. One face red ⇒ out of 36 + 30 = 66 cubes (on both the red faces together), we need to remove 6 common cubeswhich have two faces painted red. Hence, 66 – 6 = 60.

19. There are 3 common edges giving 6 + 6 + 4 cubes which have green and red, i.e., 16.

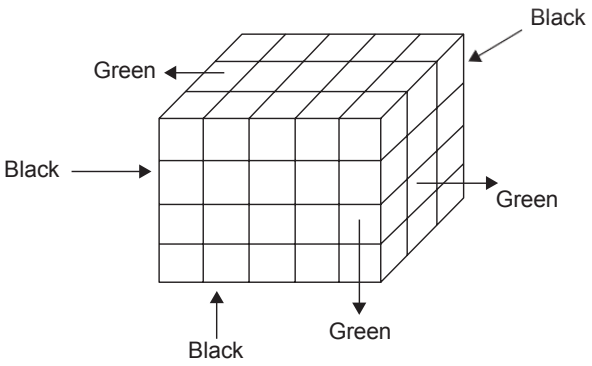
20. Only one colour (blue or green) ⇒ We have to considertwo possibilities:

(i) The central 4 × 4 square on a face (which gives 16 cubes).

(ii) The four middle-cubes along the common edge of two faces having the same colour (i.e., two green faces have a common edge of 6 cubes out of which four cubes have only green colour).

Thus, if we take the cubes which have only green colour on their faces, there are 16 cubes for each of the two green faces plus four common cubes – a total of (16 + 16 + 4) = 36 cubes with only green on their faces. Similarly, there will be 36 cubes which have only blue on their faces. Hence, a total of 72 cubes.

Solutions for questions 21 to 23:



Corners (8)	Edges (12)	Faces (6)
BBB – 1	BB – 3	B – 3
GGG – 1	GG – 3	G – 3
GGB – 3	BG – 6	
BBG – 3		

21. At the corners, three such pieces are there.
On the edges, the number of such pieces
= 1 (along the plane with 2 cuts) + 2 (along the plane with 3 cuts) + 3 (along the plane with 4 cuts)
∴Required number of pieces = 3 + 6 = 9.

22. Except two corners, all the corners have both the colours ⇒ 6 pieces.
On the edges, the number of pieces having both the colours according to the three different cuts in each plane.
∴ Required number of pieces = 6 + 12 = 18.

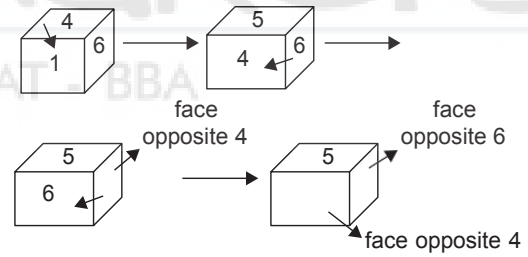
23. The number of pieces with no face painted = 1 (along the plane with 2 cuts) + 2 (along the plane with 3 cuts) + 3 (along the plane with 4 cuts) = 1 + 2 + 3 = 6.

24. 210 = 7 × 6 × 5
The number of pieces that have exactly two colours on them = 4 [(7 – 2) + (6 – 2) + (5 – 2)] = 48.

25. The maximum possible number of pieces with green and red are obtained, when the pieces with green and red are along the side where the length is the highest.
Here, the maximum length is 7 cm.
∴ The number of pieces, in this case, with green and red = 4 × 7 = 28 pieces.

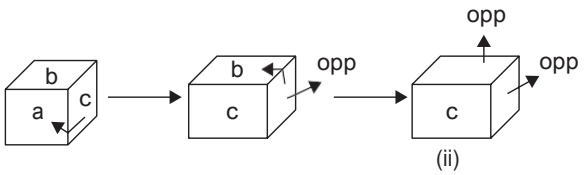
26. The minimum number of pieces with only blue colour on them is obtained when the smaller pieces are at the centre of the face with dimensions 5 × 6.
∴ The minimum possible number of required pieces
= 2 × (5 – 2) (6 – 2) = 24.

27. From figures (i) and (ii), we understand that 1 is opposite to 5, because 2, 3, 4 and 6 are adjacent to 1. We obtain figure (iii) by rotating the die in figure (ii) as follows:



Hence, 2 is opposite to 4 and 3 is opposite to 6. The first option is correct.

28. From (i) and (ii), *c* is opposite to *f*. The second figure is obtained by rotating the first figure as follows:



Hence, *e* is opposite to *a* and *d* is opposite to *b*. Therefore, *b* – *d* is the correct pair of opposite faces.

29. From (ii) and (iii), red is opposite to violet, from (i) and (ii), blue is opposite to orange. Hence, yellow is opposite to green. The colour at the bottom in the second figure is blue.

30. From (i) and (ii), * is opposite to □. From (i) and (iii), ↑ is opposite to o . Hence, Δ is opposite to #. The faces adjacent to Δ are o and ↑.

31. From (i) and (ii), t is opposite to u and from (ii) and (iii), s is opposite to p. Hence, r is opposite to q. q and u are opposite to r and t, respectively.

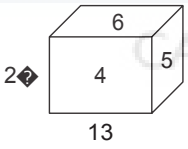
32. From (i) and (ii), 'White' is opposite to 'Green'. From (i) and (iii), 'Black' is opposite to 'Brown'. Hence, 'Grey' is opposite to 'Blue'. 'Blue' is at the bottom of figure (i).

33. From (i) and (ii), five dots are opposite to three dots. From figures (i) and (iii), two dots are opposite to one dot. Hence, six dots are opposite to four dots. The faces adjacent to both the faces with two dots and five dots are opposite to each other. Hence, they are faces with six dots and four dots, whose total is ten.

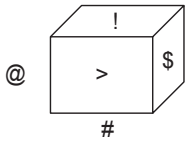
34. From the given figure, it is known that the circle and the triangle are opposite each other
Hence, Only III is correct.

35. From the given figure, it is known that the hatched face and the face with x on it, are opposite each other
Hence, Only I is correct.

36. It forms a cube as shown in the figure below. So, 6 is opposite to 3.

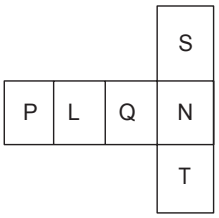


37. It forms a cube as shown in the figure below.



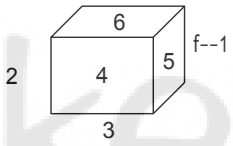
So, '$' is opposite to @.

38.

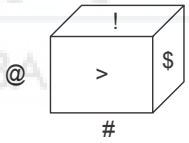


By folding the above figure, the alternate faces are opposite.
P is opposite to Q.
L is opposite to N.
S is opposite to T.

39. It forms a cube as shown in the figure below. So, 6 is opposite to 3.



40. It forms a cube as shown in the figure below.



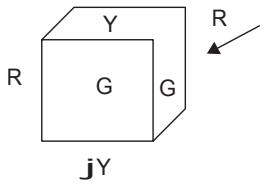
So, '$' is opposite to @.

EXERCISE-2

1. $216 = 6 \times 6 \times 6$
Here, $n = 6$, i.e., even.
(i) With one diagonal cut, the number of pieces that get cut = $n^2 = 6 \times 6 = 36$.
(ii) With two diagonal cuts, the number of pieces that get cut = $2n^2 = 2 \times 6 \times 6 = 72$.

2. $729 = 9 \times 9 \times 9$
Here, $n = 9$, i.e., odd.
(i) With one diagonal cut, the number of pieces that get cut = $n^2 = 9 \times 9 = 81$.
(ii) With two diagonal cuts the number of pieces that get cut = $2n^2 - n = 2 \times 9 \times 9 - 9 = 153$.

Solutions for questions 3 to 7: The cube can be painted in the following pattern:



R ⇒ red

G ⇒ green

The colour combination for the corners: GGY-2 pieces, RRY –2 pieces, RGY –4 pieces
Edges: GG-1 edge, RR-1edge, GY-4 edges, RY-4 edges, RG-2 edges

Middle of the face: G-2 faces, R-2 faces, Y-2 faces
Since the cube is cut into 125 small and identical cubes the number of small cubes along each edge is 5.

3. The number of small cubes with exactly two faces painted in green are found along the GG-edge, i.e., 5 small cubes.

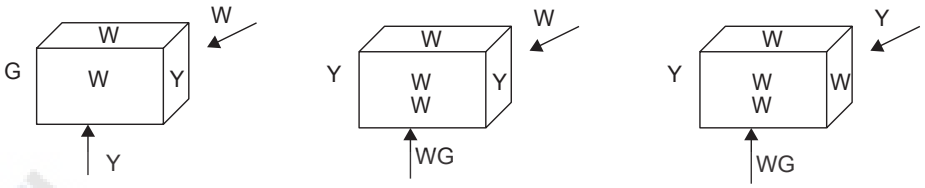
4. The small cubes with at least two different colours on their faces = Pieces at the corners with two colours or three colours + Pieces along the GY, RY and RG edges.
= 8 (corner pieces) + 10 × 3 (pieces along the edges) = 38.

5. The number of small cubes having exactly one colour on them = Pieces at the GG and RR edges + Pieces at the middle of the faces = 2 × 3 + 6 × 9 = 60.

6. The number of small cubes with yellow or red but not green = Total number of small cubes − The number of small cubes with only green − The number of small cubes with no colour = 125 − (25 + 20) − 27 = 53.

7. The number of small cubes having exactly two painted faces and have exactly two colours = The smaller cubes along the GY, RY and RG edges
= 10 × 3 = 30.

Solutions for questions 8 to 11: The cube can be painted in the following patterns:



The cube is cut into 512 small and identical cubes, i.e., each edge is cut into eight pieces. The colour combination for the pieces along the surface is as following:

	(i)	(ii)	(iii)
Corners	**WWY-2, WWG-2, YYW-2, YWG-2**	**WWY-4, YWG-4**	**WWW-1, WWY-2, YYW-1, WWG-1, YYG-1, YWG-2**
Edges	WW-2, WY-5 WG-3, GY –1 YY-1	WW-2, WY-6 GY-2, GW-2	WW-3, WY-4 YY-1, YG-2, GW-2
Middle of surface	W-3, Y-2, G-1	W-3, Y-2, G-1	W-3, Y-2, G-1

8. The number of small cubes with two faces painted in yellow is:
Case (i):
Corner: (WWY) 2 Cubes + Edge: (YY)1 edge × 6 cubes = 8
Case (ii):
No such small cube is available.
Case (iii):
Corners: (YYW) 1 cube + (YYG) 1 cube + Edge: (YY) 1 edge × 6 Cube = 1 + 1 + 6 = 8
∴ The minimum possible number of small pieces with two faces painted in yellow is zero.

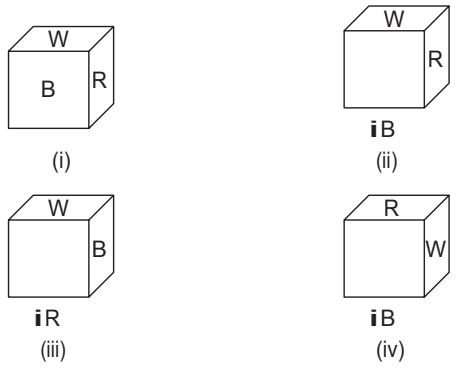
9. The number of small cubes with only green and yellow colours.
Case (i):
(GY) edge 1 × 6 Cubes = 6
Case (ii):
(GY) edge 2 × 6 Cubes = 12
Case (iii):
(YYG) corner: 1 cube + (GY) edge 2 × 6 = 13
∴ The maximum possible number of small cubes with only yellow and green colour is 13.

10. The number of small cubes with exactly one colour on them:
Case (i):
[(WW) edges 2 + (YY) edge 1] × 6 + middle part of surfaces 6 × 36 = 234
Case (ii):
(WW) edges 2 × 6 + middle parts of surface: 6 × 36 = 228
Case (ii):
(WW) corner 1 cube + [(WW) edge 3 + (YY) edge1] × 6 + middle part of surface 6 × 36 = 241
∴ The maximum and the minimum possible number of small cubes that have exactly one colour is 241 and 228, respectively.

11. The number of small cubes that have at least two painted surfaces but have only white colour on them:
Case (i):
(WW) edges 2 × 6 = 12
Case (ii):
(WW) edges 2 × 6 = 12
Case (ii):
(WWW) corner 1cube + (WW) edges 3 × 6 = 19

∴ The minimum possible number of small cubes that have only white colour on them is 12.

Solutions for questions 12 to 16: The painting can be done in the following patterns:



The cube is cut into 729 pieces by (8 + 8 + 8) = 24 cuts.

12. The maximum possible number of small cubes with all the three colours can be obtained in figure (i). The corner cube is having all the three colours on it.

13. In figure (ii), white and black colours are on opposite faces. Hence, the minimum possible number of small cubes that have only white and black colours is zero.

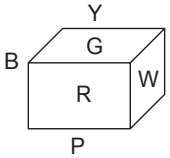
14. The minimum number of the small cubes with only red face can be obtained from the figure (ii), i.e., (9 − 2) × 9 = 63 cubes.

15. From any one of the figures (i), (ii) (iii) and (iv), cubes with white face are = 9 × 9 = 81 ⇒ 81.

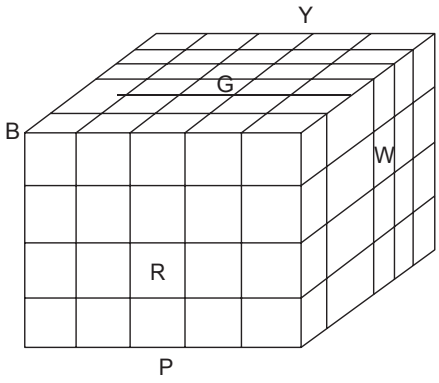
16. The number of small pieces with no colour = The pieces lying inside + The pieces from the three surfaces which have no colour.

From figure (i): $(9 - 2)^3 + (8 \times 8) + (7 \times 8) + (7 \times 7) = 512$.
From any one of the figures (ii), (iii) and (iv):
$(9 - 2)^3 + (7 \times 8) + (7 \times 8) + (7 \times 7) = 504$
∴The minimum possible number of small pieces that have no colour on them is 504.

Solutions for questions 17 to 19: As per the given directions, the coloured cube will look as follows.



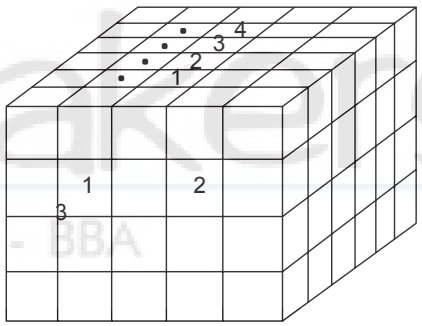
The first letters of all the colours are used in the above diagram.
Now this cube has to be cut into 120 identical pieces by using minimum possible cuts, so the combination can be 4, 5 and 6, i.e., 4 × 5 × 6 and the cuts will be 3, 4 and 5. Now the cut figure will be as follows.



17. Now the white colour pieces will be 6 × 4 as per the above diagram, i.e., 24.

18. At least two different colours, means two different colours or more than two colours. We know that more than two colours will be at 8 corners and two colours will be at the 12 edges, so 44 pieces at the edges including 8 pieces at the corners.

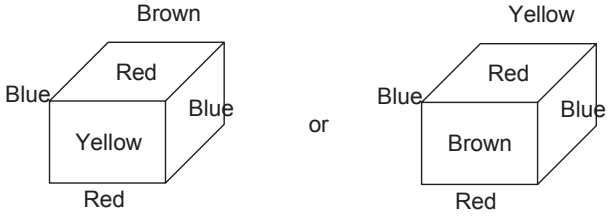
19. It is better to study the cube properly. Let's see the cube given below.



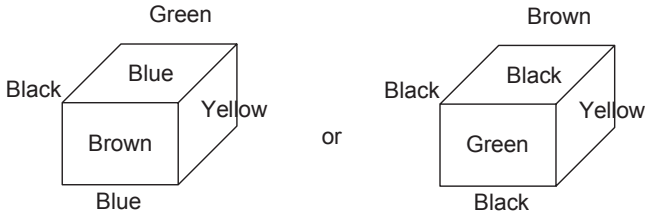
If we see the cube drawn above, then it is clear that the outer faces of the pieces will definitely be painted but the inner faces of the pieces will not be painted at all. So, the simplest approach is to count the pieces from outside to know how many pieces are to be considered, i.e., they are numbered from 1 to 6, leaving the pieces at the edges as they will be painted. Now the number of layers parallel to the front face, on which 1 to 6 are numbered inside will be 4 as shown above. So, 6 × 4 pieces will have no paint on their faces at all, i.e., 24 pieces.

Solutions for questions 20 to 22: Let us draw the diagrams of cube P and Q.

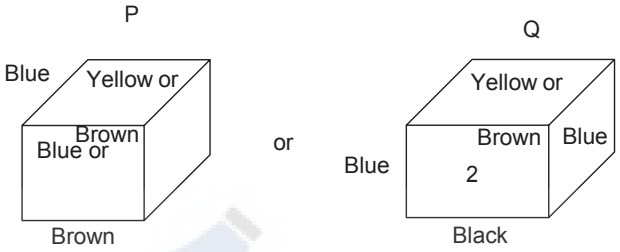
Cube P:



Two opposite faces of blue can be replaced by two opposite reds and vice-versa.
Cube Q:

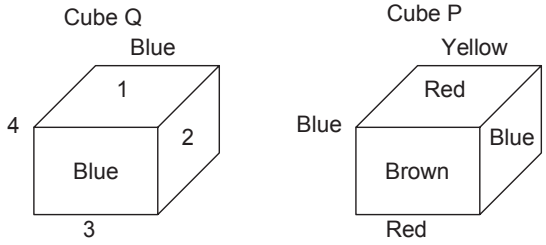


20.



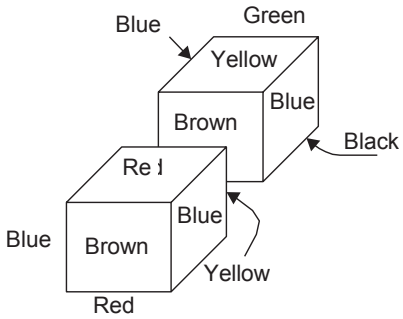
The faces marked with number 2 of cube Q can be of any colour among yellow, brown, black and green. But as far as the front face of the cube is concerned, it has to be of red colour, as the two faces of cubes P and Q which are touching each other are of the same colour even if they interchange their positions. So, those two faces must be of blue colour.

21. Cube Q is placed above P.
Cube Q



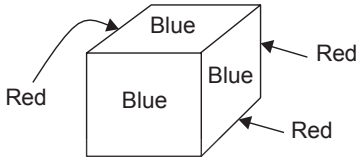
Now in cube Q the faces 1 and 3 can be of brown and green and vice-versa or they can be of black and yellow and vice-versa. On the other hand, faces 2 and 4 can also be of black and yellow and vice-versa or they can be of brown and green or vice-versa. Choice (A), (B) and (C) may or may not be true. Choice (D is definitely false. When Q is above P, then Q's bottom face and P's top face will touch each other and these two faces will have definitely red and any one of the colours, such as black, brown, green and yellow.

22. In all the possible arrangements, one thing is common, i.e., the front face will have brown colour.



If observed carefully, we find that the top faces do not have the same colours and only the two side faces have the same colour on them.

Solutions for questions 23 to 25:



23. It is possible in exactly one way. (Example: When we can see RRR, we cannot see blue.)

24. It is possible in 3 ways.

25. This is possible in 3 ways.

26. The minimum possible number of pieces with two colours on them will be obtained when the faces of the cube to be painted with same colour are on adjacent faces.
In this case, the number of pieces with exactly two faces painted in two different colours = $(12 - 3)(6 - 2) = 36$
[As there will be three edges with two faces painted but with only one colour]
The number of pieces with two colours but on three faces $= (8 - 2) = 6$
[As there will be two pieces at corner which have all the three colours]
$\therefore$Total number of required pieces = 36 + 6 = 42

27. The number of pieces with no colours on them = $4 \times 4 \times 4 = 64$.
For maximum possible number of pieces with one colour on them, the faces which are to be painted with same colour must be adjacent.
The number of pieces with only one colour on exactly one face = $6 \times (6 - 2)^2 = 96$.
The number of pieces with only one colour but on two faces = $3 \times (6 - 2) = 12$.
$\therefore$The total number of pieces = 64 + 96 + 12 = 172

Solutions for questions 28 to 30: When three faces of a cube are painted, there are two possibilities, they are: (a) the three faces are continuous (in a row) or (b) the three faces meet at a corner.

Also, when the cube is cut into 216 smaller but identical cubes, we get a $6 \times 6 \times 6$ configuration.

28. Here, also we have to consider both the cases.

(A) When the three painted faces are continuous: On the two outer painted faces, there will be 6 × 5 (= 30) cubes with exactly one face painted (on two faces, there will be 2 × 30 = 60 such cubes) whereas, on the middle face, there will be 4 × 6 (= 24) cubes with exactly one face painted. Hence, a total of 84 cubes with exactly one face painted.

(B) When the three painted faces meet at one corner: On each of the painted faces, there will be 5 × 5 cubes (after we remove the cubes along the edges common with the other painted faces); since there will be 3 such edges, a total of 75 cubes.

Hence, the answer is 84 or 75 cubes.

29. Maximum number of two faces painted will be when the three painted faces are continuous in a row. Here, all the six cubes along the common edge between green face and blue face will satisfy the given condition. Hence, the answer is 6 cubes.

30. Here again, we have to consider both the cases of painting.

(A) When the three painted faces are continuous. Here, the number of cubes that have no face painted at all is as follows:
Middle cube – 6 × 6 cubes = 36
Two end cubes – 2 × (5 × 6) = 60
A total of 96 cubes have painted face out of 216 cubes. Hence, the number of cubes that do not have any face painted at all in this case is 120.

(B) When the three painted faces meet at a corner: Here, the number of cubes having any paint at all is as follows:
Along the three common edges together, there will be (3 × 5 + 1 =) 16 cubes.
On each of the faces (after the above has been deducted), there will be (5 × 5 =) 25 cubes. On all three faces together, there will be 75 cubes.

Hence, a total of (75 + 16 =) 91 cubes have any paint at all out of a total of 216 cubes. So, there will be 125 cubes that do not have any face painted at all. Hence, the answer is 120 or 125.

31. Different ways of distributing three colours on the six faces of a cube are as follows:

0-0-6; 0-1-5; 0-2-4; 0-3-3;
1-1-4; 1-2-3; 2-2-2

0-0-6 combination:

Here, all face single colour. Hence, totally, 3 ways.

0-1-5 combination:

1 way × 3 for selection of colours out of the three available colours ⇒ 2 for distribution of these colours between 1 and 5 = 6 ways.

0-2-4 combination:

Two faces having one colour can be adjacent or opposite 2 ways. For each of these ways, two colours can be arranged in 3! ways. Hence, 2 × 6 = 12 ways.

0-3-3 combination:

Three faces of same colour on one corner or continuous ⇒ 2 ways. For each of these, two colours can be arranged in 3 ways. Hence, 2 × 3 = 6 ways.

1-1-4 combination:

2 single faces adjacent or 2 single face opposite ⇒ 2 ways. For each of these, three colours can be arranged in 3 ways. Hence, 2 × 3 = 6 ways.

1-2-3 combination:

3 faces of same colour can be in 2 ways, (A) continuous (B) at a corner.

Continuous - Under this, the 2 faces with same colour can be adjacent or opposite ⇒ 2. For each of these, the three colours can be arranged in 3! or 6 ways.

1. Hence, 2 × 6 = 12 ways.

At a corner - This gives one arrangement. The three colours can be arranged in 3! ways. Hence, 3! × 1 = 6 ways.

2. 2-2-2 combination:

Different possibilities are

(I) 2 opp - 2 opp - 2opp - 1 way

(II) 2 opp - 2 adj - 2 adj - 1 way. The three colours can be arranged in 3! ways. Hence, 3 ways.

(III) 2 adj - 2 adj - 2 adj - 1 way

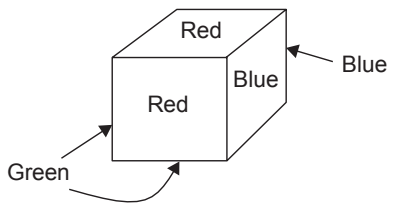
We get the total number of ways in which the cube can be painted by adding all the above values, which is 56.

32. For each of the combinations worked out, blue can come as 1 + 2 + 8 + 4 + 2 + 8 + 4 + 5 = 34.

33. For the relevant combinations discussed above, the number of ways is 6 + 12 + 6 + 5 = 29.

34. The only way that the cube can be painted such that no two adjacent faces have the same colour is where opposite faces have the same colour so that the three pairs of opposite faces can have three different colours. Hence, the answer is one way.

Solutions for questions 35 to 37: The following diagram shows the colours of the faces.



In total, there are eight possible ways of seeing three faces. They are: GGR, GGB, RRG, RRB, BBR, BBG, BGR and BGR.

Note: BGR can be seen in two ways.

B = Blue

G = Green

R = Red

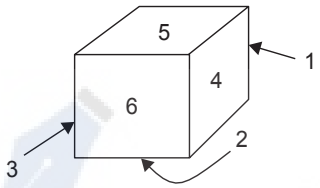
35. Red and blue both are not visible in the following cases: GGR, GGB, RRG and BBG. Both of them are visible in the other four ways.

Th total number of ways is 4.

36. It is possible in two ways.

37. It is already explained above and the required number is 7 [BGR is possible in two ways].

Solutions for questions 38 to 40:



The dice is shown in the following diagram.

The possible ways of views are:

6, 4 and 5 [sum = 15]

6, 5 and 3 [sum = 14]

6, 4 and 2 [sum = 12]

6, 3 and 2 [sum = 11]

5, 4 and 1 [sum = 10]

5, 3 and 1 [sum = 9]

4, 2 and 1 [sum = 7]

3, 2 and 1 [sum = 6]

38. This sum can be obtained in the following ways.

6 + 14 = 20

14 + 6 = 20

9 + 11 = 20

11 + 9 = 20

10 + 10 = 20

Total number of possible ways = 5.

39. Let us take D_1 and D_2 – two dice.

Assume that it is 10 on D_1 and not 10 on D_2.

There are seven possible ways to have this.

Assume that it is 10 on D_2 and not 10 on D_1.

There are another 7 ways.

Assume that it is 10 on both the die.

There is exactly one way for this.

Total number of ways is 7 + 7 + 1 = 15.

40. Any specified number appears in exactly sixteen ways.

EXERCISE-3

Solutions for questions 1 to 3: When three faces of a cube are painted, there are two possibilities.

(i) One pair of opposite faces is painted. The third painted face will be adjacent to these two faces.

(ii) The three painted faces are mutually adjacent to each other. Thus, every painted face is opposite to an unpainted face.

1. By considering the painted cubes in case (i), the number of painted faces = (5 × 5) + 2 (5 × 4) = 40 + 25 = 65.
Hence, the total number of cubes which are unpainted
= 125 – 65 = 60.

2. By considering the case (i), there are two edges common and on each of the two edges, there are 5 cubes that have exactly two faces painted.
Hence, total required cubes = 10
By considering the case (ii):
There are three common edges and along each edge, four cubes have exactly two faces painted = 3 × 4 = 12.

3. By considering the case (i), on the two opposite faces painted we have 2 × 5 × 4 = 40 cubes which have exactly one face painted and in the other faces, we have 5 × 3 = 15.
Hence, total required cubes = 55.

By considering the case (ii), except the cubes at the edges and the corner remaining 4 × 4 cubes on each painted face have only = 3 × 16 = 48.

Solutions for questions 4 to 6: Given that 4, 5 and 6 cuts are made in three different directions.

We can visualize the 42 pieces on one pair of opposite faces, 35 on second pair of opposite faces and 30 on the third pair of opposite faces.

4. To get the maximum number of smaller pieces which have only back on them, the faces which have 42, 42, 35 and 35 pieces have to be painted in black.
Hence, the pieces which are painted only in black
= 30 + 30 + 15 + 15 = 90.

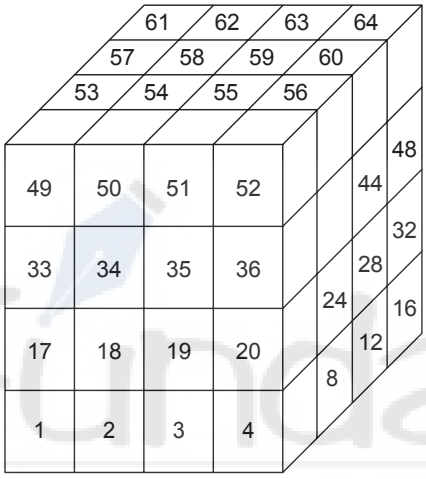
5. To get the maximum number of smaller pieces with black and yellow on them, the opposite faces which consists of 42 cuboids each are painted with black, the other pair of opposite faces which consists of 35 cuboids each are painted with yellow and the out of the remaining pair of opposite faces, one face is to be painted with black or yellow and the other has to be painted red.
Colours on faces: Opposite faces 7 × 6 = black/yellow.
Opposite face 7 × 5 = yellow/black.

One face of 5 × 6 = yellow/black (not black/yellow).
Other face of 5 × 6 = red.
There are six cuboids including corners (excluding those corners which have red paint) on 4 edges and 4 cuboids on 2 edges each which have only black and yellow on them.
Hence, the required number of cuboids

= 4 × 6 + 2 × 4 = 32.

6. By painting the three pairs of opposite faces of the larger cuboid with the three different colours, we have 8 corner pieces with three different colours on them.

Solutions for questions from 7 to 10:



7. The numbers on the referred cubes are 1, 2, 3 and 4, whose sum is 10.

8. The required numbers are 1, 17, 33 and 49. These are in AP with a common difference of 16, whose sum is 100.

9. The required numbers are 13, 29, 45 and 61. These numbers are in AP with a common difference of 16, whose sum is 148.

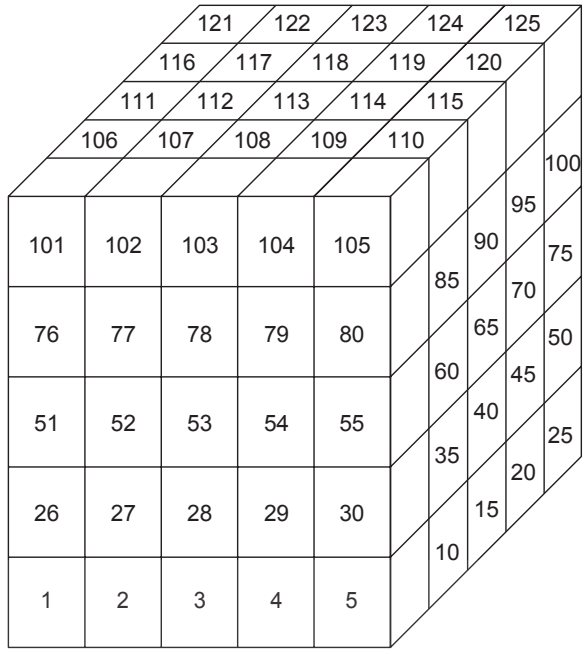
Alternate Solution:

This scenario can be viewed in relation to that in previous question. Each required cube, now, is 12 cubes away from each required cube of previous questions (from bottom to top).

Therefore, sum = 100 + 12 × 4 = 148.

10. The required numbers are 53, 54, 55 and 56, whose sum is 218.

Solutions for questions from 11 to 14:



11. The required numbers are 7, 32, 57, 82 and 107. These numbers are in AP with a common difference of 25, whose sum is 285.

12. The required numbers are 101, 107, 113, 119 and 125. These numbers are in AP with a common difference of 6, whose sum is 565.

13. The required numbers are 1, 32, 63, 94 and 125. These numbers are in AP with a common difference of 31, whose sum is 315.

14. The required numbers are 5, 34, 63, 92 and 121. These numbers are in AP with a common difference of 29, whose sum is 315.

Solutions for questions 15 to 18:

Total number of identical wooden pieces

= 455 = 5 × 7 × 13 (All prime factors of 455)
Let the dimensions of the large wooden cube be 455 cm × 455 cm × 455 cm.
Then the dimensions of each identical piece would be 5 cm × 7 cm × 13 cm.
Cubes thrown away = 11 × 5 × 3 = 165.

Cubes left with = 455 – 165 = 290.

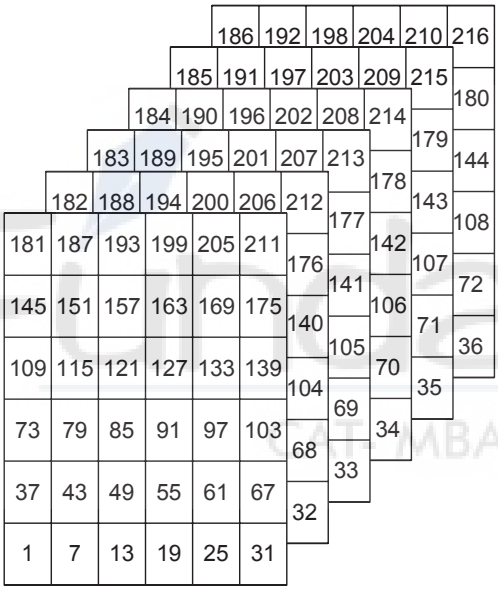
15. Total number of cuts made = 12 + 6 + 4 = 22

16. Pieces that are on opposite faces are identical. Among them, the pieces that are painted on only one face are highest in number. Among them, the two opposite faces on which 12 × 6 cuts are made will be identical. Total number of such pieces = (11 × 5) × 2 = 110.

17. The edges which are cut into 13 pieces have 11 pieces in a particular pair of colours painted on exactly two faces. There are four such edges. Hence, in total there are 44 such pieces.

18. The edges which are cut into 5 pieces have three pieces, along each of these edges, which have the same pair of colours on them. There are four such edges. Hence, there are 12 such pieces.

Solutions for questions 19 to 22: The arrangement of the large cube is as follows:



19. Four corners of the top layer have three sides painted.
181 + 211 + 186 + 216 = 794

20. The following diagram shows the bottom layer (with shaded region representing cubes with at least one side painted).

6	12	18	24	30	36
5	11	17	23	29	35
4	10	16	22	28	34
3	9	15	21	27	33
2	8	14	20	26	32
1	7	13	19	25	31

Sum of all cubes (bottom layer) = $\frac{36}{2}$ × (36 + 1) = 37 × 18 = 666

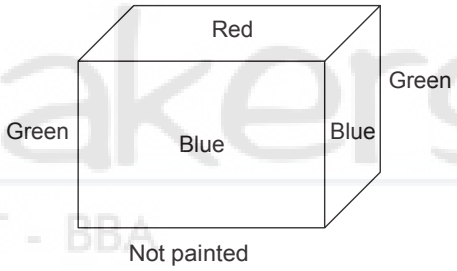
Sum of cubes of shaded region = $\frac{5}{2}$ × ((1 + 5) + (6 + 30) + (36 + 32) + (31 + 7)) = $\frac{5}{2}$ × (6 + 36 + 38 + 66) = $\frac{5}{2}$ × (146) = 370

Answer = 666 – 370 = 296

21. The cubes are on front row of the top layer; the numbers are in arithmetic progression.
Sum =181 + 187 + 193 + 199 + 205 + 211 = 3 × (181 + 211) = 1176

22. There are two such diagonals. There will be six cubes in a diagonal and the numbers will be in arithmetic progression. Sum of the numbers on any diagonal is the same though the common difference varies. The six numbers are in arithmetic progression from 211 to 186 or 181 to 216. Sum = 3 × (211 + 186) = 3 × (181 + 216) = 1191

Solutions for questions 23 to 25: The painted faces of the cube are shown below:



As the cube is cut into 512 small and identical cubes, there are 8 cubes along each edge.

23. Smaller cubes having exactly one of their faces painted = The cubes along the edge [except corner cubes] of the not painted face + The cubes on the painted faces [except corners and edges] = 24 + 36 × 5 = 24 + 180 = 204.

24. At most two painted faces = All cubes – Three painted faces = 512 – 4 = 508

25. Cubes having only one colour on them
= Painted only in blue + Painted only in green + Painted only in red
= (36 × 2 + 6 × 3 + 1) + (36 × 2 + 6 × 3 + 1) + 36
= (72 + 18 + 1) + (72 + 18 + 1) + 36
= 182 + 36 = 218

9 Deductions

Chapter

Learning Objectives

In this chapter, you will:

- Understand the correct logical interpretation of terms like 'All', 'Some', 'No', 'Some not' etc.
- Learn how to derive logical conclusions from abstract statements using various methods.

Questions based on deductions are frequently asked in competitive exams. These types of questions are generally solved by using two methods:

1. Venn diagrams
2. Rules governing syllogisms

Syllogism rules are preferred for answering those questions with two statements and do not have 'either – or' answer choice. Whereas Venn diagram method is applicable to answering questions with any number of statements and any kind of answer choices.

We are going to discuss Venn diagram method first and the syllogism concept later.

The statements given in the questions and the conclusions that are derived may not confine to generally accepted facts. None of the three statements below is a fact, but they still may be a part of a question.

Example:

1. All cats are dogs.
2. Some birds are elephants.
3. Some flowers are not mountains.

To understand and analyse these statements and to draw conclusions, we can use symbolic logic for clear expression of our thoughts. The examinee has to understand the logical implications of the given statements and verify the truthfulness of each of the given conclusions, strictly within the preview of the given statements. Each of the given statements has to be taken as true, though they deviate from generally accepted facts and check whether the given conclusions logically follow the statements.

To achieve the above task, the given statements have to be represented in a combined format. Representation through Venn diagrams is an effective way to combine and to draw conclusions based on these hypothetical statements.

❒ VENN DIAGRAMS METHOD

Venn Diagrams: These are diagrammatic/pictorial representation of sets by using geometrical figures. The Venn diagram drawn to represent all the given statements should be a combined diagram. A set of given statements can be represented in several ways using Venn diagrams. We can conclude that a conclusion definitely follows the given statements only if that conclusion is true for all possible diagrammatic representations.

Quantifiers: A quantifier describes the extent (quantity) to which one kind (or term) is similar (or dissimilar) to another kind (or term). The main quantifiers are 'All', 'No', 'Some' and 'Some-not'. The following are few examples of statements/ conclusions consisting of each of the above four quantifiers.

All: All A's are B's, All animals are living things, All shoes are socks, etc.

No: No A is B, No boy is girl, No bat is rat, No weak is coward, etc.

Some: Some A's are B's, Some doctors are men, Most girls are brave, etc.

Some – not: Some A's are not B's, Some Cricketers are not Indians, etc.

Words like 'a few, most, many, more', etc., are treated as synonyms to 'Some', 'Not all' is equivalent to 'Some-not'.

The statements, which contain the qualifiers 'All' and 'Some' are called affirmative statements and those containing the qualifiers 'No' and 'Some-not' are called negative statements.

❒ COMPLEMENTARY PAIR

Certain combinations of conclusions, consisting of one negative and the other affirmative, negate each other. For example,

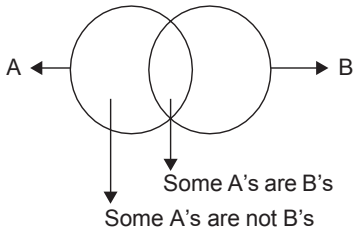
'**SOME** A's are B's' negates '**NO** A is B'.

'**ALL** A's are B's' negates **SOME** A's are **NOT** B's, i.e., when 'Some A's are B's' is true, 'No A is B' cannot be true and vice versa.

Similarly, when 'All A's are B's' is true, then 'Some A's are not B's' cannot be true and vice versa.

In each of the above pairs, only one statement can be true or false at a time but both cannot be true or false at the same time.

Thus, 'Some A's are B's' and 'Some A's are not B's' does not form a complementary pair, as both can be true at the same time, as in the following figure.

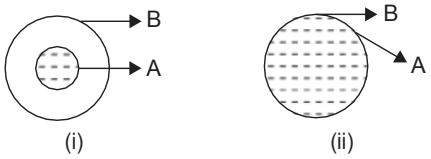
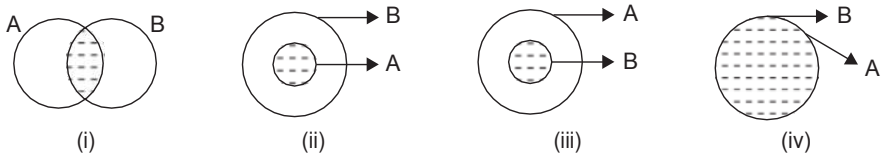
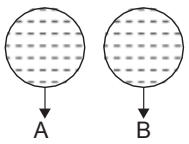
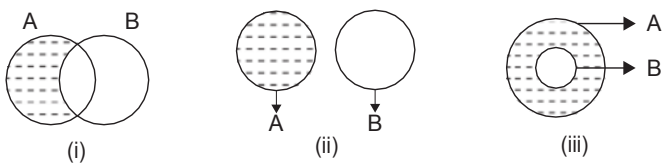


Similarly, 'All A's are B's' and 'No A is B' does not form a complementary pair because they both are false at the same time as for the above diagrams.

Thus, the pairs of qualifiers ('Some' and 'No') and ('Some-not' and 'All'), for the same terms, form complementary pairs. The existence of conclusions can be observed while reading the question itself.

The following table shows different ways of representing a statement consisting of a qualifier by using Venn diagrams.

Table – 1

Qualifier	Representations using venn diagram
1) ALL: Example: All A's are B's	
2) SOME: Example: Some A's are B's	
3) NO: Example: No A is B	
4) SOME, NOT: Example: Some A's are not B's	

From the above table, it is clear that a statement can be represented diagrammatically in several ways. Similarly, a diagram may represent more then one statement.

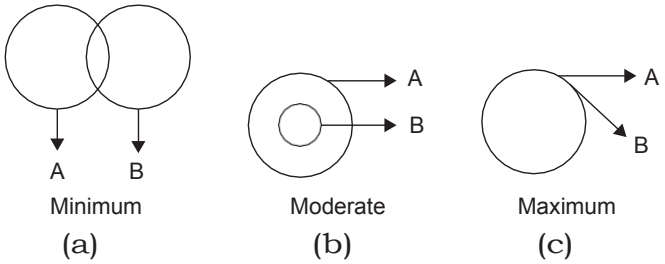
From the above table, we can draw the following possible conclusions.

Statement	Definitely true	Definitely false	May or may not be true
(1) All A's are B's	Some A's are B's Some B's are A's	No A is B No B is A	All B's are A's Some B's are not A's
(2) Some A's are B's	Some B's are A's	No A is B No B is A	All A's are B's All B's are A's Some A's are not B's Some B's are not A's
(3) No A is B	No B is A Some A's are not B's Some B's are not A's	Some A's are B's Some B's are A's All A's are B's All B's are A's	_____
(4) Some A's are not B's	_____	All A's are B's Some A's are B's Some B's are A's	Some B's are not A's No A is B No B is A All B's are A's

The diagrams are also classified as 'Basic Diagrams' (BD) and 'Alternate Diagrams' (AD), based on intersections and extent of overlap.

Basic Diagram (BD):

This is a diagram which represents the least possible situation for a given statement. To get the least possible representation, the diagram should contain minimum overlapping. The extent of overlap is of three kinds as shown below.



In Figure (a), circles (A) and (B) are overlapping with each other only to some extent, i.e., minimum for both.

In Figure (b), one circle, i.e., B is completely overlapped by A, but circle A is overlapped by B only to some extent. Here, the extent of coverage of one circle is full and the other is partial, i.e., the overlap is moderate on the whole.

In Figure (c), each of the circles is overlapped completely by the other, i.e., overlapping is the maximum.

In Table I for statement (1), Figure (i) has lesser overlapping than Figure (ii). Hence, Figure (i) forms the BD for statement (1). Similarly, Figure (i) for statement (2) has least overlapping among all possible diagrams for that statement. Hence, Figure (i) forms BD for statement (2). Similarly, Figure (ii) for statement (4) is the BD for it. For statement (3), only one diagram is possible.

Alternate Diagram (AD):

Any diagram, other than BD for the given statements is an alternate diagram. For each set of statements, several alternate diagrams are possible.

Method to draw Venn diagrams for the given statements:

Each question contains two or more statements. The Venn diagrams that we draw to represent these statements should be a combined diagram, i.e., the diagram should link all the given statements. The following examples show how a combined diagram is drawn.

Example 1:

Statements: All A's are B's.
Some B's are C's.

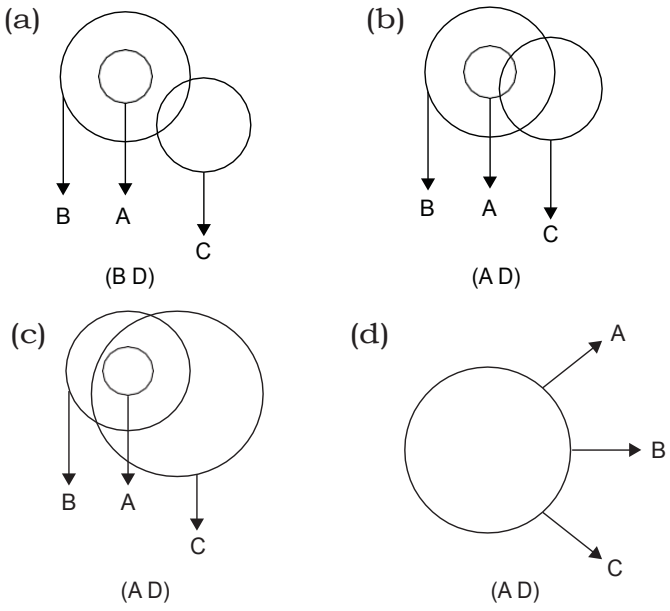


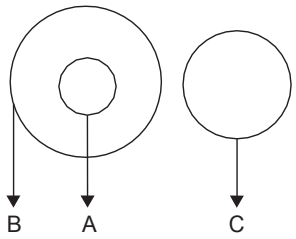
Figure (a) is the BD, as the overlapping for each of A, B and C is least in view of the given statements.

Figures (b) and (c) are the ADs because the overlap is moderate. Several other ADs are possible for the given statements. Figure (d) is the AD with the maximum overlap.

Example 2:

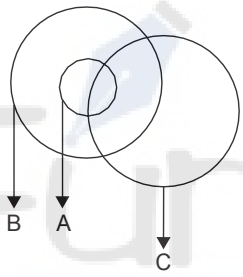
Statements: All A's are B's.
Some A's are not C's.

(a)



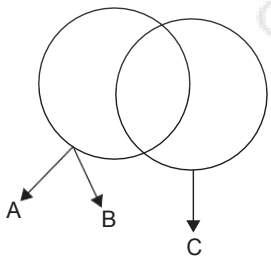
(B D)

(b)



(A D)

(c)



(A D)

Figure (a) is the BD, as it has minimum overlapping. Figure (b) is the AD with moderate overlapping and Figure (c) is the AD with maximum overlapping.

While drawing these diagrams it has to be ensured that no diagram contradicts the given statements.

Answering the questions:

In each question, the statements are followed by three or more conclusions. The student has to verify whether the given conclusions follow the statements or not. Conclusion is said to follow the given statement, if it is true for all possible Venn diagrams for a given set of statements. We can see that in Examples (1) and (2), several diagrams are possible. Instead of drawing all possible diagrams and verifying the truthfulness of each conclusion in each of these diagrams, it would be convenient if we can verify the truthfulness of these conclusions by using minimum number of diagrams. A student has to think logically in order to minimize the number of diagrams required to verify the truthfulness of a conclusion.

Guidelines to minimize the number of diagrams:

(i) We know that BD represents the least possible situation for the given set of statements. If an affirmative conclusion is true for BD, then it will be true for all ADs.

(ii) If an affirmative conclusion or a negative conclusion is false for BD, then it can be said that the conclusion does not follow the given statements.

(iii) If a negative conclusion is true for BD, it may or may not be true for ADs.

Let us understand the above with the help of the following example.

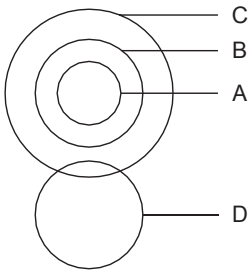
Example 1:

Statements: All A's are B's.
All B's are C's.
Some C's are D's.

Conclusions: (I) All A's are C's.
(II) Some B's are D's.
(III) No A is D.
(IV) No C is A.

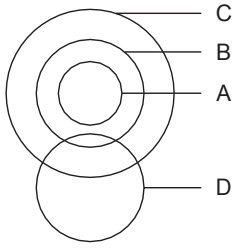
The following are some of the possible diagrams for the given set of statements.

(a)



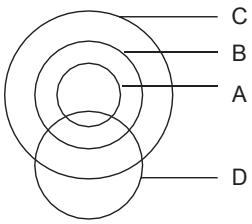
(B D)

(b)



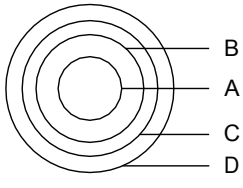
(A D)

(c)



(A D)

(d)



(A D)

Conclusion (I), 'All A's are C's', is affirmative and is true for the basic diagram (a). This means that it will be true for all the ADs. Hence, conclusion (I) follows the given statements. Conclusion (II), 'Some B's are D's', is affirmative and is false for the BD. Therefore, it does not follow the given statements. Conclusion (III), 'No A is D' is negative and is true for BD. This means that we will have to draw some ADs to verify its truthfulness. It observed that the statement is true for the AD (b), but false for the ADs (c) and (d). Hence, it can be concluded that conclusion (III) does not follow the given statements. Conclusion (IV), 'No C is A' is negative and is false in the BD. Hence, it does not follow the given statements.

Analysis:

Since BD represents the least possible situation, for the given statements, an affirmative conclusion, which is true for the least possible situation will always be true. On the other hand, a negative conclusion, though true for the possible situation, may or may not be true for the other situations.

From the above example, it is clear that we need to draw AD only when a negative conclusion becomes true for BD.

As per the above information, the truthfulness of such negative conclusion should be checked by drawing all possible ADs. But instead of checking in so many ADs, we need to draw only one AD, in which the statement, which is complementary to this particular conclusion is true. Hence, if the 'complementary conclusion' turns out to be true, then the conclusion under consideration is false. While trying to draw such AD, it has to be ensured that no given statement is negated in the AD. If such AD can be drawn, then the negative conclusion does not follow the given statements; otherwise such a conclusion is always true.

If a complementary pair exists in the given conclusions, then either negative conclusion of that pair is true and the affirmative conclusion is false for the BD, or the negative conclusion becomes false for the BD and the affirmative conclusion becomes true. In such circumstances, we choose the answer choice in terms of 'either-or'. There may be occasions where the negative conclusions always remain true for all ADs and the affirmative statements are always false. In such a case, the 'either-or' situation does not arise.

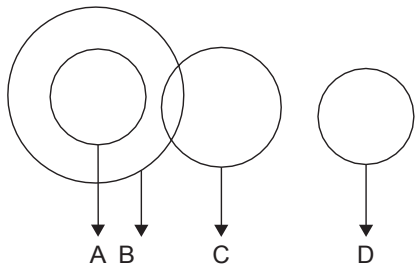
The following example will be helpful in understanding the above concept.

Example 2:

Statements: All A's are B's.
Some B's are C's.
No B is D.

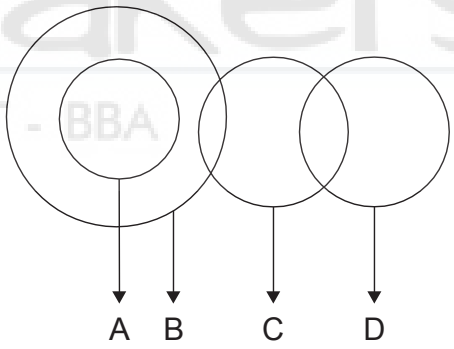
Conclusion: (I) No C is D.
(II) No A is D.
(III) Some C's are not D's.

Solution:



Above diagram is the BD for the given statements.
Conclusion (I) is negative and is true.
Conclusion (II) is negative and is true.
Conclusion (III) is negative and is true.

To prove conclusion (I), 'No C is D' to be false, we have to prove that its complementary conclusion, 'Some C's are D's' is true. Hence, the AD for this will be as shown below:



The above diagram does not defy any of the given statements. Conclusion (I), 'No C is D' is false for this diagram. Hence, it is not valid.

To negate conclusion (II), 'No A is D' and (III), 'Some C's are not D's', we have to prove that their respective complementary conclusions 'Some A's are D's' and 'All C's are D's' are true. This is possible, only if D encroaches into B. But this will violate statement (3). Hence, no diagram can be drawn to negate these two conclusions. Hence, only conclusion (II) and (III) follows.

Thus, we are able to answer the question with only two diagrams. From the BD, we can verify the truthfulness of each statement and accordingly decide whether a conclusion follows the given statements or not. In

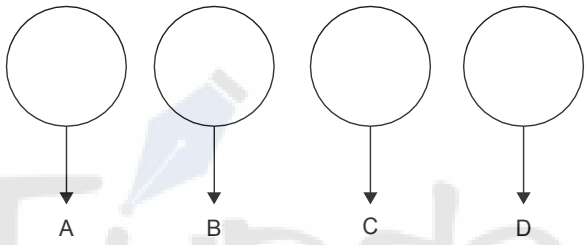
case of a negative conclusion becoming true, we go for AD to prove the negative conclusion is false. If such AD is possible, the negative statement does not follow, otherwise it follows the given statements. In certain rare cases we may have to go for a second AD, as shown in the following example.

Example 3:

Statements: Some A's are not B's.
Some B's are not C's.
Some C's are not D's.

Conclusions: (I) Some A's are not D's.
(II) Some B's are not D's.
(III) Some A's are not C's.
(IV) Some C's are not A's.

Basic diagram:

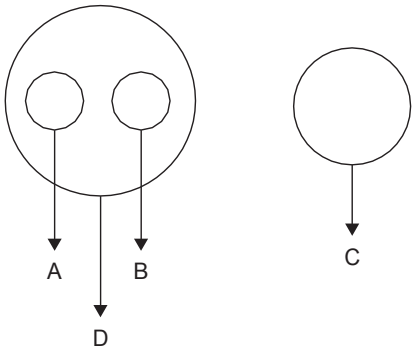


Conclusion (I) is negative and is true.
Conclusion (II) is negative and is true.
Conclusion (III) is negative and is true.
Conclusion (IV) is negative and is true.

We observe that:

'All A's are D's' is complementary to conclusion (I).
'All B's are D's' is complementary to conclusion (II).
'All A's are C's' is complementary to conclusion (III).
'All C's are A's' is complementary to conclusion (IV).

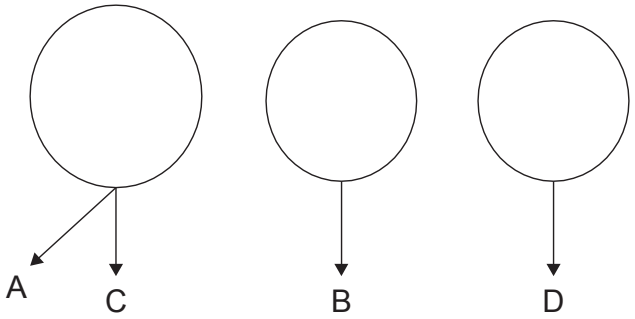
Alternate diagram 1:



Conclusion (I) is false.
Conclusion (II) is false.

To negate conclusions (III) and (IV), we have to draw another alternate diagram.

Alternate diagram 2:



Conclusion (III) is false.
Conclusion (IV) is false.
Hence, none of the conclusions follows.

From the above example, it is also clear that no conclusion can be drawn when all the statements are negative.

Let us take some more examples.

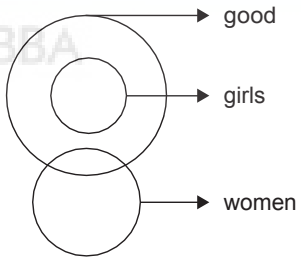
Example 4:

Statements: All girls are good.
Some good are women.

Conclusions: (I) Some women are girls.
(II) No woman is a girl.

Clearly, the above two conclusions form a complementary pair.

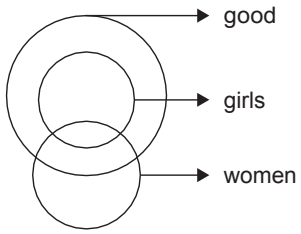
Basic diagram:



Conclusion (I) is affirmative and is false.
Conclusion (II) is negative and is true.

Now, we should draw an AD, which would make conclusion (II) false, i.e., which proves 'Some women are girls'.

Alternate diagram:



From the above diagram, conclusion (II) is false, but conclusion (I) is true at the same time. But they

both cannot be true or false at the same time. Hence, either (I) or (II) follows.

Example 5:

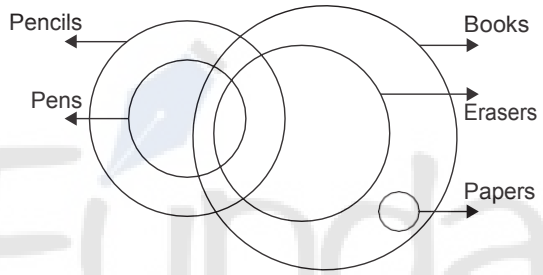
Statements: All pens are pencils.
Some pens are erasers.
All papers are books.
All erasers are books.

Conclusions: (I) Some pencils are books.
(II) Some books are pens.
(III) No paper is pen.
(IV) Some erasers are papers

(A) Only I, II and IV (B) Only I and II
(C) Either I or II (D) Only III and IV

Solution:

The given statements can be represented in the following basic diagram.

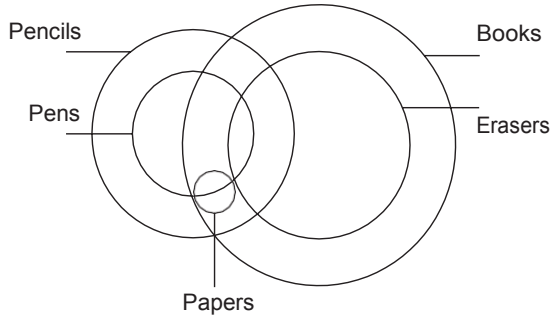


From the above diagram, we incur the following:

Conclusion I, affirmative, follows.
Conclusion II, affirmative, follows.
Conclusion III, negative follows.
Conclusion IV, affirmative, does not follow.

As the affirmative conclusions (I and II) are true in the basic diagram, they will always be true. The affirmative conclusion (IV) is false in the basic diagram. Even if it is true in other diagrams, it cannot be said to be true as there is a situation, where it is false.

The negative conclusion III, which is true in the basic diagram has to be checked whether it can be false in any alternate diagram. The following is such diagram.



There is a situation, where conclusion III is false. Hence, only I and II are true.

Example 6:

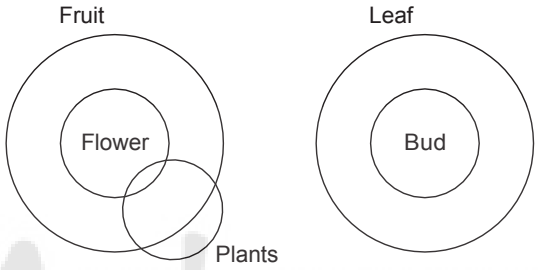
Statements: No leaves are fruits.
Flower is fruit.
Every bud is leaf.
Some plants are flowers.

Conclusions: (I) No flower is bud.
(II) Some plants are not fruits.
(III) Some plants are not leaves.
(IV) Some leaves are not buds.

(A) Only I (B) Only II
(C) Both I and III (D) Both II and III

Solution:

The given statements can be represented in the following basic diagram.



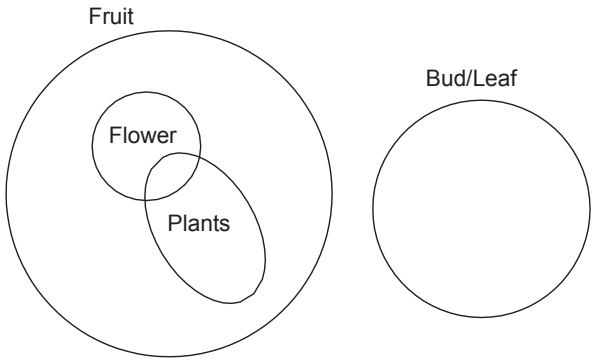
From the above diagram, we incur the following:

Conclusion I, negative, follows.
Conclusion II, negative, does not follow.
Conclusion III, negative, follows.
Conclusion IV, negative, follows.

As the negative conclusions are true for the basic diagram, let us try to negate them. As no leaf is fruit (given statement), no flower which is inside the circle fruit can ever be a bud which is inside the circle leaf. Hence, conclusion I cannot be negated. Similarly, some plants which are inside the circle flowers can never be leaves. Hence, conclusion III cannot be negated.

Conclusion IV can be negated in the following alternate diagram.

The alternate diagram is given as:



Hence, only I and III follow.

Summary:

1. The words 'Some', 'Some-not', 'All' and 'No' are called qualifiers.
2. Words like 'Many', 'More', 'a Few', 'Most', etc., are treated as synonyms to 'Some'. Words like 'Not-all' is treated equivalent to 'Some-not'.
3. Statements/conclusions with qualifiers 'Some' and 'All' are classified as affirmative statements/conclusions and those with qualifiers 'Some-not' and 'No' are classified as negative statements/conclusions.
4. ('Some', 'No') and ('Some-not', 'All') form complementary pairs.
5. Diagram with the least encroachment is called Basic Diagram (BD) and all other diagrams are called Alternate Diagrams (AD).
6. Truthfulness of conclusions are first tested for BD. Only when a negative conclusion is true for BD, AD is required to be drawn in such a way that this negative conclusion which was true for BD becomes false in the AD. If such AD is not possible, then the conclusion is always true.
7. Whenever there is a complementary pair of conclusions, check for 'either – or' as answer.
8. When all the statements are negative, no conclusion can be drawn. In such a case, the answer is always 'None of these'.
9. As a corollary, when all the conclusions are affirmative, BD alone is sufficient to answer the question

❒ SYLLOGISM METHOD

Here we will look at arriving at the deduction by using some simple rules.

First, let us look at some basic terms used in the rules and understand what they mean.

The two statements given in the question are called 'premises' and the answer, the conclusion.

Example: All dogs are cats (i)
All cats are pigs (ii)

These two statements are called 'premises.'

Conclusion: All dogs are pigs.

The premises normally start with the words All, No, Some and Some - Not.

The word 'All' has its synonyms, such as Every, Any, Each, whereas the word 'Some' can also be replaced by Many, Few, A little, Most of, Much of, More, etc.

These words are referred to as qualifiers (also termed as quantifiers).

A premise consists of a subject and a predicate wherein the first term [For example: 'dogs' in statement (i)] is the subject and the second term [For example: 'cats' in statement (i)] is the predicate. Similarly, in statement (ii), 'cats' is called the subject and 'pigs' is the predicate.

The word that occurs in both the premises is known as the 'middle term' ('cat' in the example, given above). The answer or 'conclusion' should consist of the other two words ('dogs' and 'pigs' in the above example) and the middle term should not appear in the answer.

The premises can be divided into:

1. Universal statements
2. Particular statements

This classification of the premises into the above categories is dependent on the qualifier used in the premise. For example, the statements where 'All' is used are called universal statements and the statements where 'Some' is used are called particular statements.

Premises can also be divided into:

1. Positive (affirmative) statements
2. Negative statements

If there is a negative term like 'not' or 'no' in the statement, it is called a negative premise. Otherwise it is called a positive premise or an affirmative statement.

The combination of the two different categories of classifications leads to four different premises as given in Table 2 below.

Table – 1

	Affirmative	Negative
Universal	All A	No E
Particular	some; many I	some not; many not O

The subject or the predicate can be either distributed or not distributed in the given premise.

The subject and the predicate are either distributed (✓) or not distributed (×) depending upon the type of statement given (particular, affirmative, etc.). The following table shows the distribution pattern of the subject and the predicate.

Table – 2

	Subject	Predicate
Universal affirmative	✓	×
Universal negative	✓	✓
Particular affirmative	×	×
Particular negative	×	✓

Note: ✓ indicates distributed
× indicates undistributed

❒ RULES FOR DEDUCTIONS

1. Every deduction should contain three and only three distinct terms.
2. If both the premises are particular, no conclusion can be drawn.
3. If both the premises are negative, no conclusion can be drawn.
4. The middle term must be distributed at least once in the premises.
5. If one premise is particular, then the conclusion must be particular.
6. If one premise is negative, then the conclusion must be negative.
7. No term can be distributed in the conclusion, if it is not distributed in the premises.

We take examples of each type and look at them in detail.

Example 1:

All dogs are cats. **(i)**
All cats are pigs. **(ii)**

As the first statement is a universal affirmative statement, the subject (dogs) has to be distributed (✓) and the predicate (cats) is not distributed (×). As the second statement is also universal affirmative, the subject cat is distributed (✓) and the predicate pigs is not distributed (×). The above answer/logic is arrived at on the basis of Table II.

The middle term ('cats' is the middle term as it occurs in both the premises) is distributed once in the premises. Hence, it satisfies Rule 2. As 'dogs' is distributed in the premise and 'pigs' is undistributed in the deduction also, they should appear accordingly. The type of statement that satisfies both of them is universal affirmative statement, i.e., a statement with 'All'. Hence, the answer will be 'All dogs are pigs'.

The answer cannot be 'All pigs are dogs', because Rule 7 states that no term can be distributed in the conclusion if it is not distributed in the premises. As 'pigs' is not distributed in the premise, it cannot be distributed in the conclusion (because if we take 'All pigs are dogs', then the subject 'pigs' will be distributed). Hence, the conclusion 'All pigs are dogs' is wrong.

Example 2:

All cats are dogs. **(i)**
All cats are pigs. **(ii)**

Statement (i) is universal affirmative and hence, the subject 'cats' is distributed and the predicate 'dogs' is not distributed as per Table II.

Statement (ii) is also universal affirmative and hence, the subject 'cats' is distributed and the predicate 'pigs' is not distributed as per Table II.

Here, the middle term 'cats' ('cats' is the middle term as it is occurring in both the premises) is distributed. Hence, we can draw a conclusion.

The answer should contain the terms 'dogs' and 'pigs' and both the terms are not distributed. Referring to Table II, we find that this is possible only in particular affirmative [the conclusion cannot start with the qualifier 'All' as the subject in 'All' should be distributed]. According to Rule 7, a term cannot be distributed in the conclusion if it is not distributed in the premises. So, the answer will be as follows.

Some dogs are pigs.
or
Some pigs are dogs.

Example 3:

All dogs are cats. **(i)**
All pigs are cats. **(ii)**

Statement (i) is universal affirmative and hence, the subject 'dogs' is distributed and the predicate 'cats' is not distributed. In statement (ii), which is also a universal affirmative, the subject 'pigs' is distributed and the predicate 'cats' is not distributed. This is arrived at on the basis of Table II.

The middle term 'cats' ['cats' is the middle term as it occurs in both the statements] is not distributed in either of the two statements. From Rule 2, which states that the middle term should be distributed at least once in the premises for drawing a conclusion, we cannot draw any conclusion in this case.

Example 4:

All cats are dogs. **(i)**
Some cats are pigs. **(ii)**

The first statement is a universal affirmative premise and hence, the subject 'cats' is distributed and the

predicate 'dogs' is not distributed (×). The second statement is particular affirmative and hence, both the subject 'cats' and the predicate 'pigs' are not distributed (×) as per Table II. As we have a particular premise, the conclusion should also be a particular one as per Rule 4. The middle term is distributed and we can draw a conclusion. So, the answer will be as follows.

Some dogs are pigs.
or
Some pigs are dogs.

Example 5:

All dogs are cats. **(i)**
No cats are pigs. **(ii)**

As the first premise is a universal affirmative, the subject (dogs) is distributed and the predicate (cats) is not distributed. In the second premise, which is a universal negative, the first term (cats) and the second term (pigs) are both distributed (as per Table II). As the middle term is distributed at least once in the premises, Rule 2 is satisfied and hence, we can draw a conclusion.

From Rule 3, which states that if one of the premises is negative the conclusion should be negative, the conclusion should be negative and as both the terms 'dogs' and 'pigs' are distributed, the conclusion should be a universal negative statement. Hence, the answer will be as follows.

No dogs are pigs.
or
No pigs are dogs.

Example 6:

All dogs are cats. (i)
Some cats are pigs. (ii)

Since the first statement is a universal affirmative, 'dogs' is distributed and 'cats' is not distributed. Since the second statement is a particular affirmative, 'cats' is not distributed and 'pigs' is also not distributed (as per Table II).

In the above given example, no conclusion can be drawn, as Rule 2 states that the middle term ('cats' in the above example as it occurs in both the premises) should be distributed at least once in the premises, which is not satisfied.

Example 7:

All dogs are cats. **(i)**
Some cats are not pigs. **(ii)**

The first statement is a universal affirmative and hence, the subject (dogs) is distributed and the predicate (cats) is not distributed.

The second statement is a particular negative and hence, the subject (cats) is not distributed and the predicate (pigs) is distributed (Table II).

But as the middle term (cats) is not distributed at least once in the premises, Rule 2 is not satisfied and hence we cannot draw any conclusion.

Example – 8

All cats are dogs. **(i)**
Some cats are not pigs. (ii)

The first statement is a universal affirmative and hence, 'cats' is distributed and 'dogs' is not distributed. The second statement is a particular negative and hence, 'cats' is not distributed and 'pigs' is distributed (as per Table II).

Here, the middle term (cats) is distributed and hence, we can draw a conclusion.

The conclusion should be particular negative as Rule 3 states that if a premise is negative, the conclusion should also be negative. Also Rule 4 states that if a premise is particular, the conclusion should also be particular. Hence, the conclusion should be a particular negative.

In particular negative, we know that the subject is not distributed and the predicate is distributed.

The terms 'dogs' and 'pigs' should come in the conclusion. Also, since 'dogs' is not distributed in the premise, it cannot be distributed in the conclusion, as per Rule 7.

As per the above reasoning, only 'pigs' can be the predicate in the conclusion and hence, 'dogs' will be the subject.

Thus, the answer will be 'Some dogs are not pigs'.

EXERCISE-1

Directions for questions 1 to 15: Select the alternative that logically follows from the two given statements, but not from one statement alone.

1. All cooks are drivers.
All drivers are dancers.
(A) All dancers are drivers.
(B) All cooks are dancers.
(C) No cook is dancer.
(D) Both (A) and (B)

2. All sane are men.
Some sane are insane.
(A) Some men are insane.
(B) No men are insane.
(C) All men are insane.
(D) None of the above

3. No plane is ship.
No ship is bus.
(A) No bus is plane.
(B) No plane is bus.
(C) Both (A) and (B)
(D) None follows

4. All cats are dogs.
No dogs are rats.
(A) All cats are rats.
(B) Some cats are rats.
(C) No cat is rat.
(D) None of the above

5. Some books are brooks.
Some brooks are not cooks.
(A) Some books are cooks.
(B) Some books are not cooks.
(C) Both (A) and (B)
(D) None follows

6. Some waters are rivers.
All rivers are oceans.
(A) Some waters are not oceans.
(B) Some oceans are not waters.
(C) Some waters are oceans.
(D) Both (A) and (C)

7. All papers are books.
Some books are not diaries.
(A) No paper is a diary.
(B) Some papers are not diaries.
(C) Some papers are diaries.
(D) None follows

8. No white is black.
No black is red.
(A) Some white is red.
(B) Some white is not red.
(C) No white is red.
(D) None follows

9. Some shirts are trousers.
Some trousers are pants.
(A) Some shirts are not pants.
(B) No shirt is pant.
(C) Some pants are not shirts.
(D) None follows

10. All Ws are Ps.
All Ws are Ks.
(A) All Ps are Ks. (B) All Ks are Ps.
(C) Some Ps are Ks. (D) Both (B) and (C)

11. All Asians are Indians.
No Asian is an African.
(A) Some Africans are not Indians.
(B) No Indian is an African.
(C) Some Indians are not African.
(D) Both (B) and (C)

12. Some animals are humans.
Some animals are not birds.
(A) Some humans are not birds.
(B) Some birds are not humans.
(C) No bird is a human.
(D) None follows

13. All mobiles are electronics.
Some mobiles are smart phones.
(A) Some electronics are smart phones.
(B) Some smart phones are electronics.
(C) Some electronics are not smart phones.
(D) Both (A) and (B) follow.

14. All roads are wide.
Some wide are not highways.
(A) Some highways are not roads.
(B) Some roads are highways.
(C) No highway is a road.
(D) None follows

15. Some vessels are bottles.
No vessel is a container.
(A) Some containers are not bottles.
(B) Some bottles are not containers.
(C) No bottle is a container.
(D) None follows

Directions for questions 16 to 20: Each of these questions consist of two statements followed by two conclusions marked I and II. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which of the given conclusion(s) logically follow(s) the statements, disregarding the commonly known facts. Mark your answer as follows:
(A) If only I follows.
(B) If only II follows.
(C) If neither I nor II follows.
(D) If both I and II follow.

16. Statements: All seas are bees.
Some teas are bees.
Conclusions: I. All teas are seas.
II. Some seas are teas.

17. Statements: All grapes are apples.
All apples are mangoes.
Conclusions: I. All grapes are mangoes.
II. All mangoes are grapes.

18. Statements: Some doctors are lawyers.
Some lawyers are architects.
Conclusions: I. Some doctors are architects.
II. All architects are doctors.

19. Statements: All weddings are writings.
All weddings are wirings.
Conclusions: I. Some writings are wirings.
II. All writings are wirings.

20. Statements: Some queues are rows.
No row is a circular.
Conclusions: I. All circular are queues.
II. Some circulars are queues.

Directions for questions 21 to 25: The questions given below have four groups of three statements each. Read the statements in each group carefully and identify the group/groups where the third statement logically follows the first two statements in the group.

21. (a) All books are copies. All copies are papers. All books are papers.
(b) All cubes are squares. All cubes are triangles. All triangles are squares.
(c) All singers are dancers. All dancers are musicians. All musicians are singers.
(d) No cock is hen. All hens are chickens. No hen is chicken.
(A) Only d (B) Only a
(C) Only b and c (D) Only a and d

22. (a) Some journals are magazines. Some magazines are periodic. Some journals are periodic.
(b) Some horror is ghost. All ghosts are faints. Some horror are faints.
(c) All scientists are researchers. All researchers are professors. Some professors are scientists.
(d) Many baggages are luggages. All luggages are packages. Some packages are not baggages.
(A) Only b, c and d (B) Only b and c
(C) Only a and d (D) Only b

23. (a) Many fountains are cascades. No waterfall is fountain. Some cascades are not waterfalls.
(b) No bag is pack. No pack is jack. No jack is bag.
(c) No good is bad. All bad is not good. Some good is not good.
(d) Scale is ruler. No ruler is pointer. No pointer is scale.
(A) Only a (B) Only d
(C) Only b and c (D) Only a and d

24. (a) No esthetic is an atheist. Some esthetics are monotheists. Some monotheists are not polytheists.
(b) All sentences are words. No word does not have meaning. Some which do not have meanings are not sentences.
(c) No river is sea. Some seas are oceans. Some oceans are not rivers.
(d) No MMTS is MRTS. All public transports are MRTS. No public transport is MMTS.
(A) Only b, c and d (B) Only c and d
(C) Only a and b (D) Only b and c

25. (a) No sitar is a guitar. No guitar is violin. No violin is a sitar.
(b) Ragas are songs. Some pops are not songs. Some pops are not ragas.
(c) Some costume designers are not hair designers. All designers are not hair designers. Some designers are not costume designers.
(d) AC's are not DCs. Some DCs are not BC's. Some AC's are not BC's.
(A) Only b and d (B) Only a and d
(C) Only b (D) Only a and b

Directions for questions 26 to 30: Each question below has four groups of three statements each. Read the statements in each group carefully and identify the group/groups where the third statement logically follows the first two statements in the group.

26. (a) All bohemians are transcendent. Some transcedents are vermishells. Some bohemians are vermishells.

(b) Some milks are cheese. No cheese is butter. Some butters are not milks.
(c) All hookahs are smokes. All smokes are pungents. Some hookahs are pungents.
(d) No white is black. All blacks are silks. Some silks are not whites.
(A) Only c and d (B) Only a
(C) Only a and b (D) a, b, c and d

27. (a) Few peanuts are groundnuts. Many coconuts are peanuts. Some groundnuts are not coconuts.
(b) Every one is loyal. All honest are one. Some loyal are honest.
(c) No chings are changs. Some twangs are not changes. Some twangs are not chings.
(d) People are hardworking. Some hardworking are successful. All successful are people.
(A) Only c (B) Only b
(C) Only b and d (D) Only a and c

28. (a) Tigers are kings. Kings are deers. Tigers are deers.
(b) Palika is a very good neighbour. Palika is humble. Some humble are not very good neighbour.
(c) Some friends are best. No best is enemy. Some friends are enemy.
(d) All mothers are goodness. All mothers are females. All females are goodness.
(A) Only a and b (B) Only a
(C) Only b and c (D) Only a, c and d

29. (a) All pinks are purple. All purple are violet. All violet are pinks.
(b) No chord is scale. Some scales are minors. No chord is minor.
(c) Some pollutions are dusts. Some dusts are harmfuls. Some pollutions are harmfuls.
(d) No calcium is protein. All vitamins are calcium. No vitamin is protein.
(A) Only b (B) Only a and c
(C) Only d (D) Only a and d

30. (a) All formidable are fearless. All warriors are fearless. All formidable are warriors.
(b) Some pubs are casino. No casino is public. Some pubs are not public.
(c) Some sages are ages. All fages are sages. Some ages are fages.
(d) No wine is old. No gold is old. No wine is gold.
(A) Only a and c (B) Only a and d
(C) Only b (D) Only c

Directions for questions 31 to 35: In each of the following questions, three statements followed by four conclusions marked I, II and III are given. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which of the given conclusion(s) logically follow(s) the statements, disregarding the commonly known facts.

31. Statements: All digits are symbols.
All symbols are letters.
Some letters are elements.
Conclusions: I. All digits are letters.
II. Some symbols are elements.
III. All letters are digits.
(A) Only I and II follow.
(B) Only II and III follow.
(C) Only I and III follow.
(D) Only I follows.

32. Statements: All fats are mats.
Some mats are rats.
All rats are cats.
Conclusions: I. Some fats are cats.
II. Some mats are cats.
III. Some rats are fats.
(A) Only I follows. (B) Only II follows.
(C) Only III follows. (D) Both I and II follow.

33. Statements: All inputs are outputs.
Some outputs are results.
No result is good.
Conclusions: I. Some inputs are results.
II. Some goods are not outputs.
III. Some inputs are good.
(A) Only I follows.
(B) Only II follows.
(C) Both II and III follow.
(D) None follows

34. Statements: No pen is pencil.
No pencil is paper.
No paper is board.
Conclusions: I. No pen is paper.
II. Some pencils are not boards.
III. No board is pen.
(A) Only I follows. (B) Only II follows.
(C) Only III follows. (D) None follows

35. Statements: No one is two.
Some two are threes.
All four are two.
Conclusions: I. Some four are threes.
II. No one is a four.
III. Some four are not one.
(A) Only I and II follow.
(B) Only I and III follow.
(C) Only II and III follow.
(D) Only I follows.

Directions for questions 36 to 40: Each of these questions consists of six statements followed by sets of three statements each. Find the set in which the third statement can be logically concluded from the first two statements.

36. (a) No wolf is a tiger.
(b) No deer is tiger.
(c) Some bears are not tigers.
(d) Some deers are not bears.
(e) Some bears are wolves.
(f) No deer is wolf.
(A) aec (B) bfd
(C) efd (D) fbd

37. (a) Anything which is kind is gentle.
(b) Everything which is gentle is not hard.
(c) Nothing which is firm is gentle.
(d) Something which is firm is hard.
(e) Many things which are hard are not kind.
(f) Nothing which is kind is firm.
(A) acf
(B) dfe
(C) abe
(D) More than one of the above

38. (a) Screening is sedimentation.
(b) Sedimentation is purification.
(c) Purification is filtration.
(d) Filtration is screening.
(e) Screening is purification.
(f) Sedimentation is filtration.
(A) cde (B) bfc
(C) bcf (D) aeb

39. (a) No fish is bird.
(b) Flyers are gliders.
(c) No flyer is fish.
(d) Some gliders are birds.
(e) No flyer is bird.
(f) Some flyers are birds.
(A) dbf (B) ace
(C) efd (D) None of these

40. (a) Junk food contains more fat.
(b) Fast food is not healthy.
(c) Fast food does not contain more fat.
(d) Junk foods are fast foods.
(e) Some fast food are junk foods.
(f) Junk food is not healthy.
(A) ace (B) ade
(C) bfe (D) bdf

EXERCISE-2

Directions for questions 1 to 18: Each of these questions consists of six statements followed by sets of three statements each. Find the set in which the statements are logically related.

1. (a) Shed is not shelter.
(b) Roof is protection.
(c) Roof is shed.
(d) Roof is shelter.
(e) Some shelter is not protection.
(f) Shed is protection.
(A) cda
(B) aef
(C) bcf
(D) More than one of the above

2. (a) Engineers are not doctors.
(b) Some doctors are psychologists.
(c) Some doctors are not professors.
(d) Some engineers are professors.
(e) No professor is a psychologist.
(f) Some psychologists are not engineers.
(A) acd (B) def
(C) bfa (D) All the above

3. (a) All cricketers are footballers.
(b) All footballers are magicians.
(c) All magicians are cricketers.
(d) Some cricketers are footballers.
(e) Some footballers are magicians.
(f) Some magicians are cricketers.
(A) abc (B) efb
(C) bcd (D) def

4. (a) Some RCs are not DCs.
(b) All PCs are ACs.
(c) Some ACs are not RCs.
(d) Some ACs are not DCs.
(e) Many RCs are PCs.
(f) Some PCs are not DCs.
(A) ceb (B) fdb
(C) afe (D) dbe

5. (a) Truss is not roof.
(b) Truss is not timber.
(c) Post is roof.
(d) Timber is roof.
(e) Post is not truss.
(f) Timber is post.

(A) bfe
(B) cae
(C) cdf
(D) More than one of the above

6. (a) All plays are puzzles.
(b) All riddles are plays.
(c) Some games are puzzles.
(d) No puzzle is game.
(e) Some games are riddles.
(f) All riddles are puzzles.
(A) afd (B) cef
(C) fab (D) Both (B) and (C)

7. (a) Some figures are curves.
(b) Some curves are squares.
(c) Some squares are figures.
(d) Some squares are not triangles.
(e) All curves are figures.
(f) No figure is triangle.
(A) cdf (B) def
(C) acb (D) abe

8. (a) No shoe is black.
(b) Some black is leather.
(c) Some leather are shoes.
(d) All black is dark.
(e) Some shoes are black.
(f) No shoe is dark.
(A) afd (B) abd
(C) ced (D) def

9. (a) All roses are lillies.
(b) All lillies are jasmines.
(c) All jasmines are roses.
(d) Some orchids are lillies.
(e) Some orchids are roses.
(f) Some orchids are jasmines.
(A) abc (B) dea
(C) efd (D) bef

10. (a) Some directories are dictionaries.
(b) Some yellow pages are not dictionaries
(c) All directories are information.
(d) No dictionary is directory.
(e) All directories are yellow pages.
(f) All information are yellow pages.
(A) ade (B) def
(C) bde (D) abc

11. (a) All sad are anxious.
(b) Some mood are depressed.
(c) No sad is anxious.
(d) All moods are sad.
(e) All sad are depressed.
(f) All anxious are moods.
(A) bde (B) cdf
(C) adf (D) ade

12. (a) All prayers are tantras.
(b) Some mantras are prayers.
(c) Chantings are mantras.
(d) No mantra is tantra.
(e) All tantras are chantings.
(f) Some prayers are chantings.
(A) cde (B) efa
(C) bcf (D) Both (B) and (C)

13. (a) All gliders are smoother.
(b) All gliders are shiner.
(c) Some shiner are mirror.
(d) Some smoother are shiner.
(e) All smoother are shiner.
(f) No mirror is smoother.
(A) cdf (B) abe
(C) cef (D) acd

14. (a) All seconds are minutes.
(b) All minutes are hours.
(c) All hours are days.
(d) Some hours are minutes.
(e) Some minutes are seconds.
(f) Some seconds are hours.
(A) efb (B) fda
(C) ade (D) dfe

15. (a) Some rooms are dormitories.
(b) All suites are hotels.
(c) No building is a dormitory.
(d) Some suites are not dormitories.
(e) All hotels are buildings.
(f) Some dormitories are not hotels.
(A) cbf (B) eba
(C) cfe (D) adc

16. (a) No fibre is wood.
(b) Some fibre is rubber.
(c) Some wood is not fibre.
(d) Some rubber is not wood.
(e) No stick is fibre.
(f) All sticks are wood.
(A) eaf (B) cfe
(C) adb (D) All the above

17. (a) Some doors are not locks.
(b) Some locks are not glasses.
(c) Some glasses are not keys.
(d) Some doors are not glasses.
(e) All keys are locks.
(f) No key is a door.
(A) aef (B) cbe
(C) fcd (D) None of the above

18. (a) All lions are elephants.
(b) No pig is a tiger.
(c) Some elephants are not pigs.
(d) Some lions are not pigs.
(e) Some pigs are elephants.
(f) Some lions are tigers.

(A) fbd (B) dca
(C) fde (D) Both (A) and (B)

Directions for questions 19 to 23: In each of the following questions, four statements followed by four conclusions are given. Consider the statements to be true even though they appear to be at variance with the commonly known facts. Find which of the conclusion(s) logically follow(s) the given statements, disregarding the commonly known facts and choose appropriate answer choice.

19. Statements: All pedals are frames.
All frames are roses.
All hubs are roses.
All keys are hubs.

Conclusions: I. All roses are pedals.
II. All keys are roses.
III. Some hubs are frames.
IV. Some frames are keys.

(A) Only II follows.
(B) Only II and III follow.
(C) Only III and IV follow.
(D) Only I, II and III follow.

20. Statements: Some baskets are caskets.
Some caskets are trunks.
All trunks are fans.
All sweets are fans.

Conclusions: I. Atleast some baskets are trunks is a possibility.
II. Atleast some fans are caskets is a possibility.
III. All fans are baskets is a possibility.
IV. Atleast some sweets are not caskets is a possibility.

(A) Only I and III follow.
(B) Only II and IV follow.
(C) Only I, II and III follow.
(D) All follow

21. Statements: Some forks are spades.
Some spades are not shovels.
All chisels are shovels.
No potato is a chisel.

Conclusions: I. Some shovels are not potatoes is a possibility.
II. Atleast one chisel is a spade is a possibility.
III. All potatoes are shovels is a possibility.
IV. Some forks are chisels is a possibility.

(A) Only III and IV follows.
(B) Only II and IV follow.
(C) Only I, II and IV follow.
(D) All follow.

22. Statements: All bolts are nuts.
All chips are washers.
Some screws are nuts.
All nuts are washers.

Conclusions: I. All bolts are washers.
II. Some washers are screws.
III. Some washers are bolts.
IV. All chips are screws.

(A) Only I follows.
(B) Only I and II follow.
(C) Only I, II and III follow.
(D) All follow

23. Statements: Some doctors are actors.
Some actors are teachers.
All dancers are teachers.
All doctors are engineers.

Conclusions: I. Some actors are engineers.
II. Some teachers are engineers.
III. No engineer is a teacher.
IV. All teachers are doctors.

(A) Either II or III follows
(B) Only I follows
(C) Only I and III follow
(D) Only I and exactly one of II or III follows

Directions for questions 24 to 30: Select the alternative that logically follows from the two given statements, but not from one statement alone.

24. Some shirts are pants.
All pants are shorts.
(A) No shirt is shorts.
(B) Some shirts are shorts.
(C) All shirts are shorts.
(D) None of the above

25. Some gauges are cages.
Some cages are not catches.
(A) Some guages are not catches.
(B) No guage is a catch.
(C) Some guages are catches.
(D) None of the above

26. No red is black.
All blue are black.
(A) All red are blue.
(B) Some red are blue.
(C) No red is blue.
(D) None of the above

27. Some hammers are tools.
All tools are made of iron.
(A) Some hammers are made of iron.
(B) Some hammers are not made of iron.
(C) No hammer is made of iron.
(D) None of the above

28. Some tools are not hammers.
All tools are made of iron.
(A) Some hammers are made of iron.
(B) Some hammers are not made of iron.
(C) Some tools made of iron are not hammers.
(D) None of the above

29. All cigarettes are cigars.
Some cigarettes are not good for health.
(A) Some cigars are not good for health.
(B) Some cigars are good for health.
(C) No cigar is good for health.
(D) Both (A) and (B)

30. Some MBAs are CEOs.
All CEOs are Directors.
(A) Some MBAs are not Directors.
(B) Some MBAs are Directors.
(C) Both (A) and (B)
(D) None of the above

Directions for questions 31 to 35: Each of the following questions consists of four statements followed by four conclusions. Consider the statements to be true even if they vary from the normally known facts and find out which of the conclusion(s) logically follow(s) the given statements and choose the proper alternative from the given choices.

31. Statement: Some watches are clocks.
Some clocks are times.
Some times are fast.
Life is fast.
Conclusions:
I. Some watches are life.
II. Some lifes are time.
III. Some clocks are fast is a possibility.
IV. Some watches are fast is not a possibility.
(A) Only I and II
(B) Only III follows.
(C) Only II, III and IV
(D) All follow

32. Statements: Earth is tree.
All trees are branches.
All branches are leaves.
All branches are flowers.
Conclusions: I. Earth is a flower.
II. All flowers are leaves is a possibility.
III. Some trees are flowers.
IV. No flower is leaf is not a possibility.
(A) Only II and IV
(B) Only I, II and III
(C) Only I and III
(D) All follow.

33. Statements: Some boys are engineers.
All engineers are graduates.
All graduates are literate.
Some girls are literate.
Conclusions: I. No boy is a girl.
II. Some boys are literates.
III. Some girls are engineers.
IV. All engineers are literate.
(A) Only II and IV
(B) Only I, II and IV
(C) Only II, IV and I or III
(D) Only III and II

34. Statements: No rice is curd.
All rice is grain.
Oats are grains.
No flour is grain.
Conclusions: I. No curd is grain.
II. No rice is oat.
III. No flour is oat.
IV. Some oats are curds.
(A) Only I, II and III
(B) Only III
(C) Only II and III
(D) Only III and II or IV

35. Statements: Flowers are beautiful.
No beautiful is ugly.
Coal is ugly.
Beautiful is attractive.
Conclusions: I. Flowers are attractive.
II. No flower is coal.
III. Some flowers are not ugly.
IV. Some attractive are not coal.
(A) Only I
(B) Only I, II and III
(C) Only II, III and IV
(D) All follow

Directions for questions 36 to 40: Each of these questions consists of three/four statements and four choices. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which choice logically does not follow the given statements, disregarding the commonly known facts:

36. Statements: Some bazaar are beach.
No beach is a beauty.
All beauty is bean.

(A) Some beaches being beans is not a possibility.
(B) Some beauty is bean.
(C) Some bazaar being bean is a possibility.
(D) All bean being beauty is a possibility.

37. Statements: All chat are compete.
Some chat are cherry.
All clean are compete.

(A) Some compete are cherry.
(B) Some clean are compete.
(C) Some clean are chat.
(D) All cherry being compete is a possibility.

38. Statements: All giant are glow.
Some glow are not locks.
Some locks are music.

(A) Some giant are glow.
(B) Some music being glow is a possibility.
(C) Some locks are giant.
(D) All glows being giant is a possibility.

39. Statements: Some mute are sound.
Some sound are pink.
Some sweet are sound.

(A) Some pink being mute is a possibility.
(B) All mute being sound is not a possibility.
(C) Some pink are sound.
(D) Some mute being pink is a possibility.

40. Statements: No battle is paper.
Some paper are word.
All battle are amount.

(A) All paper being word is a possibility.
(B) Some amount are battle.
(C) Some word being amount is a possibility.
(D) Some battles are papers.

EXERCISE-3

Directions for questions 1 to 7: Each question below has four groups of three statements each. Read the statements in each group carefully and identify the group/groups where the third statement logically follows the first two statements in the group.

1. (a) A few gasoline are flammable. All flammable are ignition. Many gasoline are ignition.
(b) All suppers are breakfast. Some supper are not dinner. Some breakfast are not dinner.
(c) No electron is nucleus. All protons are electrons. Some protons are not nucleus.
(d) Some cars are not taxies. All cars are buses. Some buses are not taxies.

(A) Only b (B) Only c and d
(C) Only a and b (D) All of them

2. (a) All colours are walls. No wall is plain. No colour is plain.
(b) All sonic are cosmic. Some cosmic are superfast. All sonic are superfast.
(c) Every amount is refundable. Some amounts are retainable. Some refundable is retainable.
(d) No one is novice. Some novice is shrewd. Some shrewd are not one.

(A) Only a and b (B) Only a, c and d
(C) Only b and c (D) Only c and d

3. (a) All even are numbers. Some numbers are odd. Some odd are even.
(b) Some coins are rupees. No dollar is a rupee. Some coins are not dollars.
(c) All shirts are cloths. Some good are not cloths. Some shirts are not good.
(d) Some glasses are spectacles. Some fibre are not glasses. Some fibre are spectacles.

(A) Only a (B) Only b
(C) Only c (D) Only b and d

4. (a) All relations are friends. No relation is an enemy. Some friends are not enemies.
(b) No relation is an enemy. All relations are friends. Some enemies are not friends.
(c) All bikes are vehicles. All vehicles are useful. All useful are bikes.
(d) All bikes are vehicles. All useful are bikes. Some vehicles are useful.

(A) Only b and c (B) Only a and c
(C) Only a and d (D) Only b and d

5. (a) All protocols are rules. All protocols are mandatory. All rules are mandatory.
(b) All fruits are eatable. No eatable is vegetable. No vegetable is a fruit.
(c) No protocol is a rule. Some rules are mandatory. Some mandatory are not protocols.
(d) Some eatable are fruits. Some vegetables are eatable. Some fruits are vegetables.
(A) Only a and b (B) Only b and c
(C) Only c and d (D) Only a and d

6. (a) All imports are taxable. Some exports are not taxable. Some exports are not imports.
(b) Banks are financial institutions. Some financial institutions are not NBFC. Some NBFC are not banks.
(c) No gold is silver. Some metals are silver. Some gold are not metals.
(d) Some books are files. Some manuals are not books. Some manuals are not files.
(A) Only b (B) Only d and b
(C) Only a and c (D) Only a

7. (a) Bulbs are bright. No bright is flammable. Some bulbs are not flammable.
(b) Some black are not pens. All blue are pens. Some black are not blue.
(c) Some debts are NPA. All NPA are bad debts. Some debts are bad debts.
(d) Some laptops are desktops. No tab is a desktop. Some tabs are not laptops.
(A) Only b, c and d (B) Only b and c
(C) Only a, b and c (D) All follow

Directions for questions 8 to 17: Each of these questions consists of six statements followed by several sets of three statements each. Select your answer from the given sets in which the statements are logically related.

8. (L) Every ball is round.
(M) Some balls are rings.
(N) All which are round are spheres.
(P) All rings are round.
(Q) Some rings are spheres.
(R) Some rings are not spheres.
(A) PML (B) NPL
(C) PQL (D) QNP

9. (L) Some truths are lies.
(M) No false is true.
(N) Some false are truths.
(P) All lies are false.
(Q) Some lies are not false.
(R) All false are wrong.
(A) PQR (B) NQR
(C) LPN (D) MQR

10. (L) Some teams are great.
(M) No good is great.
(N) Some teams are not good.
(P) Some players are great.
(Q) All players are good.
(R) All players are teams.
(A) PQM (B) RNQ
(C) PRL (D) MPN

11. (L) Some women are old.
(M) Some men are not old.
(N) Some engineers are women.
(P) All men are young.
(Q) All engineers are old.
(R) Some men are engineers.
(A) NQL (B) PMR
(C) LNR (D) None of these

12. (L) No cup is a saucer.
(M) Some cups are not fly.
(N) All cups are big.
(P) Some saucers are flying.
(Q) No saucer is big.
(R) Some which fly are not cups.
(A) LMP (B) RPL
(C) NQL (D) Both (B) and (C)

13. (L) Some hexagons are not pentagons.
(M) No square is a rectangle.
(N) All rectangles are pentagons.
(P) No pentagon is an octagon.
(Q) Some hexagons are not rectangles.
(R) Some quadrilaterals are not squares.
(A) NPM (B) NQL
(C) MNR (D) PQL

14. (L) Some cubes are prisms.
(M) No prism is a pyramid.
(N) No cube is a pyramid.
(P) All prisms are pyramids.
(Q) Some prisms are not pyramids.
(R) All cubes are symmetrical.
(A) NQR (B) PRN
(C) LNP (D) LNQ

15. (L) Some chocolates are good.
(M) Some fats are not good.
(N) No chocolate is protein.
(P) All proteins are good.
(Q) No protein is a fat.
(R) Some chocolates are proteins.
(A) PNL (B) LPR
(C) MPQ (D) None of these

16. (L) All grass is brass.
(M) No brass is copper.
(N) Some copper are metals.
(P) All metals are gold.
(Q) Some copper are not grass.
(R) Some copper are gold.
(A) LMQ (B) NPR
(C) MNP (D) Both (A) and (B)

17. (L) No kite is a rhombus.
(M) All rhombuses are quadrilaterals.
(N) Some rectangles are squares.
(P) All squares are quadrilaterals.
(Q) No square is a rhombus.
(R) Some quadrilaterals are not kites.
(A) LMR (B) LNP
(C) PQN (D) None of these

Directions for questions 18 to 22: Each of these questions consists of six statements followed by four sets of three statements each. Select your answer in the given sets in which the statements are logically related.

18. (a) A few tufts are combs.
(b) All crests are combs.
(c) No crest is tuft.
(d) All crests are tufts.
(e) A few crests are not combs.
(f) A few tufts are not combs.
(A) abd (B) abc
(C) eda (D) bcf

19. (a) A few straps are not curbs.
(b) Some curbs are not chains.
(c) All curbs are chains.
(d) Many straps are chains.
(e) Many chains are curbs.
(f) Some straps are not chains.
(A) acf (B) abf
(C) dae (D) afe

20. (a) Some desks are not decks.
(b) No slope is desk.
(c) Some slopes are desks.
(d) No desk is a deck.
(e) No slope is decks.
(f) All desks are slopes.
(A) cde (B) def
(C) abe (D) bde

21. (a) No dogma is a belief.
(b) Some beliefs are dogmatic.
(c) Some dogmatics are not dogmas.
(d) Some dogmatics are dogmas.
(e) Many beliefs are not dogmatic.
(f) Some beliefs are dogmas.
(A) abd (B) ace
(C) cba (D) bdf

22. (a) No frontier is limit.
(b) Some margins are not frontiers.
(c) All margins are frontiers.
(d) Some margins are frontiers.
(e) No margin is limit.
(f) Some limits are margins.
(A) eba (B) eac
(C) adf (D) acf

Directions for questions 23 to 27: In each of the following questions, three statements followed by four conclusions marked I, II, III and IV are given. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which of the given conclusion(s) logically follow(s) the statements, disregarding the commonly known facts.

23. Statements: Some arguments are arrangements.
All arrangements are agreements.
Some agreements are achievements.
Conclusions: I. All arguments are agreements.
II. Some agreements are arguments.
III. Some arguments are achievements.
IV. Some arrangements are achievements.
(A) Only I and III follow.
(B) Only I, II and III follow.
(C) Only II and IV follow.
(D) Only II follows.

24. Statements: All even are odd.
Some even are prime.
All prime are digits.
Conclusions: I. Some odd are prime.
II. All odd are prime.
III. All odd are even.
IV. Some digits are even.
(A) Only I and II follow.
(B) Only II and III follow.
(C) Only I and IV follow.
(D) Only I and III follow.

25. Statements: Some shirts are trousers.
Some trousers are not shorts.
All shorts are costly.
Conclusions: I. Some shirts are shorts.
II. No shirt is costly.
III. Some trousers are shorts.
IV. Some costly are trousers.
(A) Only I follows.
(B) Only II follows.
(C) Only I and II follow.
(D) None follows

26. Statements: Some north are east.
No east is west.
All west are south.

Conclusions: I. No north is west.
II. Some east are west.
III. Some south are not east.
IV. All south are east.

(A) Only I follows.
(B) Only II follows.
(C) Only III follows.
(D) Either III or IV follows.

27. Statements: No cause is effect.
All weak are effect.
Some effect are strong.

Conclusions: I. Some strong are cause.
II. No cause is a weak.
III. Some strong are not cause.
IV. Some weak are strong.

(A) Only I follows.
(B) Only II and III follow.
(C) Only III follows.
(D) Only II, III and IV follow.

ANSWER KEYS

Exercise-1

1. (B)	8. (D)	15. (B)	22. (B)	29. (C)	36. (A)
2. (A)	9. (D)	16. (C)	23. (D)	30. (C)	37. (D)
3. (D)	10. (C)	17. (A)	24. (A)	31. (D)	38. (C)
4. (C)	11. (C)	18. (C)	25. (C)	32. (B)	39. (D)
5. (D)	12. (D)	19. (A)	26. (A)	33. (D)	40. (D)
6. (C)	13. (D)	20. (C)	27. (B)	34. (D)	
7. (D)	14. (D)	21. (B)	28. (B)	35. (C)	

Exercise-2

1. (C)	8. (A)	15. (C)	22. (C)	29. (A)	36. (A)
2. (C)	9. (B)	16. (D)	23. (D)	30. (B)	37. (C)
3. (C)	10. (C)	17. (D)	24. (B)	31. (B)	38. (C)
4. (B)	11. (A)	18. (D)	25. (D)	32. (D)	39. (B)
5. (D)	12. (D)	19. (A)	26. (C)	33. (A)	40. (D)
6. (D)	13. (B)	20. (D)	27. (A)	34. (B)	
7. (A)	14. (A)	21. (D)	28. (C)	35. (D)	

Exercise-3

1. (D)	5. (B)	9. (C)	13. (B)	17. (A)	21. (C)	25. (D)
2. (B)	6. (D)	10. (C)	14. (D)	18. (A)	22. (B)	26. (C)
3. (B)	7. (C)	11. (A)	15. (B)	19. (A)	23. (D)	27. (B)
4. (C)	8. (D)	12. (D)	16. (D)	20. (B)	24. (C)	

SOLUTIONS

EXERCISE-1

1. A. The term 'dancers' is not distributed in the premise. Hence, it should not be distributed in the conclusion. Also, the middle term 'drivers' cannot be included in the conclusion.
B. No rule is violated, hence, it is correct.
C. From two affirmative statements, we cannot get a negative conclusion, hence, it is incorrect.

2. The middle term 'sane' is distributed in the first premise and one premise is particular. Hence, the conclusion must be particular. Choice (A) is the correct option.

3. As both the premises are negative, no conclusion can be derived.

4. As one premise is negative, the conclusion should be negative. Hence, (A) and (B) are incorrect but (C) is correct.

5. As both the premises are particular, no conclusion can be derived.

6. Conclusions (A) and (B) are negative. Hence, they do not follow. Only conclusion (C) satisfies all the conditions.

7. The middle term 'books' is not distributed. Hence, no conclusion can be drawn.

8. Both the given statements are negative. Hence, no conclusion can be drawn.

9. Both statements are particular. Hence, no conclusion can be drawn.

10. Only option (C) does not negate any rule. In option (A) and (B), the term 'P' and 'K' are distributed respectively, which are not distributed in the statements.

11. In choice (A) and choice (B) 'Indian's' is distributed which was not distributed in the premises. Choice (C) satisfies all the conditions.

12. The middle term is not distributed in the premises. Hence, none follows.

13. Choice (C) is negative whereas both given premises are positive. Choice (A) and choice (B) satisfy all the conditions.

14. Middle term is not distributed in the premises. Hence, none follows.

15. In choice (A) and choice (C) 'bottle' is distributed which was not distributed in the premises. Choice (B) satisfies all the conditions.

Solutions for questions 16 to 20: Refer the rules for deductions given in the introduction.

16. The middle term 'bees' is not distributed. Hence, no conclusion can be drawn.

17. The middle term 'apples' is distributed in the second premise. Hence, the conclusion that can be drawn is 'All grapes are mangoes'.

18. Both statements are particular. No conclusion can be drawn.

19. The middle term 'weddings' is distributed in both the premises. Hence, the conclusion that can be drawn is 'Some writings are wirings'.

20. The middle term 'row' is distributed in the second premise. Since one premise is particular and the other is negative, the conclusion that can be drawn must be particular negative, i.e., 'Some queues are not circular'.

21. (a) → Does not violate any rule.
(b) → Here, the term 'triangle' which is not distributed in the premise is distributed in the conclusion.
(c) → Here, the term 'musician' which is not distributed in the premise is distributed in the conclusion.
(d) → Here, the term 'chicken' which is not distributed in the premise is distributed in the conclusion.

22. (a) → Here the premises are particular, so no conclusions can be drawn.
(b) → Does not violate any rule.
(c) → Does not violate any rule.
(d) → The term 'baggages' which is distributed in the conclusion is not distributed in the premise.

23. (a) → Does not violate any rule.
(b) → All the statements are negative.
(c) → There are only two terms.
(d) → Does not violate any rule.

24. (a) → There are four terms.
(b) → Does not violate any rule.
(c) → Does not violate any rule.
(d) → Does not violate any rule.

25. (a) → Both the premises are negative, so no conclusion can be drawn.
(b) → Does not violate any rule.
(c) → Both the premises are negative.
(d) → Both the premises are negative.

26. (a) The middle term 'transcendent' is not distributed in any of the premises. Hence, no conclusion can be drawn.

(b) The term 'milk' is distributed in the conclusion. While it is not distributed in the premise.
(c) No rule is violated.
(d) No rule is violated.
Hence, both c and d.

27. (a) Both the premises are particular. Hence, no conclusion can be drawn.
(b) No rule is violated.
(c) Both the premises are negative. Hence, no conclusion can be drawn.
(d) When one of the premises is particular, the conclusion cannot be universal.

28. (a) No rule is violated.
(b) When both the premises are affirmative, the conclusion cannot be negative.
(c) When one of the premises is negative, the conclusion cannot be affirmative.
(d) The term 'females' is distributed in the conclusion while it is not distributed in the premise.

29. (a) The term 'Violet' is distributed in the conclusion, while it is not distributed in any of the premises.
(b) When one of the premises is particular, the conclusion cannot be universal.
(c) Both the premises are particular. Hence, no conclusion can be drawn.
(d) No rule is violated.

30. (a) The middle term 'fearless' is not distributed. Hence, no conclusion can be drawn.
(b) No rule is violated.
(c) The middle term 'sages' is not distributed in any of the premises. Hence, no conclusion can be drawn.
(d) Both the premises are negative. Hence, no conclusion can be drawn.

31. Using statements 1 and 2 as premises, the middle term 'Symbols' is distributed in the second statement. Hence, the conclusion is 'All digits are letters'.
Using statements 2 and 3 as premises, the middle term 'Little' is not distributed.
Hence, no conclusion can be drawn.
∴ Only conclusion I follows.

32. Using statements 1 and 2 as premises, the middle term 'mats' is not distributed. Hence, no conclusion can be drawn.
Using statements 2 and 3 as premises, the middle term 'rats' is distributed in the third statement.
Since the second statements is particular, the conclusion must be particular, i.e., 'Some mats are cats'.
∴ Only conclusion II follows.

33. Using statements 1 and 2 as premises, the middle term 'Outputs' is not distributed.
Hence, no conclusion can be drawn.

Using statements 2 and 3 as premises, the middle term 'results' is distributed in the third statements. Since the second statement is particular and the third statement is negative, the conclusion must be particular negative, i.e., 'Some outputs are not good'.
∴ None follows.

34. Using statements 1 and 2 as premises or statements 2 and 3 as premises, no conclusions can be drawn, since all the statements are negative.
∴ None follows.

35. Using statements 1 and 2 as premises, the middle term 'two' is distributed in the second statement since the second statement is particular and the first statements is negative the conclusion that must be drawn is particular negative, i.e., 'Some threes are not one'.
Using statements 2 and 3 as premise, the middle term 'two' is not distributed. Hence, no conclusion can be drawn.
Using statements 1 and 3 as premises, the middle term 'two' is distributed in the first statements. Since the first statements is negative, the conclusions drawn must be negative, i.e., 'No one is four', 'Some one are not fours' and 'Some fours are not ones'.
∴ Only II and III follows.

36. Choice (A) → Does not violate any rule.
Choice (B) → Both the premises are negative.
Choice (C) → The term 'bear', which is distributed in the conclusion is not distributed in the premise.
Choice (D) → All the statements are negative.

37. Choice (A) → Does not violate any rule.
Choice (B) → Does not violate any rule.
Choice (C) → The middle term 'gentle' is not distributed.

38. Choice (A) → The term 'screening' which is distributed in the conclusion is not distributed in the premise.
Choice (B) → The term 'purification' which is distributed in the conclusion is not distributed in the premise.
Choice (C) → Does not violate any rule.
Choice (D) → The term 'sedimentation' which is distributed in the conclusion is not distributed in the premise.

39. Choice (A) → The middle term 'gliders' is not distributed.
Choice (B) → A and C are negative.
Choice (C) → There are only two terms.

40. Choice (A) → Affirmative conclusion cannot be drawn from negative statement.
Choice (B) → Middle term appears in the conclusion.
Choice (C) → No conclusion can be drawn from two negative statements.
Choice (D) → Does not violate any rule.

EXERCISE-2

1. Choice (A) → There is only one negative statement.
Choice (B) → Here, only (e) can be the conclusion but the term 'protection' is distributed, which is not distributed in (f).
Choice (C) → Does not violate any rule in the order cfb.

2. Choice (A) → Only (c) can be the conclusion but the term 'professor' which is distributed in the conclusion is not distributed in the premise.
Choice (B) → Only (f) can be the conclusion, but here the term 'engineer' which is distributed in the conclusion is not distributed in the premise.
Choice (C) → Does not violate any rule in the order abf.

3. Choice (A) → In any order if we take the statements, the term which is not distributed in the premise is distributed in the conclusion.
Choice (B) → There are only two terms in the statements (b) and (e).
Choice (C) → Does not violate any rule in the order bcd.
Choice (D) → All the statements are particular.

4. Choice (A) → There is only one negative statement.
Choice (B) → Does not violate any rule in the order bfd.
Choice (C) → All are particular statements.
Choice (D) → There are four terms.

5. Choice (A) → Does not violate any rule in the order efb.
Choice (B) → Does not violate any rule in the same order.
Choice (C) → Does not violate any rule in the order cfd.

6. (A) afd → There is only one negative statement.
(B) cef → Here, efc is the correct order.
(C) fab → Here, abf is a right order.

7. (A) cdf → cfd is the correct order.
(B) def → Here, 'square' and 'curve' appear only once.
(C) acb → All are particular statements.
(D) abe → The term 'curve' appears in all the three statements.

8. (A) afd → Here, fda is the correct order.
(B) abd → There is only one negative statement.
(C) ced → The term 'dark' appears only once.
(D) def → There is only one negative statement.

9. (A) abc → For every possible order the seventh rule of syllogism is violated.
(B) dea → Here, aed is the correct order.
(C) efd → All the statements are particular.
(D) bef → The term 'lilly' and 'rose' appear only once.

10. (A) ade → There is only one negative statement.
(B) def → There is only one negative statement.
(C) bde → Here, deb is the correct order.
(D) abc → There is only one negative statement.

11. (A) bde → Here, deb is the correct order.
(B) cdf → There is only one negative statement.
(C) adf → For every possible order the seventh rule of syllogism is violated. Hence, it is incorrect.
(D) ade → The term depressed appears only once.

12. (A) cde → There is only one negative statement.
(B) efa → Here, aef is the correct order.
(C) bcf → Here, cfb is the correct order.

13. (A) cdf → There is only one negative statement.
(B) abe → Here, aeb is the correct order.
(C) cef → There is only one negative statement.
(D) acd → The term 'mirror' appears only once.

14. efb – Here, bef is the correct order.
fda – The term minutes has appeared three times.
ade – The term minutes has appeared three times.
dfe – Here, all are particular statements.

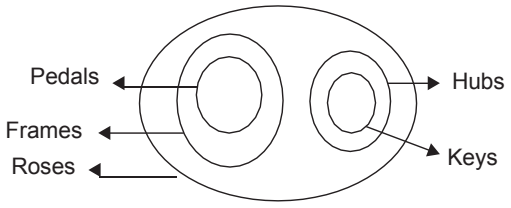
15. cdf – Here, all are negative.
eba – There are more than three terms.
cfe – Here, ecf is the correct order.
adc – There are more than three terms.

16. eaf – Here, fae is the correct order.
cfe – Here, efc is the correct order.
adb – Here, abd is the correct order.

17. aef – Here, the possible order is efa, but it violates distribution rule.
cbe – It violates distribution rule.
fcd – Here, all are negative statements.

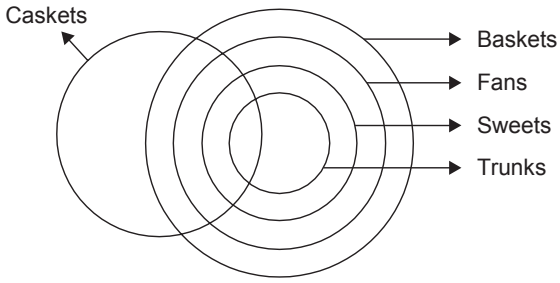
18. fbd – Here, fbd is the correct order.
dca – Here, adc is the correct order.
fde – Here, all are particular statements.

19. The basic diagram for the given statements is as follows.



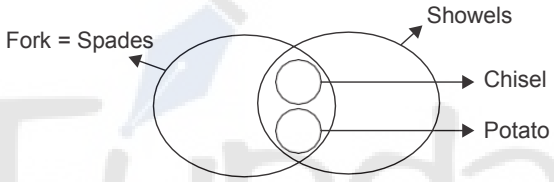
From the above basic diagram, we incur the following.
Conclusion I, affirmative, does not follow.
Conclusion II, affirmative, follows.
Conclusion III, affirmative, does not follow.
Conclusion IV, affirmative, does not follow.
∴ Only II follows.

20. The possible diagram that can be drawn from the above statements is as follows.



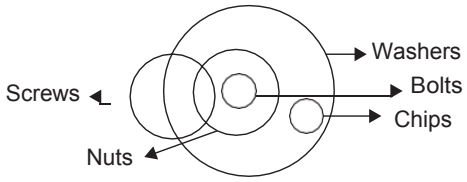
From the above possible diagram, we incur that:
Conclusion I, follows.
Conclusion II, follows.
Conclusion III, follows.
Conclusion IV, follows.
∴ All follow.

21. The possible diagram that can be drawn from the above statements is as follows.



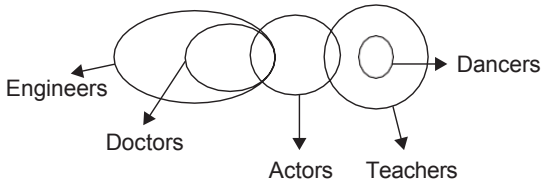
From the above possible diagram, we incur that:
Conclusion I, follows.
Conclusion II, follows.
Conclusion III, follows.
Conclusion IV, follows.
∴ All follow.

22. The basic diagram for the given statements is as follows.

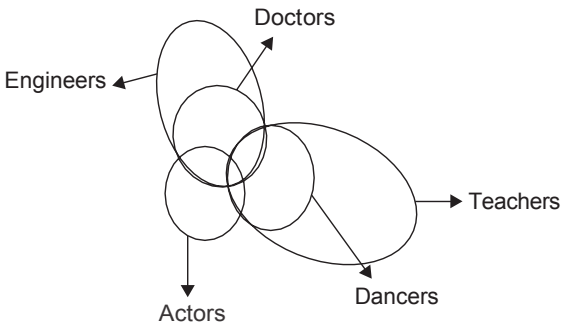


From the above basic diagram, we incur that:
Conclusion I, affirmative, follows.
Conclusion II, affirmative, follows.
Conclusion III, affirmative, follows.
Conclusion IV, affirmative, does not follow.
∴ I, II and III follow.

23. The basic diagram for the given statements is as follows.



From the above basic diagram, we incur that:
Conclusion I, affirmative, follows.
Conclusion II, affirmative, does not follow.
Conclusion III, negative, follows.
Conclusion IV, affirmative, does not follow.
Since conclusion III, negative, follows.
Let us try to draw an alternate diagram to negate it.
The required alternate diagram is shown below.



In the above alternate diagram, conclusion III does not follow, but II follows.
Here, conclusion II and III are contradictory to each other.
∴ Only I and either II or III follow.

Solutions for questions 24 to 30: Refer the rules for deductions given in the introduction.

24. As one premise is particular, the conclusion should be particular. (B) satisfies all the rules.

25. As both the premises are particular, no conclusion can be derived.

26. As one premise is negative, the conclusion must be negative. Therefore, (C) satisfies all the rules.

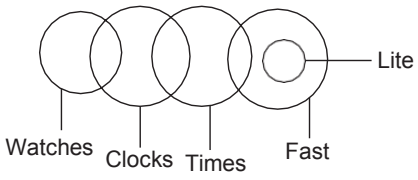
27. As both the premises are affirmative and also one premise is particular, the conclusion should be particular affirmative. Therefore, (A) satisfies all the rules.

28. All + Some not = Some not.
The middle term is distributed. Therefore, option (C) satisfies all the rules.

29. All + Some not = Some not.
The middle term is distributed. Therefore, option (A) satisfies all the rules.

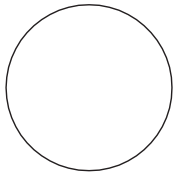
30. All + Some = Some.
The middle term is distributed. As both the premises are affirmative and one of them is particular, the conclusion should be particular and affirmative. Therefore, option (B) satisfies all the rules.

31. The basic diagram for the given statements is as follows.



From the basic diagram, we derive the conclusion as:
I. Affirmative, does not follow.
II. Affirmative, does not follow.

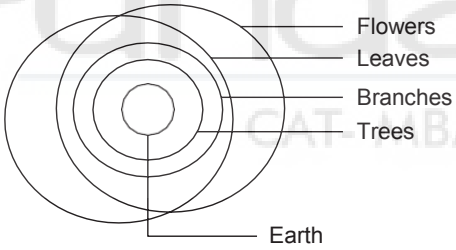
Fast = life = Time = dock = watch



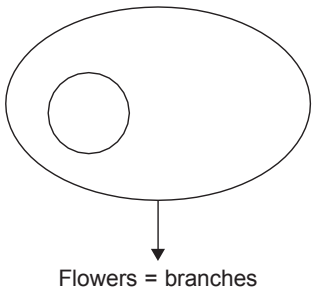
Possible diagram

From the above possible diagram, we derive that:
Conclusion III, possibility, follows.
Conclusion IV, possibility, does not follow.
Hence, only III follows.

32. The basic diagram for the given statements is as follows.

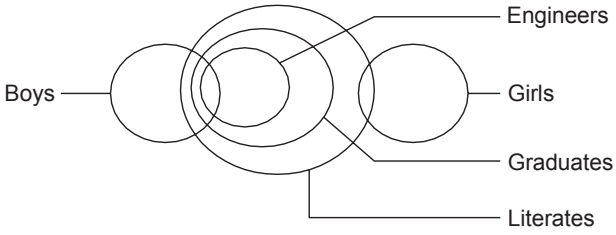


In the above basic diagram, the conclusion is as follows:
I. Affirmative, follow.
III. Affirmative, follows.
Conclusion II follows.
The possible diagram is as follows.



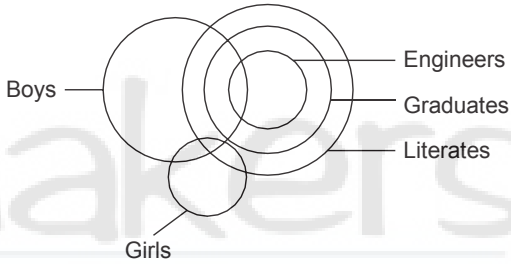
From the possible diagram:
Conclusion IV follows.
Hence, all follow.

33. The basic diagram for the given statements is as follows.



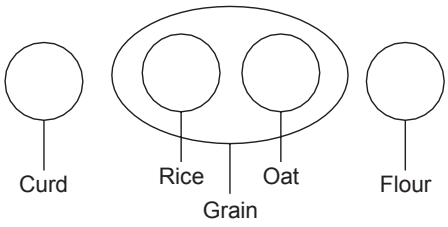
In the basic diagram, the conclusion is:
I. Negative, follows.
II. Affirmative, follows.
III. Affirmative, does not follow.
IV. affirmative, follows.

Conclusions II and IV are the definite conclusions as they are affirmative, whereas conclusion I may be false, as it is a negative conclusion. To prove that conclusion I is false, we have to prove that 'Some boys are girls'. The alternate diagram is as follows.



Hence, only II and IV follow.

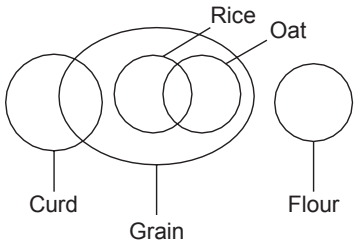
34. The basic diagram for the given statements is as follows:



From the basic diagram, the conclusion is as follows:
I. Negative, follows.
II. Negative, follow.
III. Negative, follows.
IV. Affirmative, does not follow.

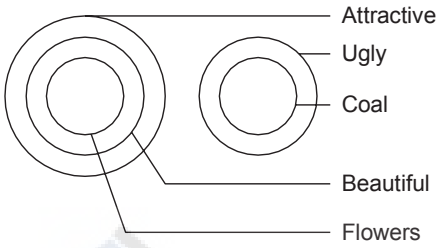
Conclusion I, II and III are true but negative. Hence, the conclusions may be false. Let us try to prove them false. So, we have to prove:

(I) Some curds are grains.
(II) Some rice are oats.
(III) Some flours are oats.
The alternate diagram for the statements is as follows:



Hence, it is not possible to draw a diagram to negate III. Only III follows.

35. The basic diagram for the given statements is as follows.



In the above basic diagram, we derive the conclusion as:

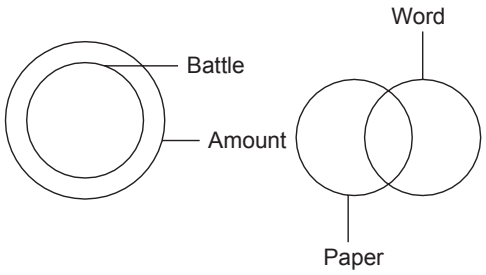
I. Affirmative, follows.
II. Negative, follows.
III. Negative, follows.
IV. Negative, follows.

To prove that conclusion II, III and IV is false, we have to prove that:

(I) Some flowers are coal.
(II) All flowers are ugly.
(III) All attractives are coal.

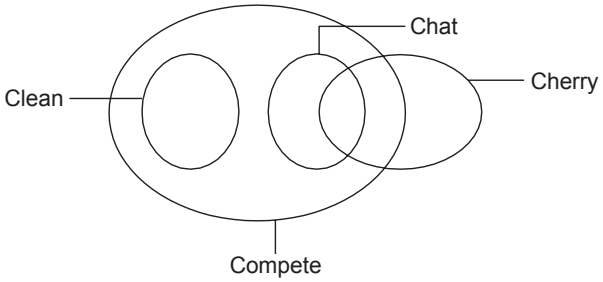
The alternate diagram for any of these three is not possible. Hence, all follow.

36. The given statements are represented in the following basic diagram.



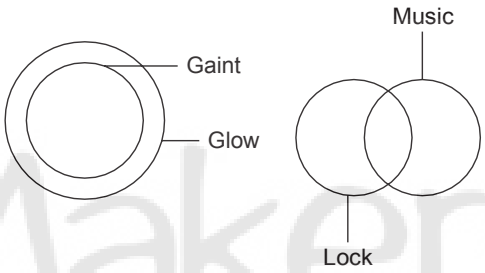
Choice (A), possibility, does not follow.
Choice (B), affirmative, follows.
Choice (C), possibility, follows.
Choice (D), possibility, follows.

37. The given statements are represented in the following basic diagram.



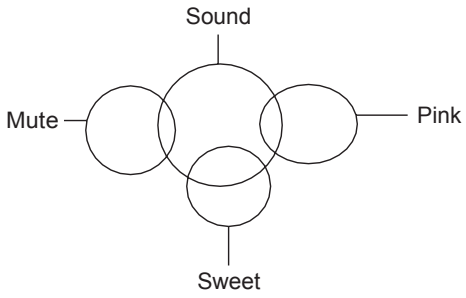
Choice (A), affirmative, follows.
Choice (B), affirmative, follows.
Choice (C), affirmative, does not follow.
Choice (D), IV, possibility, follows.

38. The given statements are represented in the following basic diagram.



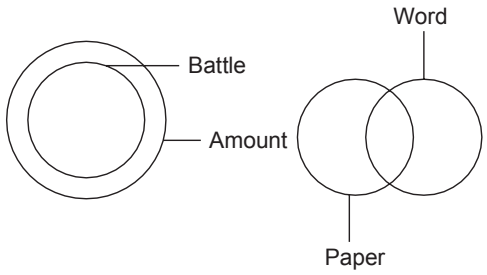
Choice (A), affirmative, follows.
Choice (B), possibility, follows.
Choice (C), affirmative, does not follow, since, some glow are not lock.
Choice (D), possibility, follows.

39. The given statements are represented in the following basic diagram.



Choice (A), possibility, follows.
Choice (B), possibility, does not follow.
Choice (C), affirmative, follows.
Choice (4), possibility, follows.

40. The given statements are represented in the following basic diagram:



Choice (A), possibility, follows.
Choice (B), affirmative, follows.
Choice (C), possibility, follows.
Choice (D), affirmative, does not follow.

EXERCISE-3

1. (a) No rule is violated.
(b) No rule is violated.
(c) No rule is violated.
(d) No rule is violated.

2. (a) No rule is violated.
(b) When one premise is particular, the conclusion cannot be universal.
(c) No rule is violated.
(d) No rule is violated.

3. (a) The middle term is not distributed. Hence, doesn't follow.
(b) It satisfies all the conditions. Hence, follows.
(c) The term 'good' is distributed in the conclusion which is not distributed in the premises. Hence, does not follow.
(d) Here, both premises are particular. Hence, does not follow.
Hence, only (b) follows.

4. (a) It satisfies all the conditions.
(b) The term 'friend's' is distributed in the conclusion which was not distributed in the premises. Hence, does not follow.
(c) The term 'useful' is distributed in the conclusion which was not distributed in the premises. Hence, it does not follow.
(d) It satisfies all the conditions.
∴ Only (a) and (d) follow.

5. (a) The term 'rules' is distributed in the conclusion which was not distributed in the premises. Hence, it does not follow.
(b) It satisfies all the conditions.
(c) It satisfies all the conditions.
(d) Here, both the premises are particular. Hence, it does not follow.
∴ Only (b) and (c) follow.

6. (a) It satisfies all the conditions.
(b) The middle term is not distributed. Hence, it does not follow.
(c) The term 'metals' is distributed which was not distributed in the premises. Hence, it does not follow.
(d) Here, both premises are particular. Hence, does not follow.
∴ Only (a) follows.

7. (a) It satisfies all the conditions.
(b) It satisfies all the conditions.
(c) It satisfies all the conditions.
(d) The term 'laptops' is distributed in the conclusion which was not distributed in the premises.
∴ Only (a), (b) and (c) follow.

8. (A) PML: By combining P and M or M and L we get a conclusion in particular.
Now, when we combine P and L then we do not get a conclusion as the common term is not distributed.
(B) NPL: No combination would give a valid conclusion.
(C) PQL: No combination would give a valid conclusion.
(D) QNP: By combining N and P, we get 'all rings are spheres'. Hence, 'some rings are spheres' is correct.
Hence, the correct combination is NPQ.

9. (A) PQR: Here no combination would give a conclusion.
(B) NQR: No combination gives a valid conclusion.
(C) LPN: By combining, L and P, the conclusion obtained is 'some false are truths'.
(D) MQR: There are more than 3 terms, hence, it is wrong.

10. (A) PQM: No combination would give a valid conclusion.
(B) RNQ: No combination would give a valid conclusion.
(C) PRL: When P and R are combined, we get the conclusion 'some teams are great'.
(D) MPN: No combination would give a valid conclusion.

11. (A) NQL: By combining N and Q we get the conclusion 'some women are old'.
Hence, choice (A) is logically related.
(B) PMR: No combination would give a valid conclusion.
(C) LNR: No combination would give a valid conclusion.

12. (A) LMP: No combination is logically related.
(B) RPL: No rule is violated; hence, it is logically related.
(C) NQL: No rule is violated; hence, it is logically related.

13. (A) NPM: No combination is logically related.
(B) NQL: No rule is violated hence it is logically related.
(C) MNR: No combination is logically related.
(D) PQL: No combination is logically related.

14. (A) NQR: No combination is logically related.
(B) PRN: No combination is logically related.
(C) LNP: No combination is logically related.
(D) LNQ: No rule is violated; hence, it is logically related.

15. (A) PNL: No combination is logically related.
(B) LPR: No rule is violated; hence, it is logically related.
(C) MPQ: No combination is logically related.

16. (A) LMQ: No rule is violated; hence, it is logically related.
(B) NPR: No rule is violated; hence, it is logically related
(C) MNP: No combination is logically related.

17. (A) LMR: No rule is violated; hence, it is logically related.
(B) LNP: No combination is logically related.
(C) PQN: No combination is logically related.

18. From the choices:
A. From b and d, we can conclude that, 'few tufts are combs', which is A.
B. It is not a valid group as exactly one statement is negative.
C. It is not a valid group as exactly one statement is negative.
D. Among b, c, f, b cannot be the conclusion of the other two as it is affirmative. As the term 'comb' is not distributed, f cannot be the conclusion. As 'tuft' is not distributed, c cannot be the conclusion.

19. From the choices:
A. From c and f, it can be concluded that, 'few straps are not curbs', which is a.
B. It is not a valid group as all the three statements are particular. For the same reason as above, (C) and (D) are also not possible.

20. From the choices:
A. Among c, d, e, as c is particular neither d nor e can be the conclusion. As both d and e are negative, C cannot be the conclusion.
B. From f and e, it can be concluded that, 'no desk is a deck', which is d.
C. It is not a valid group as all the three statements are negative.
D. It is not a valid group as all the three statements are negative.

21. From the choices:
A. It is not a valid group as exactly one statement is negative.
B. It is not a valid group as all the three statements are negative.
C. From a and b, we can conclude that, 'some dogmatics are not dogmas', which is C.
D. It is not a valid group as all the three statements are particular.

22. From the choices:
A. It is not a valid group as all the three statements are negative.
B. From c and a, we can conclude that, 'no margin is limit', which is e.
C. It is not a valid group as exactly one statement is negative.
D. It is not a valid group as exactly one statement is negative.

23. Using statements 1 and 2 as premises, the middle term 'arrangements' is distributed in the second statements. Since the first statements is particular the conclusions drawn must be particular, i.e., 'Some arguments are agreements'.
Using statements 2 and 3 as premises, the middle term 'agreements' is not distributed, hence, no conclusion can be drawn.
Using statements 1 and 3 as premises, both statements are particular, hence, no conclusion can be drawn.
∴ Only II follows.

24. Using statements 1 and 2 premises, the middle term 'even' is distributed in the first statement. Since the second statement is particular, the conclusion drawn, must be particular, i.e., 'Some odd are prime'.
Using statements 2 and 3 as premises, the middle term 'Prime' is distributed in the third statement. Since the second statement is particular, the conclusion drawn must be particular, i.e., 'Some even are digits'.
∴ Only I and IV follows.

25. Using statements 1 and 2 as premises, since both statements are particular, no conclusion can be drawn.
Using statements 2 and 3 as premises, the middle term 'Shorts' is distributed in both the premises. Since the second statement is particular and negative, the conclusion that can be drawn must be particular negative. But such a conclusion is not possible since the two terms 'Trousers' and 'Costly' are not distributed in the statements and hence, cannot be distributed in conclusion.
∴ None follows.

26. Using statements 1 and 2 as premises, the middle term 'Cast' is distributed in the second statement. Since the first statement is particular and the second statement is negative, the conclusion drawn should be particular negative, i.e., 'Some north are not west'.

Using statements 2 and 3 as premises, the middle term 'west' is distributed in the third statement. Since the second statement is negative, the conclusions drawn must be negative, i.e., 'No east is south', 'Some east is not South' and 'Some south is not east'.

∴ Only III follows.

27. Using statements 1 and 2 as premises, the middle term 'Effect' is distributed in the first statements, which is negative. Hence, the conclusions drawn must be negative, i.e., 'No cause is weak', 'Some cause are not weak' and 'Some weak are not cause'.

Using statements 2 and 3 as premises, the middle term 'effect' is not distributed. Hence, no conclusion can be drawn.

Using statements 1 and 3 as premises, the middle term 'effect' is distributed in the first statements. The first statement is negative. Hence the conclusion drawn, must be negative, i.e., 'No cause' and 'Some cause are not strong'.

∴ Only II and III follows.

10 Connectives

Chapter

Learning Objectives

In this chapter, you will:

- Understand the correct logical interpretation of various conditional statements.
- Understand the conclusions that can be drawn from conditional statements.

There are few questions that are frequently asked in entrance exams, which are based on logical statements and logical connectives. A proper understanding of some basics in 'Logic' will eliminate the difficulty in answering such questions. These questions can be answered easily and very quickly with a clear understanding of the basics that we shall look at in the following sections. The concepts discussed in this chapter, not only help in answering these questions, but also have lot of application value. The logical interpretations discussed can be applied, whenever we (irrespective of the test area) come across these kinds of statements.

In Logic, we deal with statements that are essentially sentences in the English language. However, in Logic we are not interested in or worried about the factual correctness of the sentence. We are interested only in the Logical 'truthfulness' of the statements.

For example, consider the following statement:

'If the sun rises in the west, then the moon rises in the north'.

Here, we are not concerned with whether the sun rises in the east or west or with the direction in which the moon rises. We will only look at whether the moon will rise in the north or not depending on whether the part of the statement 'The sun rises in the west' is true or not. If we are given that the sun rises in the west (which, incidentally, is factually incorrect), we can then conclude that the moon rises in the north (which again does not concern with the direction in which the moon actually rises).

We can represent statements in Logic using symbols, like p, q, etc., the way we represent variables/unknowns in Algebra using symbols like x, y, z, etc.

Statements like 'I will go for a movie', 'It is a sunny day', etc., are called simple statements. When two or more such simple statements are connected together to form a single statement, then such statement is called a compound statement.

The simple statements are combined using logical connectives to form compound statements. We should know some of the important logical operators/connectives to be able to effectively tackle questions that involve compound statements and logical operations on compound statements.

❒ Negation 'Not'

Any statement can be negated by using the words 'not' or 'no'. In layman's language, negation is like the opposite of a statement.

For example, the negation of the statement 'It is raining' is 'It is 'NOT' raining'. The negation of the statement 'He will pass the exam' is 'He will not pass the exam'. This is equivalent to saying 'He will fail in the exam'. So, when you are looking at negating the given statement, you should keep in mind the English equivalents of the statements also.

Having defined simple statements, we shall now study about a few common operators (also called connectives) that can be used to combine (or operate upon) two or more simple statements and arrive at more complicated or compound statements.

❒ Logical Connective 'OR'

Two or more statements can be connected using the connective 'OR'. The following is an example using 'OR'.

It is raining or I will go to my friend's house.

The same statement can also be written as:

Either it is raining or I will go to my friend's house.

Both the statements above mean the same. The additional word 'either' does not change the meaning of the statement.

When two (or more) statements are connected using 'OR', at least one of them is true.

Suppose we have a statement 'Either p or q', since at least one of the two statements p, q must be true, we have p alone is true or q alone is true or both are true. This is the interpretation to be given to an 'OR' statement (irrespective of the meaning of the sentence as per English language).

For example, the statement 'Either I will go for a movie or I will go to my friend's house' means:

I will go for a movie

or

I will go to a friend's house

or

I will go both for a movie and to a friend's house.

Let us take the statement 'Either he is dead or he is alive'. This statement means:

He is alive

or

He is dead

or

He is both alive and dead.

In this case, the possibility 'He is both alive and dead' does not make sense if we look at the meaning in English language because a person cannot be dead and alive at the same time. However, as discussed earlier, we will not be concerned about the meaning of the statements.

Hence, we will always interpret the statement '(Either) p or q' as 'p alone is true or q alone is true or both are true' (unless otherwise explicitly stated that both are not true at the same time). In other words, in a statement 'p or q', we can say that at least one of the two statements is true.

Given 'p or q', we get four different possibilities that follow:

1. **Given 'p or q', we are then told 'p is true':** Since we need at least one of the two statements p or q to be true and here we already know that p is true, we cannot conclude anything about q, i.e., we cannot conclude whether q is true or false but both possibilities exist.
2. **Given 'p or q', we are then told 'q is true':** Since we need at least one of the two statements p or q to be true and here we already know that q is true, we cannot conclude anything about p, i.e., we cannot conclude whether p is true or false but both possibilities exist.
3. **Given 'p or q', we are then told 'p is 'NOT' true':** Since we need at least one of the two statements p or q to be true and here we already know that p is not true, q **has** to be true so that at least one of the two statements will then be true. So, here we **can** conclude that q **is true.**
4. **Given 'p or q', we are then told 'q is 'NOT' true':** Since we need at least one of the two statements p or q to be true and here we already know that q is not true, p **has** to be true so that at least one of the two statements will then be true. So, here we **can** conclude that p **is true.**

There is one particular category of questions that has appeared in CAT for three years in a row. These questions are based on the concepts that we looked at in the previous section. We will take two or three examples to understand these questions.

The directions of the questions asked were as follows:

'Each question has a main statement followed by four statements labelled A, B, C and D. Choose the ordered pair of statements where the first statement implies the second, and the two statements are logically consistent with the main statement'.

10.1: Either the elephant is big or the lion is cruel.

(a) The elephant is big.
(b) The elephant is not big.
(c) The lion is cruel.
(d) The lion is not cruel.

(A) ac (B) db
(C) bc (D) ad

Sol: The main statement has two simple statements. 'The elephant is big' and 'The lion is cruel' connected by 'OR'. Let us call these two statements p and q, respectively for the purpose of our discussion. Then the main statement can be represented as 'p 'OR' q'.

First, let us look at each choice and understand the logic discussed above. Once we do that, we will also see how to answer such questions in a much shorter time.

At least one of these two statements have to be true in any ordered pair we look at. As per the discussion we had above, from among the choices, if we have an ordered pair where the first part of the ordered pair from the two statements in the choice is true, then we cannot conclude anything about the second part of the ordered pair. However, if the first part of the ordered pair in the choice is not true, then the second part should contain the second statement as given in the main statement (i.e., the second statement has to be 'true').

Take choice (A) for the above question. The first statement is A which says 'The elephant is big'. This is p (as we denoted above) which is given in the main statement. Since p is true, we cannot conclude whether q is true or not, i.e., q may be true or it may be false. So, we cannot have any statement following A which can be concluded from A and is consistent with the main statement. Hence, this cannot be the answer choice.

Take choice (B). The first statement is D which says 'The lion is not cruel'. This is the negation of statement q, that is to say, 'Not q' is the first of the two statements in the choice. Since q is negated, p must be true (for at least one of the two statements to be true). But the second statement in this choice is 'The elephant is not big' which is 'Negation p'. Hence, this is not the correct choice.

Take choice (C). The first statement is B which is 'The elephant is not big', i.e., Negation p. Since p is negated, q must be true (for at least one of the two statements to be true). The second statement in the choice is C which is 'The lion is cruel', i.e., q. Thus, in this choice, we have Negation p followed by q. So, this is the correct answer choice.

Let us also take a look at choice (D). The first statement in this choice is A, which is 'The lion is big', i.e., p is true. Since the first statement is true, we cannot conclude anything about statement q.

❒ Approach in the exam

In an exam, for these types of questions, we do not need to go from the answer choices and check each and every one of them. We can directly identify the correct combinations of statements that will satisfy the directions given.

We know that if the first statement out of the two statements in the choice is either p or q (that is one of the two statements given in the question), then we cannot draw any conclusion.

We also know that if p or q is negated, then the other statement should definitely be true. So, 'Negation p is followed by q' and 'Negation q is followed by p' will be the correct combination of statements. Hence, we directly check out for 'NOT' $p \rightarrow q$ or 'NOT' $q \rightarrow p$ in the answer choices.

In the above example not $p \rightarrow q$, is represented by bc and not $q \rightarrow p$, is represented by da. We should check which among bc and da is/are given in the answer choices.

❒ Logical Connective 'AND'

Two or more statements can be connected using the connective 'AND'. The following is an example using 'AND'.

It is raining **and** I will go to my friend's house.

The two statements connected by **and** have to be true for the compound statement to be true. In

general, if we have a statement 'p and q', then we can conclude that p should be true as well as q, i.e., both the statements should be true. Even if one of the two statements is false, the compound statement is false.

Negation of compound statements formed with 'OR', 'AND'

A compound statement formed with 'OR' or 'AND' can be negated in the following manner:

'Negation (p 'OR' q)' is the same as 'Negation p 'AND' Negation q'.

'Negation (p 'AND' q)' is the same as 'Negation p 'OR' Negation q'.

As can be seen in the above example, when a compound statement consisting of two simple statements (connected with 'OR' or 'AND') is negated, the result will consist of each of the individual statements negated. In addition to that, the following will also have to be observed:

'OR' will become 'AND'

'AND' will become 'OR'

❒ Logical Connective 'IF-THEN'

This is a very important connective. This is represented by $p \rightarrow q$ (and is read as 'p implies q'). This means that if we know that p has occurred, q has to occur or must have occurred. For example, the statement 'If it is raining, then I wear a raincoat' means that if we know that it is raining, we can conclude that I must be wearing a raincoat.

The statement 'p implies q' is called an implication statement. The term on the left hand side in $p \rightarrow q$ is called the 'antecedent' and the term q is called the 'consequent'.

Let us look at the following cases when we are given that $p \rightarrow q$.

1. Given that $p \rightarrow q$, we are then told that q has occurred. Can we conclude that p must have occurred?

   We cannot conclude that p must have occurred. This is because while whenever p occurs, q will definitely occur, q may occur even otherwise, i.e., even without the occurrence of p. So, both p and Negation p are possible and hence, we cannot conclude anything when we know that q has occurred.

2. Given that $p \rightarrow q$, we are then told that p has not occurred. Can we conclude that q will also not occur?

   We cannot conclude that q will not occur. This is because while whenever p occurs, q will definitely occur, q may occur even when p does not occur (as discussed above). So, both q and Negation q are possible, and hence, we cannot conclude anything when we know that p has not occurred.

3. Given that $p \rightarrow q$, we are then told that q has not occurred. Can we conclude that p must not have occurred?

   We can conclude that p must not have occurred. This is because had p occurred, q would have occurred. But we know that q has not occurred, so p must not have occurred. So, we can conclude that 'Negation p' follows 'Negation q'.

So, if we are given that $p \rightarrow q$, then 'Negation $q \rightarrow$ Negation p'. This is a very important relationship. We can express it in words as:

'In an implication statement, negation of the right hand side will always imply the negation of the left hand side'.

We can summarize the above three points as follows:

$p \rightarrow q$	Given
$q \rightarrow p$	Cannot be concluded
$q \rightarrow$ Negation p	Cannot be concluded
Negation $p \rightarrow$ Negation q	Cannot be concluded
Negation $p \rightarrow q$	Cannot be concluded
Negation $q \rightarrow$ Negation p	Is always true

In certain CAT papers, there were questions on 'if—then' concepts discussed above and the questions similar to those on 'either—or' that we looked at above. Let us take an example and understand these questions. The directions are the same as that we looked at above:

'Each question has a main statement followed by four statements labelled as A, B, C and D. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement'.

10.2: If the elephant is big, then the lion is cruel.

(a) The elephant is big.

(b) The elephant is not big.

(c) The lion is cruel.

(d) The lion is not cruel.

(A) ca (B) bd
(C) bc (D) db

Sol: The main statement has two simple statements 'The elephant is big' and 'The lion is cruel' connected by 'IF—THEN'. Let us call these two statements p and q, respectively for the purpose of our discussion. Then the main statement can be represented as 'p implies q' or '$p \rightarrow q$'.

First, let us look at each choice and understand the logic discussed above. Once we do that, we will also see how to answer such questions in a much shorter time.

Take choice (A). In terms of p and q, this can be represented as $q \rightarrow p$. As per the table above, we know that this cannot be concluded, given $p \rightarrow q$. Hence, this is not the correct answer.

Take choice (B). In terms of p and q, this can be represented as 'Negation $p \rightarrow$ Negation q'. Again, as per the table above, we know that this cannot be concluded, given $p \rightarrow q$. Hence, this is not the correct answer.

Take choice (C). In terms of p and q, this can be represented as 'Negation $p \rightarrow q$', as per the table above, we know that this cannot be concluded, given $p \rightarrow q$. Hence, this is not the correct answer.

Since we eliminated three answer choices, the fourth has to be the correct answer. Let us take choice (D) and look at it. In terms of p and q, it can be represented as 'Negation $q \rightarrow$ Negation p'. As per the table above, we know that this can definitely be concluded. Hence, this is the correct answer choice.

❒ Approach In the Exam

In an exam, for these types of questions, we do not need to go from the answer choices and check each and every one of them. We can directly identify the combinations of statements that will satisfy the directions given.

Given that $p \rightarrow q$, we know that 'Negation $q \rightarrow$ Negation p'. Hence, the two correct combinations are $p \rightarrow q$ (because this is the given statement itself) and 'Negation $q \rightarrow$Negation p'.

So, in the above example, we should look for ac or db. Hence, the correct answer is choice (D).

❒ Other Forms OF 'IF-THEN'

There are different types of statements which can be reduced to or represented as $p \rightarrow q$. Let us look at these statements in descriptive form and the representation by using '→' sign.

S. No.	Statement	Representation using →	Also equivalent to	Remarks
1.	If p, then q	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Already discussed above
2.	q, if p	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Identical to 1 above
3.	When p, then q Whenever p, then q	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Identical to "if p, then q"
4.	q, when p q, whenever p	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Same as 3 above
5.	Everytime p, q	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Same as "If p, then q"
6	q, everytime p	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Same as 5 above
7.	q, only if p	$q \rightarrow p$	Neg. $p \rightarrow$ Neg. q	
8.	Unless p, q	Negation $p \rightarrow q$	Neg. $q \rightarrow p$	
9.	q, unless p	Negation $p \rightarrow q$	Neg. $q \rightarrow p$	Same as 8 above
10.	p, otherwise q	Negation $p \rightarrow q$	Neg. $q \rightarrow p$	Same as "Unless p, q"

❒ Another Model OF Questions

There is one particular model of question that appeared in the XAT exam in the recent past. These questions are based on the logic that has been discussed above. We will take an example and see how to solve such questions.

Directions: Each question below consists of a main statement followed by four statements. From the choices, select the one that is logically consistent with the main statement.

(Please note that the directions, instead of asking you to find out the choice that is 'logically consistent with the main statement', may ask you to find out the choice that is 'logically equivalent to the main statement' or 'Which of the following statements is true?')

10.3: If it is raining, then I will go for a movie or I will visit my friend's house.

(A) It is not raining, means that I will not go for a movie or I will not visit my friend's house.

(B) It is not raining, means that I will not go for a movie and I will not visit my friend's house.

(C) I will not go for a movie or I will not visit my friend's house, means that it is not raining.

(D) I will not go for a movie and I will not visit my friend's house, means that it is not raining.

Sol: Solving this question involves the application of simple concepts/rules about IF—THEN, 'OR', 'AND' and NEGATION which we have already looked at.

EXERCISE-1

Directions for questions 1 to 20: Each question below consists of a main statement followed by four answer choices. From the answer choices, select the one that logically follows the main statement.

1. If movie is a superhit, then I watch it.
(A) I watched a movie means it is a superhit.
(B) The movie is a superhit. Hence, I do not watch it.
(C) I did not watch a movie, though it was a superhit.
(D) I did not watch a movie implies that the movie was not a superhit.

2. Whenever it is cold, I wear a jacket.
(A) It is cold implies I am wearing a jacket.
(B) I did not wear a jacket implies it was not cold.
(C) It is cold but I did not wear the jacket.
(D) Both (A) and (B)

3. Either Shaheen cooks or Salim brings the food parcel.
(A) Shaheen cooks means Salim will not bring the food parcel.
(B) Salim did not bring the food parcel. Hence, Shaheen cooked.
(C) Shaheen is cooking. Hence, Salim has brought the food parcel.
(D) Salim did not bring food parcel implies that Shaheen did not cook.

4. Only if Raj does not come, then Geetika will come to the party.
(A) Raj came, hence, Geetika will also come to the party.
(B) Geetika will not come to the party. Hence, Raj will come.
(C) Geetika has come to the party means Raj is not coming.
(D) Raj has not come. Hence, Geetika has come to the party.

5. Unless I have money, I cannot enjoy my weekend.
(A) I have money, so I can enjoy my weekend.
(B) I can enjoy my weekend means I have money.
(C) I do not have money implies I cannot enjoy my weekend.
(D) Both (B) and (C)

6. If I can swim, then I can clear the exam.
(A) I can swim. Hence, I can clear the exam.
(B) I cannot clear the exam implies I cannot swim.
(C) I can swim. Hence, I cannot clear the exam.
(D) Both (A) and (B)

7. India will talk, only if the terrorists are handed over.
(A) The terrorists are handed over; hence, India will talk.
(B) India will not talk implies that the terrorists have not been handed over.
(C) India will talk though the terrorists are not handed over.
(D) India will talk implies the terrorists are handed over.

8. Whenever there is demand, there will be supply.
(A) There is supply, hence, there is demand.
(B) There is demand, hence, there will be supply.
(C) There is no supply implies that there is no demand.
(D) Both (B) and (C)

9. Suhasita purchases either a cooler or a refrigerator.
(A) Suhasita is not purchasing a cooler implies that she is purchasing a refrigerator.
(B) Suhasita is not purchasing a refrigerator implies that she is purchasing a cooler.
(C) Suhasita is purchasing neither a cooler nor a refrigerator.
(D) Both (A) and (B)

10. I will not have enemies, unless I fight.
(A) I fight implies that I will have enemies.
(B) I do not fight implies that I will not have enemies.
(C) I have enemies implies that I fight.
(D) Both (B) and (C)

11. If you are good, then everyone loves you.
(A) You are good, hence, everyone does not love you.
(B) Everyone loves you means you are good.
(C) You are not good; hence, everyone does not love you.
(D) Everyone does not love you means you are not good.

12. Unless Pratik comes home, his son does not eat.
(A) Pratik did not come home so his son does not eat.
(B) Pratik came home, hence, his son eats.
(C) Pratik's son eats means Pratik came home.
(D) Both (A) and (C)

13. Only if you are qualified in written test, you get a call for interview.
(A) You did not qualify in written test means you do not get a call for an interview.
(B) You do not get a call for an interview means you did not qualify in written test.
(C) You are qualified in written test, hence, you get a call for an interview.
(D) Both (A) and (C)

14. If Raju plays well, then the team can win the match.
(A) Raju did not play well, implies that the team did not win the match.
(B) The team won the match implies that Raju played well.
(C) The team did not win the match implies that Raju did not play well.
(D) More than one of the above.

15. Either he plays cricket or eats biscuit.
(A) He is playing cricket implies that he is not eating biscuit.
(B) He is not eating biscuit implies that he is playing cricket.
(C) He is eating biscuit implies that he is not playing cricket.
(D) All the above

16. Unless the inflation is low, economic growth will not be high.
(A) The economic growth is low means that inflation is high.
(B) The inflation is not low implies that the economic growth will not be high.
(C) The economic growth is high; hence, the inflation is low.
(D) Both (B) and (C)

17. Only if the train does not leave late, he can attend the interview.
(A) He attended the interview implies that the train left on time.
(B) He could not attend the interview implies that the train left late.
(C) The train left late implies that he could not attend the interview.
(D) More than one of the above

18. Whenever I go to church, I pray to god.
(A) I prayed to god means I did not go to church.
(B) I did not pray to god implies that I did not go to church.
(C) I did not go to church implies that I did not pray to god.
(D) Both (B) and (C)

19. If you deposit money, then you will get interest.
(A) You did not get interest means you did not deposit money.
(B) You deposited money. Hence, you will get interest.
(C) You deposited money but did not get interest.
(D) More than one of the above.

20. Unless Kiran finds a soulmate, he will not marry.
(A) Kiran did not find a soulmate, hence, he will not marry.
(B) Kiran found a soulmate, hence, he will marry.
(C) Kiran found a soulmate, but he will not marry.
(D) Both (A) and (B)

Directions for questions 21 to 35: In each question, there is a main statement followed by four statements a, b, c and d. From the choices, choose the pair in which the first statement implies the second statement and the two are logically consistent with the main statement.

21. Teachers can teach, only if students are well mannered.
(a) Teachers can teach.
(b) Students are not well mannered.
(c) Teachers cannot teach.
(d) Students are well mannered.
(A) ab (B) bc
(C) da (D) cd

22. Prajakta is healthy, whenever she is happy.
(a) Prajakta is not happy.
(b) Prajakta is happy.
(c) Prajakta is healthy.
(d) Prajakta is not healthy.
(A) cb (B) bc
(C) da (D) bc and da

23. Rohit is suffering either from malaria or from typhoid.
(a) Rohit is not suffering from typhoid.
(b) Rohit is suffering from malaria.
(c) Rohit is not suffering from malaria.
(d) Rohit is suffering from typhoid.
(A) ab (B) ac
(C) bc (D) dc

24. Manjula works, unless she is married.
(a) Manjula is not married.
(b) Manjula is married.
(c) Manjula works.
(d) Manjula does not work.
(A) ca (B) bd
(C) bd and ac (D) ac and db

25. If tea is sweet, then Samarth cannot drink it.
(a) Samarth can drink tea.
(b) Tea is not sweet.
(c) Samarth cannot drink tea.
(d) Tea is sweet.
(A) cb (B) ab
(C) ab and bc (D) ab and dc

26. Nisha will do an MBA only if she gets admission into a good college.

(a) Nisha will not do MBA.
(b) Nisha got admission into a good college.
(c) Nisha did not get admission into a good college.
(d) Nisha will do MBA.

(A) bd (B) db
(C) ac (D) cd

27. Rajesh is wealthy, only if he is healthy.
(a) Rajesh is not wealthy.
(b) Rajesh is healthy.
(c) Rajesh is not healthy.
(d) Rajesh is wealthy.

(A) ab (B) db
(C) bc (D) ac

28. Madhuri is not a philosopher, unless she completes her Ph.D.
(a) Madhuri is a philosopher.
(b) Madhuri is not a philosopher.
(c) Madhuri completed her Ph.D.
(d) Madhuri did not complete her Ph.D.

(A) ca (B) db
(C) ad (D) Both (A) and (B)

29. Happiness is real, whenever it is shared.
(a) Happiness is not shared.
(b) Happiness is not real.
(c) Happiness is shared.
(d) Happiness is real.

(A) cd (B) ba
(C) bd (D) Both (A) and (B)

30. Ramu wants to be either a Manager or a Director.
(a) Ramu did not become a Director.
(b) Ramu becomes a Manager.
(c) Ramu becomes a Director.
(d) Ramu did not become a Manager.

(A) bd (B) da
(C) bc (D) ab

31. If I have money, I will buy a book.
(a) I do not have money.
(b) I will not buy a book.
(c) I will buy a book.
(d) I have money.

(A) ca (B) ab
(C) dc (D) bd

32. Swati would be selected in the first company, if she has an excellent academic record.
(a) Swati is selected in the first company.
(b) Swati is not selected in the first company.
(c) Swati has an excellent academic career.
(d) Swati does not have an excellent academic record.

(A) ac (B) bd
(C) db (D) ad

33. Only if Abhijeet has good knowledge in classical music, he would be elected as Musical Idol.
(a) Abhijeet does not have good knowledge in classical music.
(b) Abhijeet is elected as Musical Idol.
(c) Abhijeet is not elected as Musical Idol.
(d) Abhijeet has good knowledge in classical music.

(A) ca (B) db
(C) bd (D) ba

34. Unless the Indian government seals the borders illegal migration in India will not stop.
(a) Indian government sealed the border.
(b) Illegal migration in India stopped.
(c) Indian government had not sealed the borders.
(d) Illegal migration in India will not stop.

(A) cd (B) ab
(C) cb (D) ad

35. Whenever Sandeep receives a message from Sangeeta, he seems to be on cloud nine.
(a) Sandeep did not receive a message from Sangeeta.
(b) Sandeep is on cloud nine.
(c) Sandeep is not on cloud nine.
(d) Sandeep received a message from Sangeeta.

(A) ba (B) bd
(C) cd (D) ca

Directions for questions 36 to 40: Select the correct alternative from the given choices.

36. If Ali has good knowledge of JAVA, he will be selected in Satyam Computers. Unless Ali is not selected in Satyam Computers, he will not be selected in CTS.
Ali is selected in CTS implies that
(A) Ali has good knowledge in JAVA.
(B) Ali is selected in Satyam Computers.
(C) Ali does not have good knowledge of JAVA.
(D) None of these

37. The HR manager of TCS will come, if the strike does not affect the flight timings. Only if the HR manager of TCS comes, TCS will recruit people.
TCS is recruiting people implies that
(A) The strike affects the flight timings.
(B) The strike does not affect the flight timings.
(C) The HR manager of TCS does not come.
(D) None of these

38. Unless the coding is not tested, the company can implement it. If the company can implement the coding, the network system will work properly.
The network is not working properly, it implies that
(A) The coding is tested.
(B) The coding is not tested.

(C) The company implements the coding
(D) None of these

39. When the Infosys team's performance is excellent, then Infosys will become the top IT company. Either Infosys does not become the top IT company or TCS remains in the top rank.
The Infosys team's performance is excellent, means that
(A) TCS remains in the top rank.
(B) TCS will not remain in the top rank.
(C) Infosys will be in the top rank.
(D) None of these

40. If a person follows the conventional methods, he cannot be successful. Unless a person is successful, he cannot be a part of successful company.
Mr Prasad has become a part of P & G, a successful company. Hence, it can be concluded that
(A) Mr. Prasad is not successful.
(B) Mr Prasad follows conventional methods.
(C) Mr Prasad does not follow conventional methods.
(D) None of these

EXERCISE-2

Directions for questions 1 to 18: Each question given below is a statement followed by four different statements. Choose the one which is the correct negation of the given statement.

1. Either Anand marries Vandana or Madhavi marries Kollol.
(A) Anand does not marry Vandana, so Madhavi marries Kollol.
(B) Neither Anand marries Vandana nor Madhavi marries Kollol.
(C) Madhavi does not marry Kollol but Anand marries Vandana.
(D) None of these

2. Whenever Bhiru and Basanti go for a long drive, Joy follows them.
(A) Joy follows Bhiru and Basanti but they are not going for a long drive.
(B) Bhiru and Basanti are going for a long drive and Joy follows them.
(C) Joy does not follow Bhiru and Basanti even when they go for a long drive.
(D) None of these

3. Pratap Rana will attend the class, only if his father allows him to go by bike.
(A) Pratap Rana is not attending the classes even his father allows him to come by bike.
(B) Pratap Rana's father did not allow him to go by bike but he was attending the class.
(C) Pratap Rana is not attending the classes because his father did not allow him to go on bike.
(D) None of these

4. Unless Aiswariya plays the role of Paro, Madhuri will not play the role of Chandramukhi.
(A) Madhuri is not playing the role of Chandramukhi, but Aiswariya is playing the role of Paro.
(B) Aiswariya is playing the role of Paro, Madhuri is playing the role of Chandramukhi.
(C) Madhuri is playing the role of Chandramukhi but Aiswariya is not playing the role of 'Paro'.
(D) None of these

5. Unless the change happens, the problem will not be solved.
(A) The problem is solved and the change did not happen.
(B) The change happened but the problem is not solved.
(C) The change happened and the problem is solved.
(D) The problem is solved implies that the change happened.

6. The presentation was lengthy but simple.
(A) The presentation was not lengthy and not simple.
(B) The presentation was lengthy but not simple.
(C) The presentation was not lengthy or not simple.
(D) The presentation was simple but not lengthy.

7. Unless Tarun learns the basics, he cannot solve connectives.
(A) Tarun learned the basics but he could not solve connectives.
(B) Tarun did not learn the basics, but he could solve connectives.
(C) Tarun learned basics and solved connectives.
(D) Tarun did not learn basics and he did not solve connectives.

8. He either goes to US or he will join in a job.
(A) He went to US and did not join in a job.
(B) He went to US but joined in a job.
(C) He did not go to US and joined in a job.
(D) He did not go to US and did not join in a job.

9. If you share your sorrow with your friends, you will be happy.
(A) You did not share your sorrow with your friends and you are happy.
(B) You shared your sorrow with your friends but you are not happy.
(C) You did not share your sorrow with your friends and you are not happy.
(D) You shared your sorrow with your friends so you are happy.

10. Every mind works at its best, only if it is open.
(A) Mind worked at its best when it is open.
(B) Mind did not work at its best because it is not open
(C) Mind worked at its best even though it is not open.
(D) Mind did not work at its best even when it is open.

11. If it is the post of a manager, then Shastri will join the firm.
(A) It is the post of a manager, but Shastri did not join the firm.
(B) The post is not of a manager, but Shastri joined the firm.
(C) Shastri did not join the firm as the post is not of a manager.
(D) Shastri joined the firm as the post is that of a manager.

12. I cannot make tomato soup, unless I have some onions.
(A) I have onions but I cannot make tomato soup.
(B) I do not have onions; hence, I cannot make tomato soup.
(C) I made tomato soup though I do not have onions.
(D) I have onions; hence, I can make tomato soup.

13. Only if Tara is happy, then she does not go to work.
(A) Tara is not happy and she does not go to work.
(B) Tara is happy and she goes to work.
(C) Tara is not happy and she goes to work.
(D) Tara is happy and she does not go to work.

14. Paul is popular either as a lead guitarist or as a base guitarist.
(A) Paul is popular as a lead guitarist but not as a base guitarist.
(B) Paul is famous neither as a lead guitarist nor as a base guitarist.
(C) Paul is not popular as base guitarist but popular as a lead guitarist.
(D) Paul is popular as both a lead guitarist and as a base guitarist.

15. Kohli cannot score a hundred, unless Jhonson bowls.
(A) Kohli scored a hundred though Jhonson did not bowl.
(B) Jhonson did not bowl hence Kohli did not score a hundred.
(C) Jhonson bowled but Kohli did not score a hundred.
(D) Jhonson bowled but Kohli scored a hundred.

16. Either he wears shoes or a tie.
(A) Neither he wore shoes nor he wore a tie.
(B) He wore a tie but not shoes.
(C) He wore shoes but did not wear a tie.
(D) All of the above

17. If it is a holiday, I will sleep throughout the day.
(A) I slept throughout the day even though it is not a holiday.
(B) I did not sleep throughout the day even though it is a holiday.
(C) I slept throughout the day even though it is a holiday.
(D) Both (A) and (C)

18. Rajesh goes to college and attends classes.
(A) Rajesh either goes to college or attends classes.
(B) Rajesh will not go to college but attends college.
(C) Rajesh neither goes to college nor attends classes.
(D) None of these

Directions for questions 19 to 33: Each question below consists of a main statement followed by four answer choice. From the answer choices, select the one that logically follows the main statement.

19. If Ankita eats pastry, then it is a black forest or a pineapple.
(A) Ankita eats pastry but it is not a pineapple, means it is a black forest.
(B) Ankita eats pastry but it is not a black forest, means it is a pineapple.
(C) The pastry is neither a pineapple nor a black forest, means Ankita does not eat the pastry.
(D) All the above.

20. If you want to stay fit, then you must eat nutritious food and exercise.
(A) You did not eat nutritious food; hence, you cannot stay fit.
(B) You did not exercise which implies you cannot stay fit.
(C) You ate nutritious food and exercised which implies you have stayed fit.
(D) Both (A) and (B)

21. Yaseem plays cricket, only if he wears blue or white.
(A) Yaseem plays cricket which implies he wears blue and white.
(B) Yaseem plays cricket but he does not wear blue, hence, he wears white.

(C) Yaseem wears neither blue nor white implies that he may play cricket.
(D) None of these

22. Sunil cannot meet his friends or his family, unless he has a job.
(A) Sunil met his friend and his family implies he has a job.
(B) Sunil does not have a job and cannot meet his family; hence, he cannot meet his friends.
(C) Sunil does not have a job but he met his family implies that he cannot meet his friends.
(D) Both (A) and (C)

23. Only if there is a sale, I will buy clothes or cosmetics.
(A) I have bought clothes and cosmetics means there is a sale.
(B) I have bought cosmetics, hence, there is a sale.
(C) I have bought clothes, hence, there is a sale.
(D) All the above.

24. Unless you take medicines, you will not recover and will not be able to walk.
(A) You recovered means you have taken medicines.
(B) You are not able to walk means you have not taken medicines.
(C) You have not taken medicines; hence, you will not recover but you will be able to walk.
(D) You did not recover means you have not taken medicines.

25. If Ganshyam goes to the U.S.A., his mother or his brother will accompany him.
(A) Ganshyam is going to the U.S.A. but his brother is not accompanying him implies his mother will accompany him.
(B) Neither Ganshyam's mother nor his brother is accompanying him means Ganshyam is not going to the U.S.A.
(C) Ganshyam is not going to the U.S.A, hence neither his mother nor his brother is accompanying him.
(D) Both (A) and (B)

26. Whenever Preeti watches TV, then she watches movies and sports.
(A) Preeti is not watching sports implies that she is watching TV.
(B) Preeti is not watching movies implies she is not watching TV.
(C) Preeti is neither watching movies nor sports, hence, she must be watching something else on TV.
(D) Preeti is watching TV, but not movies, implies that she is watching sports.

27. Sagar will marry Sheela, only if she is a graduate and a good cook.
(A) Sheela is a good cook but not a graduate, hence, Sagar will not marry Sheela.
(B) Sagar will marry Sheela since she is a good cook though she is not a graduate.
(C) Sheela is a graduate and a good cook implies that Sagar will marry Sheela.
(D) Sagar did not marry Sheela implies that she is neither a graduate not a good cook.

28. The electricity supply will not be restored and we will not be able to watch TV unless you pay the bill.
(A) The electricity supply is restored and we are able to watch TV implies that you have paid the bill.
(B) We are able to watch TV but electricity supply is not restored implies that you have paid the bill.
(C) We are unable to watch TV but electricity supply is restored implies that you have paid the bill.
(D) All the above

29. If you try hard, then you can win or gain.
(A) You tried hard but did not win means you gained.
(B) You tried hard but did not gain, means you won.
(C) You neither won nor gained means you did not try hard.
(D) All the above

30. Rajesh cooks, only if it is Sunday or Saturday.
(A) Rajesh cooked implies that it is Sunday and Saturday.
(B) Rajesh cooked but it is not Sunday, hence, it is Saturday.
(C) Rajesh cooked but it is neither Sunday nor Saturday.
(D) None of these

31. Ravi does not meet Pranith or Mani, unless he goes to New York.
(A) Ravi met Pranith and Mani implies he went to New York.
(B) Ravi did not go to New York and did not meet Pranith, hence, he did not meet Mani.
(C) Ravi did not go to New York but he met Mani implies that he did not meet Pranith.
(D) Both (A) and (C)

32. Whenever David goes to church, he donates money and clothes.
(A) David did not donate clothes implies that he went to church.
(B) David did not donate money implies that he did not go to church.
(C) David donated neither money nor clothes, hence, he must have gone to church.
(D) David went to church but did not donate money implies that he donated clothes.

33. If Prashanth buys a book, he gives it to his brother or his friend.

(A) Prashanth bought a book, but he did not give it to his friend implies that he gives it to his brother.

(B) Prashanth gave the book to neither his brother nor his friend means he did not buy a book.

(C) Prashanth did not buy a book, hence, he gave the book neither to his brother nor to his friend.

(D) Both (A) and (B)

34. If I am not paid, I will not work and I will not take leave.

(A) If I have worked and I took leave, then I am paid.

(B) If I have worked and I have not taken leave, then I was paid.

(C) If I have worked or I have taken leave, then I was paid.

(D) More than one of the above.

35. If Rama leaves Ayodhya, then he will go to forest or to Sri Lanka.

(A) Rama did not go to forest and did not go to Sri Lanka, implies that he did not leave Ayodhya.

(B) Rama did not leave Ayodhya, implies that he will not go to forest or will not go to Sri Lanka.

(C) Rama went to forest or to Sri Lanka, implies that he did not leave Ayodhya.

(D) Rama did not leave Ayodhya, implies that he will not go to forest and will not go to Sri Lanka.

36. Unless the party gets a majority, the house will be dissolved and the President's rule will be imposed.

(A) The party got a majority, it means that either the house will not be dissolved or the President's rule will not be imposed.

(B) The house is not dissolved or the President's rule is not imposed, means that the party got a majority.

(C) The house is not dissolved and the President's rule is not imposed means that the party got a majority.

(D) Both (B) and (C).

37. If you plant trees, then there will be no pollution and you get fruits.

(A) If there is no pollution and you did not get fruits, then you planted trees.

(B) If there is pollution and you did not get fruits, then you did not plant trees.

(C) If there is pollution or you did not get fruits, then you did not plant trees.

(D) Both (B) and (C)

38. If there is no traffic, then I will not drive slow but I will go on a long drive.

(A) If there is traffic, then I will drive slow but I will not go on a long drive.

(B) If there is traffic, then I will not drive slow but I will not go on a long drive.

(C) If I drive slow or I do not go on a long drive, it means that there is traffic.

(D) If I did not drive slow and I went on a long drive, it means that there is traffic.

Directions for questions 29 and 30: Each question consists of a set of statements in alphabetical order. Assume that each one of these statements is individually true. Each of the four choices consists of a subset of these statements. Choose the subset as your answer where the statements therein are logically consistent among themselves.

39. (a) Only if the water level in the coastal areas rises, then the people change their life style.
(b) People change their life style only if they are rewarded.
(c) If people are rewarded, then they will not change their life style.
(d) If the temperatures rise, then the water level in the coastal areas rises.
(e) Whenever the water level in the coastal areas rises, then the temperature rises.
(f) Unless the people change their lifestyle, temperature rises.
(g) People are rewarded.
(h) Water level in the coastal area does not rise.

(A) c, d, f, g and h (B) g, f, d, *b* and h
(C) a, c, d, g and h (D) e, f, g, h and b

40. (a) If Gulam sings, then audience sleep.
(b) If Gulam sings, then audience dance.
(c) Unless audience do not dance, the concert will be successful.
(d) Only if audience dance, the concert will be successful.
(e) If Vani dances, then Gulam sings.
(f) Gulam sings, only if Vani dances.
(g) Vani dances.
(h) The concert is successful.

(A) c, f, g, *b* and h (B) a, c, f, g and h
(C) e, c, g, *b* and h (D) d, f, g, h and b

EXERCISE-3

Directions for questions 1 to 10: Each question below consists of a main statement followed by some numbered statements. From the numbered statements, select the one that logically follows the main statement.

1. If it is a holiday, then I will go for a picnic or I will visit my uncle's house.
(A) I will not go for a picnic or I will not visit my uncle's house implies that it is not a holiday.
(B) If it is not a holiday, then I will not go for a picnic and I will not visit my uncle's house.
(C) I will not go for a picnic and I will not visit my uncle's house implies that it is not a holiday.
(D) If it is not a holiday, then I will not go for a picnic or I will not visit my uncle's house.

2. Whenever my mom scolds me, I either hide behind my dad or complain to my grandma.
(A) If I complain to my grandma or I hide behind to my dad, then my mom must have scolded me.
(B) If I did not complain to my grandma and I did not hide behind my dad, then my mom must not have scolded me.
(C) If my mom does not scold me, I will neither hide behind my dad nor complain to my grandma.
(D) Both (A) and (B)

3. Whenever it rains, I will either carry an umbrella or wear a raincoat.
(A) It is not raining means that I will neither carry an umbrella nor wear a raincoat.
(B) I am carrying an umbrella or I am wearing a raincoat, implies that it is raining.
(C) I am not carrying an umbrella or I am not wearing a raincoat means that it is not raining.
(D) If it is raining but I am not wearing a raincoat means that I must be carrying an umbrella.

4. If it is very hot outside, then I will carry an onion with me and I will return home by lunch time.
(A) I will not carry an onion with me or I will not return home by lunch time means that it is not very hot outside.
(B) It is not very hot outside means that I will not carry an onion with me and I will not return home by lunch time.
(C) I will not carry an onion with me and I will return home by lunch time means that it is very hot outside.
(D) I will carry an onion with me and I will return home by lunch time means that it is very hot outside.

5. Whenever Arpita's father is in town, she abstains from college and goes to her uncle's house.
(A) If Arpita has not abstained from college or she has not gone to her uncle's house means that her father is not in town.
(B) If Arpita has not abstained from college but her father is in town, then she will definitely go to her uncle's house.
(C) If Arpita has abstained from college but she has not gone to her uncle's house, it means that her father is not in town.
(D) Both (A) and (C) above.

6. If the tea is not hot, then I will not go to school and will not have dinner.
(A) If I have gone to school or I have not had dinner, then the tea is not hot.
(B) If I have gone to school and I had dinner, then the tea is hot.
(C) If I have gone to school and I have not had dinner, then the tea is hot.
(D) If I have gone to school or I have had dinner, then the tea is hot.

7. If Ramesh leaves his job, then he will join for an MBA course or for an MCA course.
(A) Ramesh has neither joined an MBA course nor an MCA course implies that he has not left his job.
(B) Ramesh has not left his job implies that he will not join an MBA course or he will not join an MCA course.
(C) Ramesh has joined an MBA course or an MCA course implies that he has not left his job.
(D) Ramesh has not left his job implies that he will not join an MBA course and he will not join an MCA course.

8. Unless we win the Assembly elections, we will lose the Rajya Sabha elections and the Presidential elections.
(A) We have won the Assembly elections, it means that we will not lose either the Rajya Sabha elections or the Presidential elections.
(B) We have not lost the Rajya Sabha elections or we have not lost the Presidential elections means that we have won the Assembly elections.
(C) We have not lost the Rajya Sabha elections and not lost the Presidential elections means that we have won the Assembly elections.
(D) Both (B) and (C).

9. If it is a Sunday, then on that day there is no college and I go to Church.
(A) If there is no college and I do not go to Church, then that day is a Sunday.
(B) If there is college and I do not go to Church, then that day is not a Sunday.
(C) If there is college or I do not go to Church, then that day is not a Sunday.
(D) Both (B) and (C).

10. If it is not raining, then I will not go for a movie but I will visit my friend's house.
(A) If it is raining, then I will go for a movie but I will not visit my friend's house.
(B) If it is raining, then I will not go for a movie but I will not visit my friend's house.
(C) If I go for a movie or I do not visit my friend's house, it means that it is raining.
(D) If I will not go for a movie and I will visit my friend's house, it means that it is raining.

Directions for questions 11 to 13: Each question below consists of a main statement followed by four numbered statements. From the numbered statements, select the one that logically follows the main statement.

11. Harish will get through the interview, if he is thorough with the basics.
(A) Harish got through the interview, hence, he was thorough with the basics.
(B) Harish is not thorough with the basics; hence, he will not get through the interview.
(C) Harish did not get through the interview means he was not thorough with the basics.
(D) Although he was not thorough with the basics, still Harish managed to get through the interview.

12. Either Pakistan or China will attack India, only if India supports Russia and the USA.
(A) Pakistan and China attacked India means India supported Russia and the USA.
(B) India neither supported Russia nor supported the USA means that only Pakistan attacked India.
(C) India supported the USA but not Russia, means that only China attacked India.
(D) All of the above

13. I will neither talk to you nor play with you, unless you apologize to me.
(A) I talked with you or played with you means that you apologized to me.
(B) I did not apologize to you means that you neither talked with me nor played with me.
(C) You apologized to me means that you neither talked nor played with me.
(D) Both (A) and (B)

Directions for questions 14 and 15: Each question has a main statement followed by four statements labelled as a, b, *c* and d. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement.

14. Either Rajeev is a genius or he cheated in the exam.
(a) Rajeev cheated in the exam.
(b) Rajeev is a genius.
(c) Rajeev is not a genius.
(d) Rajeev did not cheat in the exam.
(A) Only ca (B) Only bd
(C) cd and ba (D) db and ca

15. Unless the politician took money, he is not good enough.
(a) The politician is not good enough.
(b) The politician took money.
(c) The politician is good enough.
(d. The politician did not take money.
(A) Only bc (B) Only da
(C) Only ab (D) cb and da

Directions for questions 16 to 20: Each question below consists of a statement followed by some numbered statements. From the numbered statements, select the one that logically negates the main statement.

16. Sravan will go to the movie, if his parents are not with him.
(A) Sravan did not go to the movie and his parents are with him.
(B) Sravan's parents are with him and he went to the movie.
(C) Sravan did not go to the movie and his parents are not with him.
(D) Sravan went to the movie and his parents are not with him.

17. Ramesh works very hard whenever there is an exam.
(A) Ramesh worked very hard and there is no exam.
(B) Ramesh did not work hard and there is no exam.
(C) Ramesh did not work hard and there is an exam.
(D) Both (B) and (C)

18. Either it is a flying saucer or the person is not telling the truth.
(A) It is not a flying saucer and the person is not telling the truth.
(B) The person is telling the truth and it is not a flying saucer.
(C) It is a flying saucer and the person is telling the truth.
(D) The person is not telling the truth and it is a flying saucer.

19. Sachin scores a century, unless he is paired with the Captain.
(A) Sachin is paired with the Captain and he did not score a century.
(B) Sachin scored a century and he is not paired with the Captain.
(C) Sachin is paired with the Captain and he scored a century.
(D) Sachin did not score a century and he is not paired with the Captain.

20. Bond will buy the car only if it is the costliest and fastest.
(A) Bond did not buy the car and it is neither the fastest nor the costliest.
(B) Bond bought the car and it is not the costliest or it is not the fastest.
(C) The car is the fastest and costliest, and Bond did not buy it.
(D) Bond bought the car and it is the fastest and costliest.

Directions for questions 21 to 23: Each question has a main statement followed by four statements labelled as a, b, *c* and d. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement.

21. If the price of a good increases, then its consumption decreases.
(a) The price of a good increased.
(b) The price of a good did not increase.
(c) The consumption of the good decreased.
(d) The consumption of the good did not decrease.

(A) cb (B) ad
(C) ca (D) db

22. The exam's difficulty level increases only if the number of applicants increases.
(a) The exam's difficulty level increased.
(b) The exam's difficulty level did not increase.
(c) The number of applicants have increased.
(d) The number of applicants have not increased.

(A) ca (B) db
(C) ac (D) both (B) and (C)

23. Whenever the hero needs money, he acts in a new movie.
(a) The hero needed money.
(b) The hero did not need money.
(c) The hero acted in a new movie.
(d) The hero did not act in a new movie.

(A) ac (B) ad
(C) ca (D) bd

Directions for questions 24 and 25: Each question below consists of a main statement followed by four numbered statements, From the numbered statements, select the one that logically follows the main statement.

24. The chief guest will come on time, if the fog does not affect the flight timings. Only if the chief guest comes, then the meeting will be started.
The meeting started implies that
(A) The fog did not affect flight timings.
(B) The fog affected the flight timings.
(C) The chief guest did not come.
(D) None of these

25. Unless coding is done, the software project cannot be completed. If the company does not meet the project completion deadline, then the team working on it will be fired.
The team working in the project, is not fired implies
(A) The coding is done.
(B) The software project was not completed.
(C) The company did not meet the project completion deadline.
(D) None of these

ANSWER KEYS

Exercise-1

1. (D)	8. (D)	15. (B)	22. (D)	29. (D)	36. (C)
2. (D)	9. (D)	16. (D)	23. (A)	30. (D)	37. (D)
3. (B)	10. (D)	17. (C)	24. (D)	31. (C)	38. (B)
4. (C)	11. (D)	18. (B)	25. (D)	32. (B)	39. (A)
5. (D)	12. (D)	19. (D)	26. (B)	33. (C)	40. (C)
6. (D)	13. (A)	20. (A)	27. (B)	34. (A)	
7. (D)	14. (C)	21. (B)	28. (B)	35. (D)	

Exercise-2

1. (B)	8. (D)	15. (A)	22. (D)	29. (D)	36. (D)
2. (C)	9. (B)	16. (A)	23. (D)	30. (B)	37. (D)
3. (B)	10. (C)	17. (B)	24. (A)	31. (D)	38. (C)
4. (C)	11. (A)	18. (D)	25. (D)	32. (B)	39. (B)
5. (A)	12. (C)	19. (D)	26. (B)	33. (D)	40. (C)
6. (C)	13. (A)	20. (D)	27. (A)	34. (D)	
7. (B)	14. (B)	21. (B)	28. (D)	35. (A)	

Exercise-3

1. (C)	5. (D)	9. (D)	13. (A)	17. (C)	21. (D)	24. (D)
2. (B)	6. (D)	10. (C)	14. (D)	18. (B)	22. (D)	25. (A)
3. (D)	7. (A)	11. (C)	15. (D)	19. (D)	23. (A)	
4. (A)	8. (D)	12. (A)	16. (C)	20. (B)		

SOLUTIONS

exeRCise-1

1. If [movie is a superhit,] (p) then [i watch it] (q) The statement is of the form, 'If p, then q'.
The implications are (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (D) is according to (ii).

2. Whenever [it is cold,] (p) [I wear a jacket.] (q) The statement is of the form 'whenever p then q'.
The implications are: (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$.
Choice (A) is according to (i) and Choice (B) is according to (ii).

3. Either or
The statement is of the form 'either p or q'.
The implications are:
(A) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (B) is according to (ii).

4. Only if [Raj is not coming] (p), then
[Geetika will come to the party] (q)
The statement is of the form 'only if p, then q'.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Choice (C) is according to (i).

5. Unless [I have money,] (p) [I cannot enjoy my weekend] (q)
The statement is of the form 'unless p then q'.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (B) is according to (ii) and Choice (C) is according to (i).

p q

6. If [I can swim,] then [I can clear the exam]
The statement is of the form, 'If p then q'.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (A) is according to (i) and Choice (B) is according to (ii).

q p

7. [India will talk] Only if [the terrorists are handed over.]
The statement is of the form 'only if p then q'.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Choice (D) is according to (i).

p q

8. Whenever [there is demand] [there will be supply]
The statement is of the form 'whenever p then q'.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (C) is according to (ii) and Choice (B) is according to (i).

p q

9. Suhasita purchases either [a cooler] or [a refrigerator]
The statement is of the form 'either p or q'.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) is according to (i).
Choice (B) is according to (ii).

q p

10. [I will not have enemies] Unless [I fight]
The statement is of the form 'unless p then q'.
The implications are:
(A) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (B) is according to (i).
Choice (C) is according to (ii).

p q

11. If [you are good,] then [everyone loves you.]
The statement is of the form, 'if p, then q'.
The implications are: (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (D) is according to (ii).

p q

12. Unless [Pratik comes,] [his son does not eat]
The statement is of the form, 'unless p, q'.
The implications are: (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) is according to (i) and Choice (C) is according to (ii).

p

13. Only if [you are qualified in written test]

q

[you get a call for an interview]

The statement is of the form 'only if p, then q'.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Choice (A) is according to (ii).

14. The given statement is of the form
If [Raju plays well] then [the team can win the match.]

p q

The implications are $p \Rightarrow q$ and $\sim q \Rightarrow \sim p$.
(C) logically follows the main statement.

15. The given statement is of the form
Either [He plays cricket] or [eats biscuit.]

p q

The implications are $\sim p \Rightarrow q$ and $\sim q \Rightarrow p$.
(B) logically follows the main statement.

16. The given statement is of the form
Unless [the inflation is low]

p

[economic growth will not high.]

q

The implications are $\sim p \Rightarrow q$ and $\sim q \Rightarrow p$
$\therefore$ Both (B) and (C) logically follow the main statement.

17. The given statement is of the form.
Only if:
[the train does not leave late] then

p

[he can attend the interview]

q

The implications are $q \Rightarrow p$ and $\sim p \Rightarrow \sim q$.
(C) logically follows from the main statement.

18. The given statement is of the form:
Whenever [I go to church] then [I pray to god]

p q

The implications are: $p \Rightarrow q$ and $\sim q \Rightarrow \sim p$
Choice (B) logically follows the main statement.

p q

19. If [you deposit money,] [you will get interest.]
The statement is of the form 'if p, then q'.
The implications are: (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (A) follows (ii) and Choice (B) follows (i).

p q

20. Unless [Kiran finds a soul mate,] [he will not marry]
The statements of the form 'unless p, q'.
The implications are: (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) follows (i).

q p

21. [Teachers can teach,] only if [students are well mannered]

The statement is of the form 'only if p then q'. The implications are: (i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$

(a) $\Rightarrow q$ (b) $\Rightarrow \sim p$
(c) $\Rightarrow \sim q$ (d) $\Rightarrow p$

Here, 'ad' and 'bc' are proper pairs.

q p

22. [Prajakta is healthy] whenever [she is happy]

The statement is of the form 'whenever p then q'.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

(a) $\Rightarrow \sim p$ (b) $\Rightarrow p$
(c) $\Rightarrow q$ (d) $\Rightarrow \sim q$

Here, 'bc' and 'da' are proper pairs.

23. Rohit is suffering either

p q

[from malaria] or [from typhoid.]

The statement is of the form 'either p or q'.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$

(a) $\Rightarrow \sim q$ (b) $\Rightarrow p$
(c) $\Rightarrow \sim p$ (d) $\Rightarrow q$

Here, 'ab' and 'cd' are the proper pairs.

q p

24. [Manjula works] unless [she is married.]

The statement is of the form 'unless p then q'.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$

(a) $\Rightarrow \sim p$ (b) $\Rightarrow p$
(c) $\Rightarrow q$ (d) $\Rightarrow \sim q$

Here, 'ac' and 'db' are the proper pairs.

p q

25. If [tea is sweet] then [Samarth cannot drink it.]

The statement is of the form 'if p then q'.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

(a) $\Rightarrow \sim q$ (b) $\Rightarrow \sim$p
(c) $\Rightarrow q$ (d) $\Rightarrow p$

Here, 'dc' and 'ab' are the proper pairs.

q

26. [Nisha will do an MBA] only if

p

[she gets admission into a good college.]

The statement is of the form 'only if p then q'.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$

(a) $\Rightarrow \sim q$ (b) $\Rightarrow p$
(c) $\Rightarrow \sim p$ (d) $\Rightarrow q$

Here, 'db' and 'ca' are the proper pairs.

q p

27. [Rajesh is wealthy], only if [he is healthy]

The statements of the form 'only if p, then q'.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$

(a) $\sim q$ (b) p
(c) $\sim p$ (d) q

Here, 'db' and 'ca' are proper pairs.

q

28. [Madhuri is not a philosopher,] unless

p

[she completes her Ph.D.]

The statement is of the form 'unless p, q'.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$

(a) $\sim q$ (b) q
(c) p (d) $\sim p$

Here, 'db' and 'ac' are proper pairs.

q p

29. [Happiness is real,] whenever [it is shared]

The statement is of the form 'whenever p, then q'.
The implications are:
(i) $p \Rightarrow$ q (ii) $\sim q \Rightarrow \sim$ p

(a) $\sim$ p (b) $\sim q$
(c) p (d) q

Here, 'cd' and 'ba' are proper pairs.

30. Ramu wants to be either

p q

[a Manager] or [a Director]

The statement is of the form 'either p or q'.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$

(a) $\sim q$ (b) p
(c) q (d) $\sim p$

Here, 'dc' and 'ab' are proper pairs.

p q

31. If [I have money,] [I will buy a book]

The statement is of the form 'if p, then q'.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

(a) $\sim p$ (b) $\sim q$
(c) q (d) p
Here, 'dc' and 'ba' are proper pairs.

q

32. Swati would be selected in the first company,

p

if she has an excellent academic record.

The implications of the statement are:
(i) $p \Rightarrow q$ and (ii) $\sim q \Rightarrow \sim p$
$\therefore$ It can be ca or bd.

p

33. Only if Abhijeet has good knowledge is classical music,

q

he would be elected as Musical Idol.

The implications of the above statement are:
(i) $q \Rightarrow p$ and (ii) $\sim p \Rightarrow \sim q$
It can be bd or ac.

p

34. Unless The Indian government seals the borders,

q

illegal migration wil not stop.

The implications of the above statement are:
(i) $\sim p \Rightarrow q$ and (2) $\sim q \Rightarrow p$
It can be cd or ba.

p

35. Whenever Sandeep receives a message from Sangeeta

q

he seems to be on cloud nine.

The implications of the above statement are:
(1) $p \Rightarrow q$ and (2) $\sim q \Rightarrow \sim p$
It can be db or ca.

p

36. If Ali has good knowledge of JAVA,

q

he will selected in Satyam Computers,

The implications for the above statement are:
(i) $p \Rightarrow q$ and (ii) $\sim q \Rightarrow \sim p$
Unless

$\sim q$

Ali is not selected in Satyam Computers

r

he will not be selected in CTS.

The implications for the above statement are:
(iii) $q \Rightarrow r$ and (iv) $\sim r \Rightarrow \sim q$
The given statement:
Ali is selected in CTS [$\sim r$]
From (iv) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow \sim p$
$\therefore \sim r \Rightarrow \sim p$, i.e., Ali does not have good knowledge of JAVA.

q

37. The HR manager of TCS will come,

p

if the strike does not effect the flight timings.

The implications of the above statement are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

q

Only if The HR manager of TCS comes,

r

TCS will recruit people.

The implications of the above statement are:
(iii) $r \Rightarrow q$ and (iv) $\sim q \Rightarrow \sim r$
The given statement is TCS is recruiting people [r].
From (iii), $r \Rightarrow q$.
But there is no implication for q.
So, the answer will be none of these.

p

38. Unless the coding is not tested,

q

the company can implement it.

The implications of the above statement are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$

q

If the company can implement the coding

r

the network system will work properly.

The implications of the above statement are:
(iii) $q \Rightarrow r$ and (iv) $\sim r \Rightarrow \sim q$
The given statement, 'The network is not working properly' ($\sim r$).
From (iv) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow p$
$\therefore \sim r \Rightarrow p$ (The coding is not tested).

p

39. Whenever the Infosys team's performance is excellent,

q

they become the top IT company

The implications of the above statement are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

~q

Either [Infosys does not become the top IT company]

r

or [TCS remains in the top rank.]

The implications for the above statement are:
(iii) $q \Rightarrow r$ (iv) $\sim r \Rightarrow \sim q$
The given statement, 'The Infosys team's performance is excellent' (p).
From (i) $p \Rightarrow q$ and from (iii) $q \Rightarrow r$
$\therefore p \Rightarrow r$ [TCS remains in the top rank].

p

40. If [a person follows conventional methods,]

q

[He cannot be successful.]

The statement is of the form, if p then q.
The implications are:
(i) $p \Rightarrow q$; (ii) $\sim q \Rightarrow \sim p$

~q

Unless [a person is successful,]

r

[he cannot be a part of successful company.]

The statement is of the form unless ($\sim q$), r.
The implications are:
(i) $q \Rightarrow r$ (ii) $\sim r \Rightarrow \sim q$
The given statement, Mr Prasad has become a part of P & G, a successful company ($\sim r$).
From (ii) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow \sim p$
Now,
$\sim r \Rightarrow \sim q \Rightarrow \sim p$ (Mr Prasad does not follow conventional methods).

Exercise-2

p

1. Either [Anand will marry Vandana] or

q

[Madhavi will marry Kollol.]

The negation of the above statement is $\sim p$ and $\sim q$.

p

2. Whenever [Bhiru and Basanti go for long drive,]

q

[Joy followed them.]

The negation of the above statement is p and $\sim q$.

q

3. [Pratap Rana will attend the class,]

p

only if [his father allows has to go by bike]

The negation of the above statement is $\sim p$ and q.

p

4. Unless [Aiswariya plays the role of 'Paro',]

q

[Madhuri will not play the role of 'Chandramukhi'.]

The negation of the above statement is $\sim p$ and $\sim q$.

p

5. Unless [The change happens,]

q

[The problems will not be solved.]

The statement is of the form:
Unless p, q.
Negation for the above statement is $\sim p$ and $\sim q$.

6. The statement is of the form:
p and q
The negation is $\sim p$ or $\sim q$.

7. The statements is of the form:
Unless p, q.
The negation is $\sim p$ and $\sim q$.

8. The statement is of the form:
Either p or q.
The negation is $\sim p$ and $\sim q$.

9. The statement is of the form:
If p, then q.
The negation is p and $\sim q$.

10. The statement is of the form, p, only if q.
The negation is p and $\sim q$.

p

11. If [it is the post of a manager,] then

q

[Shastri wil join the firm.]

The statement is of the form 'if p then q'.
The negation is 'p and $\sim q$'.

q p

12. I cannot make tomato soup, unless I have some onions.

The statement is of the form 'unless p then q'.
The negation is $\sim p$ and $\sim q$.

p q

13. Only if Tara is happy, then she does not go to work

The statement is of the form 'only if p then q'.
The negation is $\sim p$ and q. p

14. Paul is popular either as a lead guitarist or

q

as a base guitarist.

The statement is of the form 'either p or q'.
The negation is $\sim p$ and $\sim q$.

q p

15. Kohli cannot score a hundred, unless Jhonson bowls.

The statement is of the form 'unless p, q'.
The negation is $\sim p$ and $\sim q$.

16. The given statement is of the form

He either wears shoes or a tie

p q

The negations are: $\sim p$ & $\sim q$ and $\sim q$ & $\sim p$.
Choice (A) is the correct negation of the given statement.

17. The given statement is of the form

If It is a holiday then I sleep throughout the day

p q

The negations are p & $\sim q$ and $\sim q$ & $\sim p$.
Choice (B) is the correct negation of the given statement.

18. The given statement is of the form

Rajesh goes to college and attends classes.

p q

The negations are $\sim p$ or $\sim q$ and $\sim q$ or $\sim p$.

19. The statement is of the form, 'If p, then q or r'.

p q

If Ankita eats pastry then It is a black forest

r

or a pinapple.

The implications are:
(i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Choice (A) is according to (iv).
Choice (B) is according to (iii).
Choice (C) is according to (ii).

20. The statement is of the form 'if p then q and r'.

p q

If you want to stay fit, then you must eat healthy food

r

and exercise.

The implications are:
(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) $\sim q \Rightarrow \sim p$ (iv) $\sim r \Rightarrow \sim p$
(v) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (A) is according to (iii) and Choice (B) is according to (iv).

21. The statement is of the form 'only if q or r then p'.

p q

Yaseem plays cricket only if he wears blue

r

or white

The implications are:
(i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r = q$

Choice (B) is according to (iii).

22. The statement is of the form 'unless p then q or r'.

q r

Sunil cannot meet his friends or his family unless

p

he has a job.

The implications are:
(i) $\sim p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow p$
(iii) $\sim p$ and $\sim q \Rightarrow r$ (iv) $\sim p$ and $\sim r \Rightarrow q$

Choice (A) is according to (ii).
Choice (C) is according to (iv).

23. The statement is of the form 'only if p then q or r'.

p q

Only if there is a sale, I will buy clothes

r

or cosmetics.

The implications are:
(i) q or $r \Rightarrow p$ (ii) $q \Rightarrow p$
(iii) $r \Rightarrow p$ (iv) q and $r \Rightarrow p$
(v) $\sim p \Rightarrow \sim q$ and $\sim r$

Choice (A) is according to (iv).
Choice (B) is according to (iii).
Choice (C) is according to (ii).

24. The statement is of the form 'unless p then q and r'.

p q

Unless [you take medicines,] [you will not recover] and

r

[will not be able to walk.]

The implications are:

(i) $\sim p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow p$

(iii) $\sim q \Rightarrow p$ (iv) $\sim r \Rightarrow p$

(v) $\sim q$ and $\sim r \Rightarrow p$

Choice(A) is according to (iii).

25. The statement is of the form 'if p, then q or r'.

p q

If [Ganshyam goes to the U.S.A,] [his mother]

r

or [his brother] will accompany him.

The implications are:

(i) $p \Rightarrow q$ or r (ii) p and $\sim q \Rightarrow r$

(iii) p and $\sim r \Rightarrow q$ (iv) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (A) is according to (iii).

Choice (B) is according to (iv).

26. The statement is of the form 'whenever p then q and r'.

p

Whenever [Preeti watches T.V.,] then

q r

[she watches movies] and [sports]

The implications are:

(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$

(iii) $\sim q \Rightarrow \sim p$ (iv) $\sim r \Rightarrow \sim p$

(v) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (B) is according to (iii).

27. The statement is of the form 'only if q and r, then p'.

p q

[Sagar will marry Sheela,] only if [she is a graduate]

q

and [a good cook.]

The implications are:

(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$

(iii) $\sim q \Rightarrow \sim p$ (iv) $\sim r \Rightarrow \sim p$

(v) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (A) is according to (iii).

28. The statement is of the form 'unless p, then q and r'.

q

[The electricity supply will not be restored] and

r

[we will not be able to watch T.V.,] unless

p

[you pay the bill.]

The implications are:

(i) $\sim p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow p$

(iii) $\sim q \Rightarrow p$ (iv) $\sim r \Rightarrow p$

(v) $\sim q$ and $\sim r \Rightarrow p$

Choice (A) is according to (v).

Choice (B) is according to (iv).

Choice (C) is according to (iii).

29. The statement is of the form, 'if p, then q or r '.

p q r

If [you try hard] then [you can win] or [gain.]

The implications are:

(i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$

(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Choice (A) is according to (iii).

Choice (B) is according to (iv).

Choice (C) is according to (ii).

30. The statement is of the form 'only if q or r then p'.

p q r

[Rajesh cooks,] only if [it is Sunday] or [Saturday]

The implications are:

(i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$

(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Choice (B) is according to (iii).

31. The statement is of the form 'unless p, then q or r '.

p q

Whenever [David goes to church,] [he donates money]

r

and [clothes]

The implications are:

(i) $\sim p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow p$

(iii) $\sim p$ and $\sim q \Rightarrow r$ (iv) $\sim p$ and $\sim r \Rightarrow q$

Choice (A) is according to (ii).

Choice (C) is according to (iv).

32. The statement is of the form 'whenever p, then q and r'.

p q

Whenever [David goes to church,] [he donates money]

r

and [clothes]

The implications are:
(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) $\sim q \Rightarrow \sim p$ (iv) $\sim r \Rightarrow \sim p$
(v) $\sim q$ and $\sim r \Rightarrow \sim p$
Choice (B) is according to (iii).

33. The statement is of the form 'if p, then q or r'.

p

If [Prashanth buys a book,]

q

then he gives it to his [brother]

r

or [his friend.]

The implications are:
(i) $p \Rightarrow q$ or r ii) p and $\sim q \Rightarrow r$
(iii) p and $\sim r \Rightarrow q$ (iv) $\sim q$ and $\sim r \Rightarrow \sim p$
Choice (A) is according to (iii).
Choice (B) is according to (iv).

p q

34. If [Iam not paid,] then [I will not work] and

r

[I will not take leave.]

Statement: If p, then q and r.
Implications:
(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) q and $\sim r \Rightarrow \sim p$ (iv) $\sim q$ and $r \Rightarrow \sim p$
(v) $\sim q$ and $\sim r \Rightarrow \sim p$
Implication (v) is represented in Choice (A), (iv) is represented in Choice (B) and (ii) is represented in the Choice (C).

p q

35. If [Rama leaves Ayodhya,] then [he will go to forest]

r

or [to Sri Lanka.]

Statement: If p, then q or r.
Implications:
(i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

$\sim p$ is 'Rama did not leave Ayodhya', $\sim q$ is 'Rama did not go to forest' and $\sim r$ is 'Rama did not go to Sri Lanka'.
Implication (i) is represented in the Choice (A).

p

36. Unless [the party gets majority,]

q

[the house will be dissolved]

r

and [the President's rule will be impossed.]

Statement: Unless p, then q and r.
Conclusions:
(i) $\sim p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow p$
(iii) $\sim q$ & $r \Rightarrow p$ (iv) q & $\sim r \Rightarrow p$
(v) $\sim q$ & $\sim r \Rightarrow p$

Conclusions:
(i) The party did not get a majority, implies that the house will be dissolved and the President's rule will be imposed.
(ii) The house is not dissolved or the President's rule is not imposed means that the party got a majority, Choice (B).
(iii) The house is not dissolved but the President's rule is imposed means that the party got the majority.
(iv) The house is dissolved and the President's rule is not imposed means that the party got a majority.
(v) The house is not dissolved and the President's rule is not imposed implies that the party got a majority, Choice (C).

p q

37. If [you plant trees,] then [there will be no pollution]

r

and [you get fruits.]

Statement: If p, then q and r.
Implications:
(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) $\sim q$ and $r \Rightarrow \sim p$ (iv) q and $\sim r \Rightarrow \sim p$
(v) $\sim q$ and $\sim r \Rightarrow \sim p$
$\sim p$ is 'You did not plant trees', $\sim q$ is 'There will be pollution' and $\sim r$ is 'You do not get fruits'.
Implication (v) is represented in the Choice (B) and (ii) is represented in Choice (C).

p q

38. If [there is no traffic,] then [I will not drive slow]

r

but [I will go on a long drive.]

Statement: If p, then q and r.
Implications:
(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) $\sim q$ and $r \Rightarrow \sim p$ (iv) q and $\sim r \Rightarrow \sim p$
(v) $\sim q$ and $\sim r \Rightarrow \sim p$
Implication (ii) is represented in Choice (C).

p

39. (a) Only if [the water level in the coastal areas rises,]

q

then the [people change their life style]

The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$

(b) , only if
q
People change their life style, only if
r
they are rewarded.

The implication are:
(iii) $q \Rightarrow r$ (iv) $\sim r \Rightarrow \sim q$

(c) If people are rewarded
r
$\sim q$
then they will not change their life style.

The implications are:
(v) $r \Rightarrow \sim q$ (vi) $q \Rightarrow \sim r$

(d) If
s
the temperature rises,
p
then the water level in the coastal areas rises.

The implications are:
(vii) $s \Rightarrow p$ (viii) $\sim p \Rightarrow \sim s$

(e)
p
Whenever the water level in the coastal areas rises,
s
then the temperature rises.

The implications are:
(ix) $p \Rightarrow s$ (x) $\sim s \Rightarrow \sim p$

(f) Unless
q
the people change their life style,
s
temperature rises.

The implications are:
(xi) $\sim q \Rightarrow s$ (xii) $\sim s \Rightarrow q$

(g) People are rewarded $\Rightarrow r$

(h) Water level in the coastal area does not rise.
$\Rightarrow \sim p$

Choice (A) $\Rightarrow h \rightarrow$ (viii) $\rightarrow$ (xii) $\rightarrow$ (vi) $\rightarrow \sim r$
$\therefore$ Hence, the statements are inconsistent.
or G $\rightarrow$ (v) $\rightarrow$ (xi) $\rightarrow$ (vii) $\rightarrow p$
$\therefore$ Hence, the statements are inconsistent.
Choice (B) $\Rightarrow h \rightarrow$ (viii) $\rightarrow$ (xii) $\rightarrow$ (iii) $\rightarrow r$, i.e., G.
$\therefore$ Hence, the statements are consistent.
Choice (C) $\Rightarrow$ Here s is mentioned only in statement (*d*).
$\therefore$ No consistency or inconsistency can be established.
Choice (D) $\Rightarrow$ There is no relation with either g or h for any of the other statements. So, no consistency can be established.

40. (a) then
p q
If Gulam sings, then audience will sleep.

The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

(b) then
p r
If Gulam sings, then audience dance.

The implications are:
(iii) $p \Rightarrow r$ (iv) $\sim r \Rightarrow \sim p$

(c)
$\sim r$
Unless audience do not dance,
s
the concert will be successful.

The implications are:
(v) $r \Rightarrow s$ (vi) $\sim s \Rightarrow \sim r$

(d)
r
only if the audience dance,
s
the concert will be successful.

The implications are:
(vii) $s \Rightarrow r$ (viii) $\sim r \Rightarrow \sim s$

(e)
p t
Gulam sings, only if Vani dances.

The implications are:
(ix) $t \Rightarrow p$ (x) $\sim p \Rightarrow \sim t$

(f) only if
p t
Gulam sings, only if Vani dances.

The implications are:
(xi) $p \Rightarrow t$ (xii) $\sim t \Rightarrow \sim p$

(g) Vani dances $\Rightarrow t$

(h) The concert is successful $\Rightarrow s$

Choice (A) $\Rightarrow$ There is no implication for either s or t.
$\therefore$ Consistency cannot be established.
Choice (B) $\Rightarrow$ The term q is mentioned only in statement *a*.
$\therefore$ Consistency cannot be established.
Choice (C) $\Rightarrow g \rightarrow$ (ix) $\rightarrow$ (iii) $\rightarrow$ (v) $\rightarrow s \rightarrow h$.
$\therefore$ The statements are consistent.
Choice (D) $\Rightarrow$ We can only relate g to (vii).
$\therefore$ Consistency cannot be established.

Exercise-3

p *q*

1. If [it is a holiday,] then [I will go for a picnic]

r

or [I will visit my Uncle's house.]

Statement:
If *p*, then *q* or *r*.

Conclusions:

(i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Conclusions:

(i) It is a holiday means that I will go for a picnic or I will visit my uncle's house.
(ii) I did not go for a picnic and I did not visit my uncle's house means that it was not a holiday.
(iii) It was a holiday but I did not go for a picnic means that I visited my uncle's house.
(iv) It is a holiday but I did not visit my uncle's house means that I went for picnic.

But only statement (ii) is represented in Choice (C).

p

2. Whenever [my mom scolds me,] I either

q

[hide behind my dad] or

r

[complain to my grandma.]

Statement:
Whenever *p*, then *q* or *r* is same as if *p*, then *q* or r.

Conclusions:

(i) $p \Rightarrow q$ or r (ii) $\sim q$ & $\sim r \Rightarrow \sim p$
(iii) p & $\sim q \Rightarrow r$ (iv) p & $\sim r \Rightarrow q$

Conclusions:

(i) My mom scolded me, so I hid behind my dad or I complained to my grandma.
(ii) I did not hide behind my dad and I did not complain to my grandma means that my mom did not scold me.
(iii) My mom scolded me but I still did not hide behind my dad means that I complained to my grandma.
(iv) My mom scolded me but I did not complain to my grandma means that I hid behind my dad.

Questions numbered 3 and 7: These questions can be solved in the same way as questions numbered 1 and 2 are solved.

p

4. If [it is very hot outside,] then

q

[I will carry on onion with me]

r

and [I will return home by lunch time.]

Statement:
If *p*, then *q* and *r*.

Conclusions:

(i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) $\sim q$ & $r \Rightarrow \sim p$ (iv) q & $\sim r \Rightarrow \sim p$
(v) $\sim q$ & $\sim r \Rightarrow \sim p$

Conclusions:

(i) It is very hot outside means that I will carry an onion with me and I will return home by lunch time.
(ii) I will not carry an onion with me or I will not return home by lunch time means that it is not very hot outside.
(iii) I will not carry an onion with me but I will return home by lunch time means it is very hot outside.
(iv) I will carry an onion with me but I will not return home by lunch time means that it is not very hot outside.
(v) I will not carry an onion with me and I will not return home by lunch time means that it is not very hot outside.

Question 5: This can be solved in the same way as question 4 is solved.

p *q*

6. If [tea is not hot,] then [I will not go to school]

r

nor [will I have dinner.]

Statement:
If *p*, then *q* and r.
Note: Here, 'nor' is same as 'and'
so, Questions 7 is similar to question 1.

p

8. Unless [we win the Assembly elections,]

q

[we will lose the Rajya Sabha elections] and

r

[the presidential elections.]

Statements:
Unless *p*, *q* and *r*.

Conclusions:

(i) $\sim p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow p$
(iii) $\sim q$ & $r \Rightarrow p$ (iv) q & $\sim r \Rightarrow p$
(v) $\sim q$ & $\sim r \Rightarrow p$

Conclusions:
(i) We did not win the Assembly elections means that we lost the Rajya Sabha elections and the Presidential elections.
(ii) We did not lose the Rajya Sabha elections or we did not lose the Presidential elections means that we won the Assembly elections.
(iii) We did not lose the Rajya Sabha elections but lost the Presidential elections means that we won the Assembly elections.
(iv) We lost the Rajya Sabha elections but did not lose the Presidential elections means that we won the Assembly elections.
(v) We did not lose the Rajya Sabha elections and did not lose the Presidential elections means that we won the Assembly elections.

Questions 9 and 10: These questions can be solved in the same way as question 8 is solved.

q

11. [Harish will get through the only interview] if

p

[he is through with the basics.]

Implications:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (C) follows (ii).

q

12. [Either Pak or China attacks India,] only if

p

[India supports Russia and USA.]

Implications:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
The first choice follows the first implication.

q

13. [I will neither talk to you nor play with you,]

p

[you apologize to me.]

Implications:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) follows (ii).

14. The given statement is of the form, *p* or *q*, i.e.,

either [Rajeev is a genius] or

p

[he cheated in the exam.]

q

The possible implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Therefore, the answer is ca or db.

15. The given statement is of the form, unless *p*, then *q*, i.e.,

unless [the politician took money]

p

[he is not good enough.]

q

The possible implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q = p$
Therefore, the answer is cb and da.

q

16. [Sravan will go to the movie,] if

p

[his parents are not with him]

Statement: *q*, if *p*
Negation: *p* and ~*q*
Sravan's parents are not with him and he did not go to the movie.

q

17. [Ramesh works very hard] whenever

p

[there is an exam]

Statement: *q*, whenever *p*
Negation: *p* and ~*q*
There is an exam and Ramesh did not work hard.

q

18. Either [it is a Flying Saucer] or

p

[the person is not telling the truth]

Statement: Either *p* or *q*
Negation: ~*p* and ~*q*
It is not a flying saucer and the person is telling the truth.

q

19. [Sachin scores a century,] unless

p

[he is paired with the Captain]

Statement: *p* unless *q*
Negation: ~*p* and ~*q*
Sachin did not score a century and he is not paired with the Captain.

q *p*

20. [Bond will buy the car] only if [it is the costliest]

r

[fastest]

Statement: *p* only if (*q* and *r*), i.e., $p \Rightarrow q$ and *r*
Negation: *p* and ~(*q* and *r*) $\Rightarrow$ *p* and (~*q* or ~*r*)
Therefore, Bond bought the car and it is not the costliest or it is not the fastest.

21. The statement is in the form of if p, then q.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Therefore, it can be ac or db.

22. The statement is in the form of q, only if p.
Implications:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Therefore, it can be ac or db.

23. Statement: whenever p, then q.
Implications:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Therefore, the answer can be ac or db.

24. The chief guest will come on time = q
if
the fog does not affect the flight timings = p.
The implications of above statements are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Only if
the chief guest comes = q
then the meeting be started = r.
The implications of above statements are:
(i) $r \Rightarrow q$ (ii) $\sim q \Rightarrow \sim r$
Therefore, implications with respect to q is not possible here.

25. Unless
the coding is done = p
the software project cannot be completed = q.
The implications of above statements are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
If
the company does not meet the project completion dead line = q,
the team working on it employees will be fired = r.
The implications of above statements are:
(iii) $q \Rightarrow r$ (iv) $\sim r \Rightarrow \sim q$
The given statement is 'the team working on the project are not fired' $\Rightarrow \sim r$.
From (iv) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow p$
Therefore, $\sim r \Rightarrow p$ 'the coding is done'.

11 Quant Based Reasoning

Chapter

Learning Objectives

In this chapter, you will:

- Learn how to deal with questions which involve concepts of both logical reasoning and quantitative aptitude
- Learn how to interpret the given data and get the final outcome out of it.

❒ Introduction

In this section we deal with questions which are a mixture of both quantitative as well as reasoning section. Such, questions are important from the exam point of view as the CAT generally gives questions based on combination of multiple topics.

Exercise-1

Directions for questions 1 to 10: Select the correct alternative from the given choices.

1. The maximum possible number of squares that can be formed using 12 straight lines is_____.

(A) 45 (B) 55
(C) 60 (D) 65

2. Two candles of different lengths burn at different rates. Each candle burns exactly for one hour. Which of the following time intervals can we measure by burning these candles?

(A) 20 minutes (B) 15 minutes
(C) 10 minutes (D) 24 minutes

3. A group of three friends Rose, Jasmine and Tulip were watching butterflies. All three of them saw one butterfly in common. Any two of them saw two butterflies in common and each one of them saw one butterfly which is not common with others. Among the butterflies seen by Tulip, four have polka dots on them. Among the butterflies seen by Jasmine, three have polka dots on them and among the butterflies seen by Rose, two have polka dots on them. What is the minimum possible number of butterflies that do not have polka dots on them?

(A) 0 (B) 1
(C) 2 (D) 3

4. Mr Bhatnagar is an exporter of Champagne. While crossing the borders he bribes the guards by giving them a bottle of Champagne per box of Champagne to cross every border. Each box can contain a maximum of 15 bottles of Champagne. If he has to cross 10 borders to supply 50 bottles of Champagne, then what is the minimum possible number of bottles of Champagne he should start with?

(A) 110 (B) 99
(C) 105 (D) 107

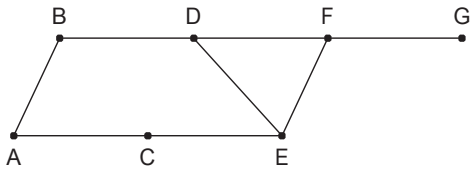
5. When I asked my friend about her age, she said that she has two siblings and the product of the ages of the three is 15 and the sum of their ages is an odd number, then what is the age of my friend if she is the eldest?
(A) 1 (B) 3
(C) 5 (D) Cannot be determined

6. A pile has 34 coins. Two friends, Neeta and Leena are playing a game in which each of them draws 2 or 3 coins from a pile of 34 coins. The person to draw the last coin is the loser. How many coins should Neeta draw to ensure her win if she is the first one to draw?
(A) 2
(B) 3
(C) Either (A) or (B)
(D) Neeta cannot win

7. Using a 4 litre vessel and 6 litre vessel which of the following quantities of water cannot be measured? (Assume there is infinite supply of water)
(A) 2 litre
(B) 3 litre
(C) 8 litre
(D) More than one of the above

8. Each of A, B and C is a different digit among 1 to 9. How many different values of the sum of A, B and C are possible, if ABA × AA = ACCA?
(A) 1 (B) 3
(C) 7 (D) 8

9. In the following diagram, A is the reserve station from which a lorry can take 100 units of liquid at a time to be supplied to B, C, D, E, F and G, whose requirements per day are 78, 61, 26, 42, 34 and 59 units, respectively. Every day a lorry starts at A and supplies the requirements. In this process it moves back and forth from A to the other places and the location of all places is as shown in the diagram given below:



In a day, how many times does the lorry start from A and what is the unused capacity of the lorry per day?
(A) 4 times and 100 units.
(B) 5 times and 200 units.
(C) 3 times and zero units.
(D) 5 times and zero units.

10. The following sets of weighing stones are available to measure weights.

Number of stones in the range	Weights in the range (in grams)	Interval between two successive weights
9	1.001, 1.002, …1.009	0.001 g
49	1.01, 1.02, 1.49	0.01 g
19	0.5, 1.0, 1.5, ...9.5	0.5 g
9	10, 20, 30, ...90	10 g

What is the minimum number of stones required to weigh an item which weighs 68.892 g?
(A) 6 (B) 5
(C) 3 (D) 4

Directions for questions 11 to 13: These questions are based on the following letter multiplication in which each letter represents a unique non-zero digit.

A B C
B A C

C A D E F C

Also, it is known that E = 3B, F = A + B and 3A = 2D

11. What is the value of C?
(A) 1 (B) 3
(C) 5 (D) 2

12. What is the value of A?
(A) 2 (B) 4
(C) 5 (D) 6

13. What is the value of F?
(A) 3 (B) 6
(C) 9 (D) 7

Directions for questions 14 and 15: These questions are based on the following letter multiplication in which each letter represents a unique non-zero digit.

A B
C D

F E B D

Also, it is known that D = E + A, B = 2E and 2B = 3F.

14. What is the value of D?
(A) 4 (B) 1
(C) 8 (D) 5

15. What is the value of C?
(A) 3 (B) 7
(C) 9 (D) 6

Directions for questions 16 and 17: These questions are based on the following letter multiplication in which each letter represents a unique non-zero digit.

A B
C D

CCEB

Also, it is known that B = 2C, 5D = 6E and A = B + E.

16. What is the value of A?
(A) 7 (B) 9
(C) 5 (D) 3

17. What is the value of C?
(A) 4 (B) 2
(C) 1 (D) 6

Directions for questions 18 to 21: These questions are based on the following information.

A computer helps in finding out a 4-digit code number in the following way.

If we select a number, the computer gives the number of digits present in the selected number. These numbers are also present at the same positions in the code number as shown in the column 'R' in the table given below. The computer also gives the number of digits present in the selected number. These numbers are not present in the code number, which is shown in the column W in the table.

To construct a code number only digits from 1 to 6 are used.

The following 3 numbers are selected to find out the code.

S. No.	Selected number	R	W
1	3425	2	2
2	3625	1	2
3	3426	2	1

18. If 6 is the first digit from the left in the code number then which of the following is the second digit from right?
(A) 1 (B) 2
(C) 3 (D) 4

19. If 6 is the second digit from the right, then which of the following is the first from the left in the code number?
(A) 1 (B) 2
(C) 3 (D) 4

20. Which of the following digits is not in the code number?
(A) 2 (B) 3
(C) 5 (D) 4

21. Which of the following cannot be the code number?
I. 6421 II. 3461
III. 3416
(A) Only I (B) Only III
(C) Only II (D) Both I and III

Directions for questions 22 to 25: These questions are based on the following information.

A group of five people, namely Govind, Mathew, Naveen, Jagdish and Preet travelled for a different time duration among 1 hour, 2 hour, 3 hour, 4 hour and 5 hour and at a different speed among 15 kmph, 20 kmph, 30 kmph 40 kmph and 60 kmph, not necessarily in the same order. The total distance travelled by each of them is also different. The following is the information known about them.

(i) Naveen travelled the maximum distance but he neither travelled at the maximum speed nor for the maximum duration.
(ii) Govind travelled more distance than Preet but less distance than Mathew.
(iii) Jagdeesh travelled a distance of 120 km.
(iv) None of them travelled a distance of 60 km and one of them travelled a distance of 30 km.

22. Who travelled at a speed of 15 kmph?
(A) Jagdish (B) Mathew
(C) Govind (D) Cannot be determined

23. For what time duration did Govind travel?
(A) 1 hour (B) 2 hour
(C) 3 hour (D) 5 hour

24. Who travelled for the least time duration?
(A) Jagdish (B) Govind
(C) Mathew (D) Preet

25. If everyone reached the picnic spot at the same time then who among them started earlier than anyone else?
(A) Jadish (B) Govind
(C) Mathew (D) Preet

Directions for questions 26 to 29: These questions are based on the following information.

A group of six teams from A to F participated in a football tournament. Each team played exactly one match against each of the other teams in the tournament. The tournament was planned in three weeks such that equal number of matches are played in each week and each team played at least one match but not more than two matches in a week. The following table gives week-wise performance of the teams.

Teams	Result at the end of the 1st week		Result at the end of the 2nd week		Result at the end of the 3rd week	
	Goals for	Goals against	Goals for	Goals against	Goals for	Goals against
A	6	3	9	5	14	8
B	1	3	1	9	7	13
C	4	6	10	8	11	8
D	1	3	6	7	8	11
E	5	4	7	7	10	12
F	6	4	10	7	12	10

(i) No match ended in a draw.
(ii) No team scored more than 3 goals in a match.
(iii) No match was played between A and E in the second week.

26. Who won the maximum number of matches?
(A) C (B) F
(C) A (D) B

27. Against whom did B play in the third week?
(A) Both A and F (B) Both D and F
(C) Only D (D) Both D and E

28. In the first week, D play (s) the match against
(A) A only (B) E only
(C) Both A and E (D) Both A and C

29. In how many matches was there a goal difference of more than 1?
(A) 3 (B) 4
(C) 5 (D) 6

Directions for questions 30 to 33: These questions are based on the following information.

Narayan, Michael and Rusell participated in a car race. All three of them could drive the car for distinct time periods (because their fuel tanks got empty) and at different speeds (in km/hr). The person who drove the car for the maximum time period had driven at a minimum speed compared to the other two but covered the maximum distance. The person who drove at the maximum speed covered the minimum distance of 360 km, but he was not Michael, who drove at 150 km/hr. Russell drove the car for a time period, which was the same as the sum total of the time periods taken by the other two contestants. The total distance covered by all the three contestants is 1620 km. The speeds and the time taken by the contestants in their respective units (km/hr and hr) are integral numbers.

30. What is the distance covered by Russell?
(A) 360 km (B) 600 km
(C) 810 km (D) 660 km

31. What is the time taken by Michael?
(A) 2 hours (B) 3 hours
(C) 4 hours (D) 5 hours

32. Which of the following statements may be true?
(A) Russell drove at a speed of 110 km/hr.
(B) Narayan drove the car for 2 hours.
(C) Russell drove at a speed of 132 km/hr.
(D) More than one of the above

33. If no contestant drove the car at a speed beyond 200 km/hr, then what was the speed of Narayan?
(A) 110 km/hr (B) 132 km/hr
(C) 180 km/hr (D) 150 km/hr

Directions for questions 34 to 37: These questions are based on the following information.

In a tournament, each of the six teams played every other team. In a match between two teams, the winner got two points, the loser got zero points and if it was a draw, then each team got one point. Scores of A, B, C, D, E and F were 9, 8, 7, 3, 2 and 1 point, respectively. There were exactly two draws.

34. D had a tie with which of the following teams?
(A) A (B) C
(C) F (D) Cannot be determined

35. A had a tie with which of the following teams?
(A) D (B) C
(C) F (D) B

36. Which of the following lost the maximum number of matches?
(A) D (B) E
(C) F (D) Both E and F

37. Out of the following teams, A did not win against
(A) B (B) C
(C) D (D) F

Directions for questions 38 to 40: These questions are based on the following information.

Ravi, a retail dealer of Air-Tel prepaid cards, asked his brother Gopi to buy cards of denominations `200, `700, `1000, `1500 and `2000. He asked Gopi to buy five cards each of exactly three of the above denominations and six cards each of the remaining denominations. However, Gopi forgot which denominations he was supposed to buy five and which he had to buy six of each. However, the wholesale dealer could figure out how many cards of each denomination were required as Ravi had sent an amount of `30,000, which was the exact amount required to buy the cards of Ravi's choice.

38. What is the ratio of the total number of cards of denominations `200 and `2000 to those of all other cards purchased by Gopi?

(A) 10 : 17 (B) 16 : 11
(C) 17 : 11 (D) 11 : 16

39. What is the total value of all those cards of which five each were bought?

(A) 14,400 (B) 12,000
(C) 18,000 (D) 16,000

40. If Gopi had told the shopkeeper that he required 6 cards each of the 3 denominations that his brother asked him to get 5 each and 5 cards each of the other denominations that his brother asked him to get 6 each, then what is the amount that Gopi would have left with him or fall short of from the total amount of `30,000 his brother had given him?

(A) He was left with `600.
(B) He fall short of `400.
(C) He fall short of `600.
(D) He was left with `400.

ExErcisE-2

Directions for questions 1 to 3: These questions are based on the following information.

There are 8 containers and each container has K number of balls. Each of the balls in seven containers weighs 2 kg, whereas each of the balls in the remaining container weighs 1 kg. A spring balance is used to weigh these balls and n is the number of minimum weighing required to find the container that contains 1 kg balls.

1. If $K = 12$, then $n = ?$

(A) 1 (B) 2
(C) 3 (D) 4

2. If $K = 4$, then $n = ?$

(A) 1 (B) 2
(C) 3 (D) 4

3. If $K = 3$, then $n = ?$

(A) 1 (B) 2
(C) 3 (D) 4

Directions for questions 4 to 6: These questions are based on the following information.

Mr Helpinghand has `$x$ with him in the denomination of `1 only. Each time a beggar approaches him, he divides the money with him into four equal parts and a remainder (if any). He gives one part and the remainder (if any) to the beggar. This continues till he is left with less than `4, which he gives to the last beggar.

4. If Mr Helpinghand has `45 with him, then to how many beggars can he give money?

(A) 9 (B) 7
(C) 8 (D) 6

5. If Mr Helpinghand wants to give money to five beggars, then what is the minimum possible initial amount he has to carry with him?

(A) `12 (B) `24
(C) `18 (D) `16

6. If Mr Helpinghand wants to serve six people, then what is the maximum possible amount he might be carrying?

(A) `31 (B) `27
(C) `28 (D) `30

Directions for questions 7 to 10: These questions are based on the following information.

A group of five people, namely Sarvajeet, Manjeet, Paramjeet, Karamjeet and Biswajeet invested a different amount, such as `2000, `3000, `4000, `5000 and `6000 at a different simple rate of interest among 4, 5, 6, 7.5 and 8 per cent per year for 5 years. The following is the information known about them.

(i) The interest earned by each one of them was different.
(ii) The interest earned by Sarvajeet was more than that earned by Karamjeet, which was more than that earned by each of Paramjeet and Biswajeet. Manjeet earned the least interest among the five.
(iii) The interest earned by Biswajeet was `600.
(iv) The person who invested the maximum amount did not earn the highest interest.

7. What is the investment made by Paramjeet?
(A) `4000 (B) `5000
(C) `3000 (D) Cannot be determined

8. What is the interest earned by Sarvajeet?
(A) `1800
(B) `1875
(C) `2000
(D) Cannot be determined

9. Who invested at 6% per annum rate of interest?
(A) Paramjeet (B) Karamjeet
(C) Biswajeet (D) Sarvajeet

10. What is the difference between the interest earned by Biswajeet and Karamjeet?
(A) `1000 (B) `1500
(C) `1275 (D) `1200

Directions for questions 11 to 15: These questions are based on the following information.

In a game show called 'Graded Answer' there were five contestants, namely Kamal, Ranjit, Ajay, Varun and Sashank.

In each round a question was given to all the contestants. For each question the computer has ten predetermined answers. In each round, every contestant gave one answer from these predetermined answers and no contestant is aware of the answers given by the other contestants. Each set of answers were given district grades by the computer. In each round, the computer awards points to the contestants based on the grade of the answer given by them. The contestant whose answer has the lowest grade among the five answers, gets one point and the points for other contestants are increased if the grade goes on increasing. In the first round the five contestants gave five different answers. The table given below shows some of the cumulative scores of the contestants at the end of different rounds.

No.	Kamal	Ranjit	Ajay	Varun	Sashank
1	5	2			4
2	6		3		
3					5
4	7	7	7		7
5		9			11
6			9		
7	13	14		15	

In any round if a group of contestants (i.e., two or more) give the same answer, then the cumulative scores at the end of that round of each contestant in the group is reduced to the least of the cumulative scores of the contestants of this group at the end of the previous round the rest of the contestants get points starting from 1 depending on the grades as explained in earlier.

We know the following additional information about the proceedings of the game.

(i) The cumulative scores of at least two contestants are equal at the end of the second round onwards until at the end of the sixth round (both the rounds included).
(ii) If two or more people give the same answer in a round, in the next round the answers given by the contestants are district.
(iii) The game ended in the seventh round, at the end of which the cumulative scores are district.
(iv) Each contestant's answer matches with that of another contestant in at least one round in the game.
(v) The averages of cumulative scores for the five contestants at the end of each of the round 1 and 2 are the same.
(vi) In the sixth question, only Kamal and Varun gave the same answers.
(vii) Total of cumulative scores of the contestants at the end of the fifth round was 51 and that at the end of the seventh round was 71.
(viii) In the fourth round, Varun gave the least graded answer.
(ix) The person with the highest cumulative score at the end of the game was the winner.

11. Who was the winner?
(A) Ajay (B) Varun
(C) Sashank (D) Either (A) or (B)

12. Who gave the same answer in the second round?
(A) Varun and Sashank
(B) Ajay and Sashank
(C) Ranjit and Sashank
(D) Ranjit, Varun and Sashank

13. What was the score of Ranjit at the end of the third round?
(A) 3 (B) 5
(C) 4 (D) Either (3) or (5)

14. What was the score of Kamal and Varun at the end of the sixth round?
(A) 10, 10 (B) 11, 11
(C) 12, 12 (D) Either (A) or (C)

15. Who gave the highest graded answer in the fifth round?
(A) Kamal (B) Sasankh
(C) Varun (D) Ajay

Directions for questions 16 to 19: These questions are based on the following information:

In sports gambling's, fractional odds are often used. If a bookmaker is offering an odd of 10/1 on a particular team, it means that for every `1 that a gambler puts at stake, he earns `10, in addition to the original stake being returned to him. If the team loses, the gambler, of course, does not win anything and loses his stake on a particular day, when three football matches are taking place. Match I is between teams A and B, Match II is between teams C and D, Match III is between teams E and F. A bookmaker has offered the following odds on different teams:

Match	Odds	Odds
I	A – 1/4	B – 10/1
II	C – 2/5	D – 7/2
III	E – 20/1	F – 1/5

An 'upset' happens when a team beats an opposing team, which had better chance of winning. The bookmaker offers worse odds on teams that are expected to win.

For example: A team with odds 2/7 has a better chance of winning than a team with 7/2 odds.

16. Amit put `100 at stake in each of the three matches (one team per match). What is the maximum possible amount that he can receive, if there is only one match that results in an upset?

(A) 2365 (B) 2745
(C) 2435 (D) 2565

17. If there was no upset in any of the three matches and Bhaskar bet `20, `40 and `60 in each match (in any order) and he ended up earning the maximum possible amount, then what is his total earnings?

(A) 158 (B) 162
(C) 170 (D) 188

18. If Ravi bet equal amounts on all the six teams, then which results are most favourable to him if there are 2 upsets? Pick the option with the winning teams.

(A) B, C, E (B) A, D, E
(C) B, D, E (D) B, C, F

19. Suresh has a strong feeling that team F will win and he bought stake `50 on it. He bought a stake `50 in one of the teams playing Match II. What is the difference between the maximum and minimum earnings?

(A) 285 (B) 250
(C) 265 (D) 295

Directions for questions 20 to 23: These questions are based on the following information.

In a college, each of the 900 students participated in at least one of the six events, 50 m dash, 100 m dash, 150 m dash, 200 m dash, 250 m dash and 300 m dash. No student who participated in the 50 m dash participated in the 200 m dash or in the 250 m dash. No student who participated in the 300 m dash participated in the 100 m or 150 m dash. The same number of students participated in only 50 m dash, only 100 m dash, only 150 m dash, only 200 m dash, only 250 m dash and only 300 dash. The same number of students participated in each combination of exactly two events. An equal number of students participated in each combination of exactly three events. 20 students participated in exactly four events. The number of students who participated in only 100 m dash, in only 100 m and 50 m dash and in only 100 m, 50 m and 150 m dash are in 1 : 2 : 3 ratio.

20. How many students participated in the 50 m dash?

(A) 80 (B) 160
(C) 100 (D) 120

21. How many students participated in both the 100 m dash and the 150 m dash?

(A) 240 (B) 180
(C) 200 (D) 320

22. How many students did not participate in the 300 m dash?

(A) 160 (B) 640
(C) 580 (D) 740

23. How many students participated in at most two events?

(A) 680 (B) 520
(C) 600 (D) 440

Directions for questions 24 to 27: These questions are based on the following information.

P, Q and R played a game and each scored some points. The number of points is an integer. When I asked four individuals A, B, C and D about the scores of P, Q, and R, they made the following statements.

A: Exactly two of P, Q and R together scored 10 points.
B: Exactly two of P, Q and R together scored 11 points.
C: Exactly two of P, Q and R together scored 12 points.
D: Exactly two of P, Q and R together scored 13 points.

I understood that at least one of A, B, C and D was lying and later I found out the names of the people who could have lied.

24. Who was not lying?

I. A II. B
III. C IV. D

(A) Only I and III
(B) Only II and IV
(C) Only I and IV
(D) Only II and III

25. If the average score of P, Q and R is an integer, then who lied?

(A) A (B) B
(C) C (D) D

26. Which of the following is the highest score?

(A) 6 (B) 7
(C) 8 (D) 9

27. Which of the following is the least score?

(A) 3 (B) 4
(C) 5 (D) Cannot be determined

Directions for questions 28 to 31: These questions are based on the following information.

A group of four wealthy people, namely Ozwald Henry, Princess Stephanie, Gennady Yuganov and Henry Ford III each bought one of four different classic watches, such as a Louis Ulysse Chopard, a Breguet Dupuis, a Piaget Sunmaster and a Rolex Mercator at the annual Sotheby's auction. The following information is available about the person, the watch purchased and their prices.

(i) The total amount paid for these four watches was $8,40,000 and the costliest watch was priced $1,20,000 more than the cheapest.
(ii) Ozwald did not purchase the costliest watch and neither did he purchase a Piaget.
(iii) Gennady did not buy the costliest or the cheapest watch but had paid $1,80,000 for his watch.
(iv) The Rolex Mercator is the costliest and the Chopard is the cheapest among the watches.
(v) Princess Stephanie purchased the Breguet Dupuis and had paid $40,000 more than what Gennady Yuganov had paid.

28. Which watch did Ozwald Henry purchase and at what price?

(A) Louis Ulysse Chopard at $2,20,000.
(B) Rolex Mercator at $1,80,000.
(C) Louis Ulysse Chopard at $1,60,000.
(D) Rolex Mercator at $1,60,000.

29. What is the difference in the cost of the watches purchased by Henry Ford III and Gennady Yuganov?

(A) $80,000 (B) $1,00,000
(C) $1,20,000 (D) $1,10,000

30. Which of the following statements is true?

(A) Princess Stephanie bought the cheapest watch.
(B) Ozwald Henry did not purchase the Louis Ulysse Chopard.
(C) Henry Ford III bought a watch that was priced $60,000 more than the Piaget Sunmaster.
(D) The watches bought by Ozwald Henry and Henry Ford III cost more than the watches bought by Gennady Yuganov and Princess Stephanie.

31. Which of the following watches was purchased by Gennady Yuganov?

(A) The watch that was priced $40,000 less than the one bought by Henry Ford III.
(B) The watch that was the cheapest of all.
(C) The watch that was called Piaget Sunmaster.
(D) The watch that was called Breguet Dupuis.

Directions for questions 32 to 35: These questions are based on the following information:

These questions are based on the following information.

Six friends are comparing their expenses on a recent trip to Goa. Each of them spent a different amount. The following information is known about their expenses.

(i) Piyush spent ` 3783.
(ii) Saket spent ` 4640, which is ` 600 more than how much Uday spent.
(iii) The difference between the expenses of Uday and Tomar is ` 535.
(iv) The maximum difference between the expenses of any two of the six is ` 1135, whereas the minimum difference between the expenses of any two people is ` 167.
(v) The difference between the expenses of Qureishi and Raina is ` 246.
(vii) Raina spent ` 4227.

32. How much did Qureishi spend?

(A) ` 4473 (B) ` 4493
(C) ` 3981 (D) ` 4040

33. Whose expense was the highest?

(A) Qureishi (B) Saket
(C) Raina (D) Tomar

34. What is the difference between the expenses of Raina and Uday?

(A) ` 167 (B) ` 246
(C) ` 187 (D) ` 257

35. Which of them spent the third least amount?

(A) Tomar (B) Uday
(C) Raina (D) Qureishi

Directions for questions 36 to 40: These questions are based on the following information.

A company named XYZ Ltd. manufactures a product 'Q' and sends it to five of its outlets A, B, C, D and E. The cost of production is `10,000 per unit. To transport one unit of Q to A, B, C, D and E, XYZ Ltd. spends `1000, `2000 `3000, `4000 and `5000, not necessarily in that order. The selling price of Q is `20,000 at three of the outlets, `21,000 at one of the outlets and `22,000 at another. Two of the outlets sell 40 units each per month and the remaining outlets sell 30 units, 45 units and 50 units per month. Sum of the cost of production and cost of transportation is subtracted from the selling price to arrive at profit per unit. The product of profit per unit and sales in units per month is profit per month. The following additional information is available.

I. One of the outlets earns `5,000 as profit per unit and it gets the least profit per month.
II. Exactly two outlets earn the same amount of profit per unit.
III. None of the outlets earn `11,000 profit per unit.
IV. Profit of outlet E per month is `3,20,000.
V. Profit per unit at outlet D is more than that at outlet E but its profit per month is less than that at outlet E.
VI. Profit of outlet B per month is `10,000, which is more than that of another outlet.
VII. Profit of outlet A per month is more than that of outlet C.
VIII. There is exactly one outlet which earns more profit per month than that of outlet E.
IX. Selling prices at outlets A, D and E are distinct.

36. What is the profit per month earned by the outlet B?

(A) `2,70,000 (B) `4,50,000
(C) `4,05,000 (D) `2,80,000

37. What is the selling price of the outlet E?

(A) `20,000 (B) `21,000
(C) `22,000 (D) Cannot be determined

38. If the selling price at outlet A is more than that at outlet D, then what is the transportation cost per unit at outlet A?

(A) `1000 (B) `2000
(C) `3000 (D) `4000

39. If the number of units sold by the outlet A is more than those sold by the outlet C, then what is the profit per month of C?

(A) `2,50,000 (B) `2,70,000
(C) `2,25,000 (D) `2,80,000

40. What is the profit per unit at the outlet E?

(A) 8000 (B) 9000
(C) 10,000 (D) None of these

Exercise-3

Directions for questions 1 to 4: These questions are based on the following information:

A chemical crusher unit has five different mills, such as P, Q, R, S and T of different capacities. The crusher unit operates 24 hours per day in three shifts 01st – 08th hour, 09th – 16th hour and 17th – 24th hours.

The time during which the mill is running is called uptime. For any mill each uptime is of exactly one-hour duration. In a period of 24 hours each mill has at least four hours of total uptime. The time period between two successive uptimes is called downtime. It is measured in hours and is always a whole number.

The downtime of a mill is directly proportional to its capacity and a constant. No two mills have the same downtime duration between successive uptimes.

During his visit in the third shift on a particular day, the new maintenance engineer observed that the mills P, Q , R , S and T were in uptime in the first five hours of the third shift, in that order. He was given a slip of paper indicating the history of functioning of the mills, observed during their uptime.

Mill	Day	Time
P	Yesterday	5th hour of the third shift
Q	Two days ago	6th hour of the third shift
R	Two days ago	3rd hour of the third shift
S	Yesterday	2nd hour of the day
T	Yesterday	Last hour of the day

The engineer kept thinking if he could determine the uptimes and downtimes of each of the mill.

1. Which mill has the highest capacity?
(A) P (B) S
(C) R (D) Cannot be determined

2. If different ranks from 1 to 5 were given to the mills in the descending order of their downtimes, then which mill will be ranked the second?
(A) P (B) T
(C) R (D) Cannot be determined

3. If mill R has lesser downtime than P, but not the lowest amongst all, then what is the downtime of mill R?
(A) 4 hours (B) 6 hours
(C) 3 hours (D) 8 hours

4. If mill R has greater downtime than mill S, which of the following is true for the mills P, Q, R, S and T to be in their uptime in the first five hours of a day respectively?
(A) This is possible at least once in a week.
(B) This is possible at most once in a week.
(C) Cannot be determined.
(D) Such a case is not possible.

Directions for questions 5 to 8: These questions are based on the following information.

A tour operator plans a one tour package each in four different circuits. Each tour starts at 7 a.m. from the office in a bus on the first day of the tour package and ends by dropping the tourists back at the office at 7 p.m. on the last day of the tour package. The four tour packages are (i) Circuit A – Seven days duration which starts every Wednesday and Thursday (ii) Circuit B – Three days duration which starts every Thursday and Friday (iii) Circuit C – Four days duration which starts every Wednesday and Saturday and (iv) Circuit D – A daily tour of 12 hour duration.

5. If a person has started his tour with Circuit A, then what is the minimum number of days required for him to completely tour all the circuits?
(A) 18 days (B) 17 days
(C) 16 days (D) 15 days

6. To completely tour all the four circuits in the shortest possible time, with which tour does a person shall start his touring?
(A) Circuit C on Saturday.
(B) Circuit B on Friday.
(C) Circuit C on Wednesday.
(D) Circuit B on Thursday.

7. On which day of the week, will there be the least activity at the tour operator's office?
(A) Sunday (B) Friday
(C) Monday (D) Saturday

8. If a person wants to complete all the circuits in the shortest possible time but with one day rest between any two tour packages, what is the best day for a person to start touring?
(A) Friday (B) Monday
(C) Sunday (D) Wednesday

Directions for questions 9 to 12: These questions are based on the following information.

A kid is promised by his father that starting the following Monday, a pocket money of five rupees per day will be given every day in the morning. The kid has school for five days in a week from Monday to Friday and wants to spend that amount for purchasing snacks during break in the school. He equally likes the chocolate (`5), Samosa (`10) and the pastry (`15). He purchases not more than one item on any day. He makes a purchase if he has sufficient amount to purchase an item and he will not purchase the same item in the next two purchases.

(Assume that the kid did not have any other money and there are no holidays other than Saturdays and Sundays)

9. Which of the following is true with regard to the pattern in which the kid makes his purchases?
I. More data is required to identify a pattern.
II. The pattern of the purchases is repetitive.
III. If the first purchase of the kid is known, then the pattern will be repetitive.
(A) Only I and III (B) Only II
(C) Only I (D) Either I or III

10. What is the maximum possible amount available with the kid on any Monday?
(A) `15 (B) `20
(C) `25 (D) Cannot be determined

Additional information for questions 11 and 12: During the second week, the kid tasted a complimentary fruit worth `5, he decided to add to the fruit his purchase list from the following Monday, along with the other three such that the price of every next purchase increases and decreases alternately.

11. Which of the following is definitely true?
(A) The kid does not purchase on a Wednesday.
(B) The kid does purchase on a Thursday.
(C) The kid does not purchase on a Friday.
(D) The kid does purchase on a Tuesday.

12. What is the maximum possible amount available with the kid on any Monday (after he decided to eat the fruit)?
(A) `15 (B) `20
(C) `25 (D) Cannot be determined

Directions for questions 13 to 16: These questions are based on the following information.

Annie, Ben, Cain, Dan and Engel are five friends who purchased a book where each of them related to one of

the following fields, such as Architecture, Biotechnology, Criminology, Demography and Economics. Further, the following information is known.

(a) No friends first letter of the name matches with the field to which the book purchased is related.
(b) Annie and Dan love to read books related to Criminology apart from the books they purchased.
(c) Engel hates Criminology and Biotechnology and hence, did not purchase them.
(d) The first letter of the field to which the book that Ben purchased pertains to, matches with the first letter of the name of the friend who purchased a book pertaining to Biotechnology.

13. After a month of reading, Annie exchanges her book with Dan and then Dan exchanges this book with Engel. The exchanges resulted in the first letter of the friends matching with the field to which the book belonged without violating conditions (b) to (d). Which of the following is true?

(A) Engel bought the book which is related to Demographics.
(B) Annie bought the book which is related to Demographics.
(C) Dan bought the book which is related to Economics.
(D) Engel bought the book which is related to Architecture.

14. Which of the following is not necessarily true?

(A) Either Annie or Ben bought a book which is related to Criminology.
(B) Dan bought the book which is related to either Architecture or Economics.
(C) Either Dan or Engel bought the book which is related to Architecture.
(D) Either Engel or Cain bought the book which is related to Demographics.

15. While delivering the books, the sales man interchanged the books of two friends in such a manner that the field to which the book belonged and the starting letter of only one of the friends matched. However, conditions (b) to (d) were not violated.

Which of the following conditions lets you to completely determine the fields of the books possessed by the five friends?

(A) Annie's and Engel's books were interchanged.
(B) Neither Annie nor Engel possess the book related to Economics after the sales man interchanged their books.
(C) Neither Dan nor Engel had books related to Biotechnology after the interchange.
(D) Interchange happened between the books of Annie and Dan.

16. While delivering the books, the sales man interchanged the books of two friends in such a manner that the field to which the book belonged and the starting letter of only one of the friends matched. However, conditions (b) to (d) were not violated. Then which pair of statements among (a), (b), (c) and (d) cannot be true simultaneously?

(a) Dan did not possess books related to Economics after the interchange.
(b) Engel did not possess books related to Architecture after the interchange.
(c) Neither Dan nor Annie possess the books related to Economics after the interchange.
(d) Interchange took place between Annie and Dan.

(A) (a) and (b)
(B) (b) and (d)
(C) (c) and (d)
(D) (a) and (c)

Directions for questions 17 to 20: These questions are based on the following information.

A test consists of two parts. Part I consists of five questions and for any question the student will score two marks for a correct answer and zero for a wrong answer. Part II consists of four questions, in which for any question, the student will score ten marks for a correct answer, five marks for a partially correct answer and zero for a wrong answer.

17. Which of the following scores is not possible for the test?

(A) 29 (B) 31
(C) 47 (D) 41

18. If Virat scored 33 marks then which of the following is not necessarily true?

(A) Virat got at least one question wrong in Part I.
(B) Virat answered less than six questions in all.
(C) Virat did not answer any question of Part II wrong.
(D) Virat gave wrong answer to at least one question of Part II.

19. Each of Rahul, Beena, Johan and Bijaya attempted seven questions and did not get zero in any question. No two of them scored the same marks. What is the maximum possible difference of the total marks scored by Rahul and Beena, and that of the marks scored by Bijaya and Johan?

(A) 51 (B) 43
(C) 52 (D) 44

20. If both U and V attempted six questions each, the marks scored by each of them are unique and the marks received for any question is other than zero, what is the minimum possible difference between their respective scores?

(A) 1 (B) 2
(C) 3 (D) 4

Directions for questions 21 to 25: These questions are based on the following information.

A library assistant has marked four racks for shelving the books each from different specializations, such as Marketing, Operations, Systems and Human Resource. Totally, there are 24 books. The librarian arranged the textbooks in such a way that each rack contained even number of textbooks and they are unique and are non-empty. The students often misplace the textbooks among any of the racks. The following information about the books in various racks on a particular day are as follows.

(i) Half the textbooks are placed incorrectly. But each rack has the same number of textbooks as there was originally.

(ii) The number of textbooks in Marketing rack is equal to the sum of the number of textbooks in the other three racks.

(iii) One third of the textbooks in the Marketing rack originally belong to the Operations rack.

(iv) All but two textbooks that are there in the Human Resource rack originally belonged to a different rack.

(v) The number of textbooks in the Operations rack is twice that of the number of textbooks in the Systems rack.

(vi) The textbooks from a rack are misplaced into at most one rack.

21. How many textbooks belonging to Operations rack are placed in Human Resource rack?

22. How many textbooks belonging to Systems rack is placed correctly?

23. How many textbooks belonging to Human Resource rack are in the Operations rack?

24. Which rack has all the books correctly placed?

(A) Marketing (B) Operations
(C) Systems (D) None of these

25. How many text books related to Operations are in the systems rack?

ANSWER KEYS

Exercise-1

1. (B)	8. (C)	15. (B)	22. (C)	29. (C)	36. (D)
2. (B)	9. (C)	16. (A)	23. (C)	30. (D)	37. (B)
3. (C)	10. (D)	17. (C)	24. (D)	31. (C)	38. (D)
4. (D)	11. (A)	18. (B)	25. (C)	32. (D)	39. (B)
5. (D)	12. (B)	19. (C)	26. (C)	33. (C)	40. (A)
6. (B)	13. (D)	20. (C)	27. (D)	34. (C)	
7. (B)	14. (C)	21. (B)	28. (B)	35. (B)	

Exercise-2

1. (A)	8. (D)	15. (A)	22. (D)	29. (B)	36. (D)
2. (B)	9. (B)	16. (A)	23. (B)	30. (D)	37. (C)
3. (B)	10. (D)	17. (A)	24. (B)	31. (C)	38. (B)
4. (C)	11. (C)	18. (A)	25. (A)	32. (A)	39. (C)
5. (D)	12. (D)	19. (A)	26. (B)	33. (B)	40. (A)
6. (A)	13. (C)	20. (B)	27. (D)	34. (C)	
7. (A)	14. (B)	21. (A)	28. (C)	35. (B)	

Exercise-3

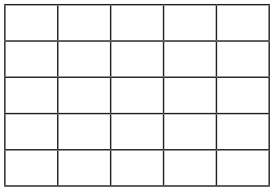
1. (D)	6. (A)	11. (D)	16. (C)	21. 0
2. (A)	7. (C)	12. (A)	17. (C)	22. 2
3. (C)	8. (D)	13. (A)	18. (B)	23. 4
4. (D)	9. (B)	14. (D)	19. (D)	24. (C)
5. (B)	10. (C)	15. (B)	20. (A)	25. 0

SOLUTIONS

EXERCISE-I

Solutions for questions 1 to 10:

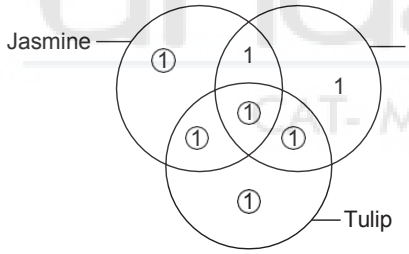
1. For the formation of maximum number of squares, six lines are to be horizontal and parallel to each other and the other six lines vertical are as shown below.



. The maximum possible number of squares
$= 1^2 + 2^2 + 3^2 + 4^2 + 5^2 = 1 + 4 + 9 + 16 + 25 = 55$

2. At first one candle is lighted from two sides and the second candle is lighted from one side.
The first candle is burnt in 30 minutes. Immediately, the second stick is burnt from the other side.
Now the remaining part of the second stick will be burnt in 15 minutes.

3. This question can be answered by using a Venn diagram as follows.



Here, the circled number are having polka dots.
. There are only two butterflies which do not have polka dots.

4. The details of the number of bottles while crossing the border is given below.

After crossing	Remaining number of bottles	Number of boxes	Number of bottles given as bribe
10th	50 = 15 × 3 +5	–	–
9th	54 = 15 × 3 +9	4	4
8th	58 = 15 × 3 +13	4	4
7th	63 = 15 × 4 + 3	5	5
6th	68 = 15 × 4 + 8	5	5
5th	73 = 15 × 4 + 13	5	5
4th	79 = 15 × 5 + 4	6	6
3rd	85 = 15 × 5 + 10	6	6
2nd	92 = 15 × 6 + 2	7	7
1st	99 = 15 × 6 + 9	7	7
Initial	107 = 15 × 7 + 3	8	8

. He should start with a minimum of 107 bottles of champagne.

5. There are two possible sets of values for their ages.
The product can be 5 × 3 × 1 or 15 × 1 × 1.
. The age cannot be uniquely determined.

6. Neeta should draw in such a way that always $n(2 + 3) + 1$ coins remain, so that if Leena draws 3 coins Neeta should draw 2 coins and vice versa.
So, there should be 30 + 1 coins remaining.
. She should draw 3 coins.
So, at the end there will be 6 coins from which Leena has to draw.
So, in any case Neeta will win if she draws 3 coins initially.

7. The process is tabulated below:

	4 litres	6 litres
Initial	0	0
1	0	6
2	4	2
3	4	0
4	0	4
5	4	4

Hence, 3 litres cannot be measured.

8. From the given expression, A must be 1, the expression must be:

1 B 1
× 1 1
1 C C 1

Here, B can be any value from 2 to 8.
. There will be a total of 7 different values.

9. The total requirement is 78 + 61 + 26 + 42 + 34 + 59 = 300 units.
⇒ The lorry starts 3 times and the unused capacity is zero units.

(*Continued*)

10. 68.892 g can be measured by using the following stones
1.002 + 1.39 + 6.5 + 60 = 4 stones

Solutions for questions 11 to 13: The possible value for C is 1/5 (1 or 5).
As E = 3B, B = 1/2/3
As 3A = 2D, A = 2/4/6 and D = 3/6/9.
If A = 2, then D = 3, B = 1, C = 5, F = 3
Hence, A = 2 is not possible as values of D and F will be same. If A = 4, then D = 6 and B cannot be 1 or 2. Therefore, B must be 3. Then F = 7 and E = 9.
if C = 5, E = 9

```
  435
× 345
-------
150075
-------
```

Hence, C cannot be 5.

If C = 1

```
  431
× 341
-----------
146971
-----------
```

Therefore, A = 4, B = 3, C = 1, D = 6, E = 9 and F = 7.

11. The value of C is 1.

12. The value of A is 4.

13. The value of F is 7.

Solutions for questions 14 and 15: The possible values for B = 3/6/9 and F = 2/4/6
As B = 2E, B must be 6.
If B = 6, then E = 3, F = 4, D = 8, and A = 5.
⇒ 4368 ÷ 56 = 78 ⇒ C = 7
. The values of A = 5, B = 6, C = 7, D = 8, E = 3 and F = 4.

14. The value of D is 8.

15. The value of C is 7.

Solutions for questions 16 and 17: As 5D = 6E, D must be 6 and E must be 5.
If D = 6, B must be either 2 or 4.
Case (i): B = 2.
A = 7, C = 1 ⇒ 72 × 16 = 1152.
Hence, B = 2 is possible.
Case (ii): B = 4.
A = 9, C = 2 ⇒ 94 × 26 = 2444.
Hence, B = 4 is not possible.
. A = 7, B = 2, C = 1 D = 6 and E = 5.

16. The value of A is 7.

17. The value of C is 1.

Solutions for questions 18 to 21: Assume that 2 and 5 are in the correct position for the 1st selection. Then it must indicate 2 in column R in the 2nd selection.
⇒ Both 2 and 5 are not at the correct position.
Assume that 5 is at the correct position.
⇒ 3 and 2 are wrong.
⇒ 4 is the 2nd digit in the code.
⇒ There cannot be '2' in column 'R' in the 3rd selection.
⇒ 5 is not present in the code.
Assume '2' is in the correct position.
⇒ 4 is also in the correct position.
⇒ 6 is present in the code but is not the 4th digit.
⇒ The number is '6421'.
Assume '2' is not present in the code.
⇒ 3 and 4 are in the correct position.
⇒ 1and 6 are present in the code and 6 is not the 4th digit in the code.
⇒ The number is '3461'.

18. 2 is the second digit from right.

19. 3 is the first digit.

20. 5 is not present in the code number.

21. '3416' cannot be the code number.

Solutions for questions 22 to 25: Let us represent the people with the first letter of their name.
From (i) and (ii), we get the comparison of the distance travelled by them N > M > G > P.
From (i), it is given that the speed and the number of hour travelled by Naveen is not the maximum.
. Speed cannot be 60 kmph and the number of hours travelled is not 5.
Hence, the distance travelled by N has to be less than 200 km.
As Jagdish travelled 120 km, Naveen travelled more than 120 km.
That can only be 160 km.
. Naveen's Speed = 40 kmph and time = 4 hours.
Distance = 160 km
. Jagdish cannot travel for 4 hours.
To get 120 km distance, there is only one possibility.
Jagdish has travelled at 60 kmph speed for 2 hrs.
Now, as one of them has travelled 30 km, that must be at 30 kmph speed for 1 hour.
The person who travelled at 20 kmph speed travelled for 5 hours, i.e., 100 km.
. The person who travelled at 15 kmph speed travelled for 3 hours, i.e., 45 km.
The table of the final result is as follows.

Name	Speed	Time	Distance
Naveen	40	4	160
Jagdish	60	2	120
Mathew	20	5	100
Govind	15	3	45
Preet	30	1	30

22. Govind travelled at 15 kmph speed.

23. Govind travelled for 3 hours.

24. Preet travelled for the least time.

25. Mathew travelled for maximum time.

Solutions for questions 26 to 29: There are 6 teams, so 15 matches are played in the tournament and 5 matches in each week.

As no team scored more than 3 goals in a match. From the result of the first week it is clear that, each of A, C, E and F plays two matches. There was no match between A and F. The goals in the matches for each team in the first week can be represented as follows.

	1st week	
	For	Against
A	3 + 3	2 + 1
B	1	3
C	2 + 2	3 + 3
D	1	3
E	3 + 2	1 + 3
F	3 + 3	2 + 2

From the above table, E played one match with one of A and F and the other match with one of B and D.

C must play a match with A and the other match with F.

. The result of these two matches are A – 3, C – 2, and F – 3, C – 2.

As E scores 2 goals in the other match, then that match must be between F and E.

The result of that match is F – 3, E – 2.

. B will play the match with either A or E and D will also play the match with A or E.

Similarly, for the second week after subtracting the goals of first week we will get the goals scored and conceded by a team.

The scoring pattern of the matches played by the 6 teams in the 3 weeks are tabulated below.

Teams	1st Week		2nd Week		3rd Week	
	Goals for	Goals against	Goals for	Goals against	Goals for	Goals against
A	3	1	3	2	3	2
	3	2			2	1
B	1	3	0	3	3	2
			0	3	3	2
C	2	3	3	2	1	0
	2	3	3	0		
D	1	3	3	1	0	1
			2	3	2	3
E	3	1	2	3	2	3
	2	3			1	2
F	3	2	1	3	2	3
	3	2	3	0		

F played the 2nd match with D. Since A did not play with E in the 2nd week, so A's match was with D. The remaining match in 2nd week was between C and E.

Matches played in 2nd week were BC, BF, FD, AD and CE.

In the 1st week C played one match with A and the other with F. Since A played with D in the 2nd week, so A's other match in the 1st week was with B. E played on match with F and the other one with D. Matches played in 1st week were CA, CF, AB, EF and ED.

In the 3rd week C's only match was with D. A played one match with E and the other with F. B played one match with D and other with E.

Matches played in 3rd week were CD, AE, AF, BD and BE.

The results are as follows.

BC	B – 0	C – 3
BF	B – 0	F – 3
AD	A – 3	D – 2
EC	E – 2	C – 3
DF	D – 3	F – 1

. In the first week a match cannot be between A and D. Hence, the match must be between A vs B and E vs D.

Similarly, for 3rd week, F and C play exactly one match each. In the match which C plays, it scores 1 goal and concede 0 goals.

. Now the remaining matches are played in 3rd week.

The remaining matches are (A, F), (A, E), (B, D), (B, E), (C, D). By comparing the goals scored and conceded in the round, the goals scored by each team can be obtained.

The goals scored by each team will be as follows.

AE	A – 2	E – 1
AF	A – 3	F – 2
BD	B – 3	D – 2
BE	B – 3	E – 2
CD	C – 1	D – 0

(*Continued*)

26. A won the maximum number of matches.

27. B plays against D and E in the 3rd week.

28. In the 1st week the match was between D and E.

29. There are 5 such matches.

Solutions for questions 30 to 33: It is clear that Russell drove the car for a maximum time period. Hence, his speed was minimum but the distance covered was maximum.

Person	Time	Speed	Distance
Narayan	t_n	S_n	$S_n t_n$
Michael	t_m	150	$150t_m$
Russell	$(t_n + t_m)$	S_r	$(t_n + t_m)S_r$
1620			

Let t_n, t_m be the time taken by Narayan, Michael while S_n and S_r are the respective speeds of Narayan and Russell.
$S_r < S_n$
$S_r < 150$
Since, $S_n > 150 \Rightarrow S_r < 150$ s_n
Since all the values in their respective units are integral numbers.
$\Rightarrow 150\ t_m$ -:: 360
Also, $(t_n + t_m)s_r$ -:: 360
(Since, 360 km is the minimum distance)
Hence, $s_n\ t_n = 360$
Here, $s_n > 150$

If $t_n = 1$ $s_n = 360$
$t_n = 2$ $s_n = 180$
$t_n = 3$ $s_n = 60$ (not possible)
Let $t_n = 1 \Rightarrow s_n = 360$
Exploring possibilities, we get:

S. No.	t_n	t_n	$S_n t_n$	$(150\ t_m)$	$(t_n + t_m)s_r$
1	2	1	360	300	960
2	3	1	360	450	810
3	4	1	360	600	660
4	5	1	360	750	410
5	6	1	360	900	260

Only in S. No. (3) the conditions are satisfied.
$660 = (4 + 1)s_r$
$s_r = 132$
Case I:

Person	Time (hours)	Speed (km/hr)	Distance (km)
Naryan	1	360	360
Michael	4	150	600
Russell	5	132	660

Case II:
Let $t_n = 2$, $S_n = 180$
Over here also, $t_m + t_n = (4 + 2) = 6$ hours is the only possibility.
$\Rightarrow s_r = 660/6 = 110$ km/hr
Case (II):

Person	Time	Speed	Distance
Narayan	2	180	360
Michael	4	150	600
Russell	6	110	660

30. Distance covered by Russell is 660 km.

31. Time taken by Michael is 4 hours.

32. By observing the two possible cases, all the statements may be true.

33. This belongs to case (II). Narayan drove at a speed of 180 km/hr.

Solutions for questions 34 to 37: As the scores of A, C, D and F are odd, they must have a draw each.
$\Rightarrow$ B and E did not have any draw as only two draws are there in the tournament.
Now their scores are shown below:

Name	Won	Dram	Lost	Score
A	4	1	0	9
B	4	0	1	8
C	3	1	1	7
D	1	1	3	3
E	1	0	4	2
F	0	1	4	1

If D had a tie with either A or C, F must also have a tie with A or C.
$\Rightarrow$ Both D and E won against F.
$\Rightarrow$ D and E have a tie, this is not possible.
$\Rightarrow$ D had a tie with F.
$\Rightarrow$ A had a tie with C.
$\Rightarrow$ A won against B, D, E and F.
B won against C, D, E and F.
C won against D, E and F.
D won against E.
E won against F.

34. D had a tie with F.

35. A had a tie with C.

36. Both E and F lost four matches each.

37. A had a tie with C Hence, it did not win against C.

Solutions for questions 38 to 40: The total amount given is `30,000. 5 cards each of 3 of the given denominations and 6 cards each of the other denominations is required. The denominations are `200, `700, `1000, `1500, `2000. The key lies in identifying the cards of which 5 are bought.

Take for example, the `700 denomination card. If 6 of them are bought, it amounts to `4200 and whatever combination of other cards are bought, one cannot round off the hundreds to thousands (since exactly 30,000 is spent). It implies that 5 cards of `700 are bought which amounts to `3500. To round off the hundreds to the thousands Gopi needs to buy 5 cards of `1500 denomination (`7500). 6 cards of `200 denomination will cause the same problem as discussed above. Hence, only 5 cards of `200 denomination is purchased. Therefore, 5 cards each of denominations 200, 700 and 1500 are purchased and 6 cards each of `1000 and `2000 denominations are purchased.

Denomination	Number purchased	Total amount
`200	5	`1000
`700	5	`3500
`1000	6	`6000
`1500	5	`7500
`2000	6	`12,000

38. The number of cards of denomination `200 are 11 and those of denomination `2000 are 16.
. Ratio is 11 : 16.

39. 5 cards each of `200, `700 and `1500 were bought.
. The combined value of these cards is
5 (200 + 700 + 1500) = 12000.

40.

Denomination	Number purchased	Total amount
200	6	1200
700	6	4200
1000	5	5000
1500	6	9000
2000	5	10000

Total amount = 29,400
. Gopi would have left with `600.

EXERCISE-2

Solutions for questions 1 to 3:

1. When K = 12 we have to take one ball from the first bag, two from the second and so on. If the total weight is 1 kg less then the required box is the first one. If the weight is 2 kg less, then it is the second box and so on.
. Only one weighing is required.

2. If K = 4 we have to take one ball each from the first two containers, two balls each from the third and fourth containers and so on.
Similar to the logic in the previous question we can find which group of containers consists 1 kg ball. Now by weighing one ball from one of these two containers we can find that the container having balls of 1 kg.
Thus, two weighings are required.

3. If K = 3 then we have to take one ball each from the first three containers and two balls each from the next three containers and three balls each from the last two containers.
We can find which group of containers has 1 kg ball.
Now one more weighing is required to find the exact container in which 1 kg balls are present.
. A total of two weightings are required.

Solutions for questions 4 to 6:

4. The money with Mr Helpinghand after giving to each beggar will be as follows:

	Initial	1st beggar	2nd beggar	3rd beggar	4th beggar	5th beggar	6th beggar	7th beggar	8th beggar
Amount given to the beggar	–	12	9	6	6	3	3	3	3
Amount with Mr Helpinghand	45	33	24	18	12	9	6	3	0

. Mr Helpinghand gives money to eight beggars.

5. Mr Helpinghand will always be left with money which is a multiple of 3 but the initial amount need not be a multiple of 3.

	Last beggar	Previous one	Previous one	Previous one	First beggar	Initial
Amount to the beggar	3	3	3	3	4	–
Amount with Mr Helpinghand	–	3	6	9	12	16

. The last beggar will always get `3. The total amount will be minimum, when there is a minimum possible remainder each time. The calculation is shown in the following table from the last to the first beggar.
. `16 is the minimum possible initial amount.

6. As already explained, the initial steps should be the same. Here, we will try to maximize the remainder.

	Last beggar	Previous one	Previous one	Previous one	Previous one	Previous one	Initial
To the beggar	3	3	3	6	6	10	–
With Mr Helpinghand	–	3	6	9	15	21	31

. `31 is the maximum possible amount value.

Solutions for questions 7 to 10: Let us represent the people with the first letter of their names.

As per the given information in (ii) the interest earned by them can be written in the following order.

S > K > P /B > M

From (iii), B earned `600 as interest which is possible for an investment of `2000 at 6% per annum or an investment of `3000 at 4% per annum.

B cannot be the least interest earner.

The least interest would be earned for an investment of `2000 at 5% per annum.

It has to be `3,000 at 4% per annum for B.

. B is the second lowest interest earner.

From (iv), `6000 is not invested at 7.5% per annum or at 8% per annum.

Hence, it is invested at 6% per annum.

. Interest earned would be `1800, which is not the highest interest.

The highest interest would be earned for an investment of `5000 either at 7.5% per annum or at 8% per annum and the third highest interest would be earned for the investment of `4000 either at 7.5% per annum or at 8% per annum.

. The following table shows the distribution of the investment, interest rate and interest earned.

	Investment	Rate of interest (per annum)	Interest earned
Manjeet	2000	5%	500
Biswajeet	3000	4%	600
Paramjeet	4000	7.5/8 %	1500/1600
Karamjeet	6000	6%	1800
Sarvajeet	5000	7.5/8%	1875/2000

7. Investment of Paramjeet is `4000.

8. Sarvajeet earned `1875 or `2000.

9. Karamjeet invested at 6% per annum.

10. The difference between the interest earned by Biswajeet and Karamjeet = `1200.

Solutions for questions 11 to 15: Let each contestant be denoted by the first letter of his name.

Given, in the first round all the contestants gave distinct answers.

Let the cumulative scores of K, R, A, V, S at the end of the nth round be denoted by $C(K)_n$, $C(A)_n$, $C(V)_n$ and $C(S)_n$, respectively.

Let the total of cumulative scores at the end of nth round be denoted by $C(Total)_n$.

. The sum of the cumulative scores at the end of the first round is 1 + 2 + 3 + 4 + 5 = 15.

$C(K)_1 + C(R)_1 + C(A)_1 + C(V)_1 + C(S)_1 = 15$

Given the averages of the cumulative scores at the end of the rounds 1 and 2 are the same.

. The total of the cumulative scores of the contestants at the end of the second round is 15.

We can say that at least two contestants given the same answer in the second round.

. The sum of the cumulative scores of R, V, S at the end of the second round is 15 – (9 + 3) = 6.

$\Rightarrow C(R)_2 + C(V)_2 + C(S)_2 = 6$

As K's cumulative score is increased by 1 from round 1 to round 2, K have given the least graded answer.

. If S is not one of the contestants who gave the same answer, then his cumulative score at the end of the second round must be at least 6, if so the sum of the cumulative scores of R and V must be 0, which is not actually possible.

. S must have given the same answer as other in the second round.

If A given the same answer as S, then $C(S)_2 = 3$.

But $C(R)_2 + C(V)_2$ cannot be 3

. $C(Total)_2 > 15$, which is not possible.

Here, A given a district answer in the second round.

. C(A) is increased by at least two.

As $C(A)_2 = 3$, $C(A)_1$ must be equal to 1.

- $C(V)_1 = 3$

Hence, V must have given the same answer as S in the second round.

If R given a distinct answer, then

$C(V)_2 + C(S)_2 = 3 + 3$, which results in $C(Total)_2 > 15$.

. R given the same answer as V and S in the second round.

$C(R)_2 = C(V)_2 = C(S)_2 = 2$

From (ii), we can say that C(Total) is increased by 15 at the end of the third round comparing to that at the end of the second round.

. C(Total)3 = 15 + 15 = 30

From (vii) and (vi), we can say that,

C(Total)6 = C(Total)7 – 15

= 71 – 15 = 56

From (iv) and the above data, we can say that A has given the same answer as at least one of the other in the fourth round.

. C(Total)4 = C(Total)5 – 15

= 51 – 15 = 36

. $C(V)_4 = 36 – 28 = 8$

Also, in rounds 1, 3, 5 and 7 all contestants given district answers.

. $C(K)_3$ is at least 7.

$\Rightarrow$ K have given the same answer as A in the fourth round.

. Each of $C(K)_3$ and $C(A)_3$ must be at least 7.

From (viii), we can say that V have got 1 point in the fourth round.

$C(V)_3 = C(V)_{4-1} = 8 – 1 = 7$

. V got five points in the third round.

A can get at most five points in the third round.

As $C(A)_2 = 3$, $C(A)_3$ 2: 7, $C(A)_3 = 7$

. A got four points in the third round.

As $C(R)_3 < 7$, R has given a distinct answer in the fourth round.

Also, we have S, which has got 2 points in the fourth round.

. R must have got 3 points in the fourth round.

$C(R)_3 = C(R)_4 – 3$

= 7 – 3 = 4

. R got 2 points in the third round.

$\Rightarrow$ K got 1 point in the third round.

From (vi), as A given a district answer in the sixth round,

$C(A)_6$ 2: $C(A)_4 + 2$

As $C(A)_6 = 9$ and $C(A)_4 = 7$, $C(A)_5$ must be equal to 8.

. A got 1 point each in the fifth round and sixth round.

R and S got 2 and 3 points in the sixth round.

. $C(R)_6 + C(S)_6 = 9 + 11 + 2 + 3 = 25$.

As $C(Total)_6 = 56$,

$C(K)_6 + C(V)_6 = 56 – C(R)_6 – C(S)_6 – C(A)_6$

= 56 – 25 – 9 = 22

As K and V given the same answer in the sixth round,

$C(K)_6 = C(V)_6 = \frac{22}{2} = 11.$

. $C(K)_5$ or $C(V)_5$ must be equal to 11.

As S got four points in the fifth round, K cannot get four points in the fifth round.

$C(K)_5$ -:: 11 $\Rightarrow C(K)_5 > 11$

- $C(V)_5 = 11$

V got 3 points in the fifth round.

. K got 5 points in fifth round and $C(K)_5 = 12$.

As $C(R)_5 = 9$ and $C(R)_7 = 14$, the sum of the points scored in the sixth and the seventh round by R is 5.

Also, R got 2 or 3 points in the sixth round

As K got 2 points in the seventh round, R can not get 2 points in that round.

. R cannot get 3 points in the sixth round.

R got 2 points in the sixth round and 3 points in the seventh round.

. S got 3 points in the sixth round and $C(S)_6 = 14$

From (iii), we can say that $C(A)_7$ -:: 14.

. A did not got five points in the seventh round

A must have scored 1 point and S must have got 5 points in the seventh round.

. $C(S)_7 = 14 + 5 = 19$

The final scores will be as follows:

Round no.	Total of cumulative scores	The contestants who gave same answer	K	R	A	V	S
1	15	X	5	2	1	3	4
2	15	RVS	6	2	3	2	2
3	30	X	7	4	7	7	5
4	36	KA	7	7	7	8	7
5	51	X	12	9	8	11	11
6	56	KV	11	11	9	11	14
7	71	X	13	14	10	15	19
Cumulative scores are:			61	49	45	57	62

11. Sashank was the winner.

12. Ranjit, Varun and Sashank gave the same answer in the second round.

13. The score of Ranjit after at the end of the third round = 4.

14. The score of Kamal and Varun at the end of the sixth round are 11 and 11, respectively.

15. Kamal gave the highest graded answer in the fifth round.

Solutions for questions 16 to 19: The teams with better chances of winning are teams A, C and F. The teams that have worst chances of winning are B, D and E.

16. If there is only one upset, in order to maximize Amit's earnings, then let us assume that he put stakes on three winning teams, two that were expected to win and the one that caused an upset.
Among B, D, E, team E has the best odds of 20%.
Hence, if Amit bets `100 each on teams A, C and E, then he will maximize his eanings.

∴ His earnings = $\left(100+\frac{1}{4}\times 100\right)+\left(100+\frac{2}{5}\times 100\right)+\left(100+\frac{20}{1}\times 100\right)$

= 125 + 140 + 2100
= 2365

17. In order to maximize his earnings, let us assume that Bhaskar put more money at stake on teams with better odds (among the expected winners only).
Among A, C and F, Bhaskar has the best odds on C followed by A and then F.

∴ Bhaskar's earnings = $\left(60+\frac{2}{5}\times 60\right)+\left(40+\frac{1}{4}\times 40\right)+\left(20+\frac{1}{5}\times 20\right)$

= 84 + 50 + 24
= 158

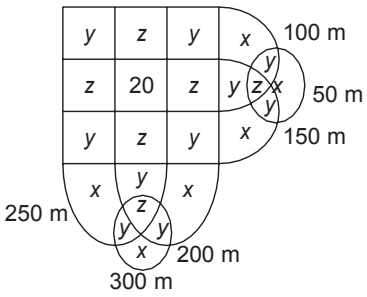
18. Among the team expected to lose, i.e., B, D and E, B and E have the best odds. Assuming that these two teams caused upsets and the other match went the expected way, teams B, C, E winning would be the most favourable to Ravi.

19. Suresh's minimum possible earnings are zero, if both his teams lose.
In Match III, the best possible outcome for Suresh is team F winning, which gives him an earning of $\left(50+\frac{7}{5}\times 50\right)$ = ` 60.

In Match II, an upset would maximize his earning. If team D wins and Suresh put his money on that team, his earnings would be $\left(50+\frac{1}{2}\times 50\right)$ `225.

∴ His maximum earnings = Difference between maximum and minimum possible earnings = 225 + 60 = 285.

Solutions for questions 20 to 23: The given information can be represented in the following Venn diagram.



x represents exactly one.
y represents exactly two.
z represents exactly three.
Since exactly four is 20, $6x + 10y + 6z = 880$.
Given $x : y : z = 1 : 2 : 3$
$6x + 20x + 18x = 880$
∴ $x = 20$

20. The number of students who participated in 50 m dash = $x + 2y + z = 8x = 160$.

21. The number of students who participated in both 100 m and 150 m dashes = $3z + y + 20 = 9x + 2x + 20 = 11x + 20 = 240$.

22. The number of students who did not participate in 300 m dash = 900 – 160 = 740.

23. The number of students who participated in at most two events = $6x + 10y = 26x = 520$.

Solutions for questions 24 to 27: Assume that A is lying.

⇒ Total score is (11 + 12 + 13) ÷ 2 = 36 ÷ 2 = 18 **(1)**

Assume that B is lying.

⇒ Total score is (10 + 12 + 13) ÷ 2 = 35 ÷ 2 = 17.5

This is not possible.

⇒ B is not lying.

If C is lying:

Total score = (10 + 11 + 13) ÷ 2 = 34 ÷ 2 = 17

D cannot be wrong, because otherwise the total score will not be an integer.

⇒ Either A or C is lying.

(i) Assume that A lied.

⇒ Total score is 18.

Individual scores are:

18 – 11 = 7

18 – 12 = 6

18 – 13 = 5

(ii) Assume that C lied.

⇒ Total score = 17

Individual scores are:

17 – 10 = 7

17 – 11 = 6

17 – 13 = 4

In both the cases, the first two individual scores are the same, but the least score varies.

If A lied, P, Q, R = 5, 6, 7 (in any order)

If C lied, P, Q, R = 4, 6, 7 (in any order)

24. We can definitely say that B and D are not lying.

25. In this case, A lied as 18 is divisible by 3 but 17 is not.

26. 7 is the highest score.

27. Least score cannot be determined.

Solutions for questions 28 to 31: From (v), we know that Stephanie purchased the Breguet Dupuis and from (iv) and (vi) we know that Henry Ford purchased the Rolex Mercator. From (ii), we know that Ozwald did not purchase a Rolex or a Piaget (also, not a Breguet according to (v)). Hence, he must have purchased a Louis Ulysse Chopard which means that Gennady purchased the Piaget.

From (iii) and (v), we know that Gennady paid $1,80,000 and Stephanie paid $2,20,000 for their watches, respectively.

From (i) and (iv), we know that all four watches together cost $8,40,000 of which Gennady had purchased a watch worth $1,80,000 and Stephanie, a watch that was worth $2,20,000.

. Cost of the other two watches

= 8,40,000 – 4,00,000 = $4,40,000

From (i), we know that the Rolex costs $1,20,000 more than the Chopard, which means that the Rolex costs $2,80,000 and the Chopard costs $1,60,000.

28. Ozwald Henry purchased the Chopard at $1,60,000.

29. Henry Ford's watch costs $2,80,000 where as Yuganov's watch costs $1,80,000.

. The difference is $1,00,000.

30. Choice (D) is the only one that's true from the data given.

31. Choice (C) is the only one that is correct.

Solutions for questions 32 to 35: From (i) and (ii), Piyush spent ` 3783, Saket spent ` 4640 and Uday spent ` 4040.

From (iii) and (iv), the maximum difference between the expenses must be between the highest and lowest spenders. Hence, Tomar's expenses must be the lowest at ` 3505.

From (i) and (v), the minimum difference between the expenses of any two persons is ` 167. The difference between the expenses of Piyush and Tomar is ` 278, whereas the difference between the expenses of Uday and Tomar is ` 535. Hence, Piyush must have spent the second least amount, whereas Uday must have spent the third least amount.

The difference between the expenses of Saket and Uday is ` 600, whereas that between the expenses of Qureishi and Raina is ` 246. Since Raina spent ` 4227, Qureishi must be the second highest spender at ` 4473 and Raina must be the third highest spender.

The descending order of their expenses is as follows:

Saket (` 4640) > Qureishi (` 4473) > Raina (` 4227) > Uday (` 4040) > Piyush (` 3783) >Tomar (` 3505)

32. Qureishi spent ` 4473.

33. Saket spent the highest amount.

34. The difference between the expenses of Raina (` 4227) and Uday (` 4040) is ` 187.

35. Uday spent the fourth highest or the third least amount.

Solutions for questions 36 to 40: The profit per month of E is `3,20,000. The only possibility is 8000 × 40, i.e., profit per unit is `8000 and the number of units sold is 40.

The profit per unit of D is greater than that of E and as profit per month is less than that E, the number of units sold is less than that of E, i.e., less than 40, i.e., 30.

Profit per month of B is greater than the profit per month of one of the other outlets by `10,000 and profit per unit of A is greater than that of C.

C is the only outlet that can have least profit per unit, i.e., 5000 and the least profit per month.

. C got `5,000 per unit.

Given that the selling prices of A, D and E are different.

. Selling prices of B and C are same, i.e., `20,000.

B's profit per month cannot be 10,000 more than that of E because we cannot get 3,30,000 by multiplying any of the profits per unit given (6000, 7000, 8000, 9000, 10,000) by the number of units sold (40, 45, 50).

If the profit per month of B is more than `3,30,000, then there will be a minimum of two outlets with profit per month more than that of outlet E. This is not possible as it is a contradiction of the given data.

Profit per month of B must be less than 3,20,000.

. The outlet with profit per month greater than that of E cannot be B, D or C. Therefore, it must be A.

The profit per month of C can be:

(1) 5000 × 40 = `2,00,000

(2) 5000 × 45 = `2,25,000

(3) 5000 × 50 = `2,50,000

Let us take the profit per month of B as 10,000 more than that of C.

B's profit per month can be 2,10,000 or 2,35,000 or 2,60,000. Number of units sold by B = 40 or 45 or 50.

For any of the values of profit per unit, this is not possible.

Hence, the profit per month of B is not 10,000 more than that of C.

B's profit per month is not 10,000 more than that of A or C or E. It should be 10,000 more than that of D.

The possible profits per month of D are:

(1) 10,000 × 30 = 3,00,000

(2) 9,000 × 30 = 2,70,000

B's profit per month can be 3,10,000 or 2,80,000. Only 2,80,000 is possible, i.e., 40 × 7000.

The profits per unit of D and E are 9000 and 8000, respectively. The profit per unit of A must be 8000 or 9000.

The unit that is selling at 22,000 cannot have the cost price of 11,000 or 12,000, i.e., it has 14,000 as the cost price. The outlet that is selling the unit at `21,000 cannot have 11,000 as the cost price.

. It should have 12,000 as cost price, i.e., a profit of 9000.

The outlet that is selling at 20,000 has a cost price of 11,000, i.e., a profit per unit of 9000.

The profit of different outlets is

Outlets	Selling price(`) and cost price (`)respectively	Profit(`)/ Unit	Unit/ Month
A	20,000 and 11,000 or 21,000 and 12,000	9,000	45/50
B	20,000 and 13,000	7,000	40
C	20,000 and 15,000	5,000	45/50
D	21,000 and 12,000 or 20,000 and 11,000	9,000	30
E	22,000 and 14,000	8,000	40

36. The profit per month of B is `7000 × 40 = `2,80,000.

37. The selling price at the outlet E is `22,000.

38. The selling price of A is more than that of D.

. The selling price of D is `20,000 and the selling price of A is `21,000 and the total cost price is `12,000, i.e., the transportation cost is `2000.

39. The number of units sold by A is more than that by C, i.e., the number of units sold by A is 50 and that by C is 45.

. The profit per month of C is 45 × 5000 = `2,25,000.

40. Profit per unit of E is `8000.

EXERCISE-3

Solutions for questions 1 to 4: Each mill has a different downtime and each mill has at least four hours of uptime in a day. Thus, the maximum downtime for any mill is 5 hours so that it has an uptime of one hour for six hours.

From the given information, the difference (in hours) between the two different uptimes of each mill are tabulated as below:

Mill	Difference in hours between the known uptimes	Possible frequency of uptimes (Every nth hour)
P	20 hours	2nd, 4th, 5th
T	21 hours	3rd
Q	44 hours	2nd,4th
R	48 hours	2nd, 3rd, 4th, 6th
S	42 hours	2nd, 3rd, 6th
T	21 hours	3rd

Every mill has a different downtime, it implies that the possible downtimes are 1, 2, 3, 4 and 5 hours.

Thus, mill T runs every 3rd hour ⇒ downtime = 2 hours.

Only P can run every 5th hour ⇒ downtime = 4 hours.

Thus, the possible downtime for the mills are as follows:

Mill	Possible frequency of uptimes (Every nth hour)
P	5th
Q	2nd,4th
R	2nd, 4th, 6th
S	2nd, 6th
T	3rd

1. Either R or S can have the highest capacity based on the possibility that both can have the highest downtime.
2. The second highest downtime is four hours. Mill P has a downtime of 4 hours.
3. If R is not of the lowest downtime but lesser than that implies that R runs every 4th hour.
   Thus, the downtime of mill R is 3 hours.
4. If R has greater downtime than mill S, then mill S has to run every 2nd hour. The only possibility is Q has to run every 4th hour and R has to run every 6th hour.
   The frequencies of the mills P, Q, R, S and T will be once every 5th, 4th, 6th, 2nd and 3rd hours, respectively.
   The same pattern repeats every 60 hours (LCM of 2,3,4,5 and 6). For this pattern to repeat in the first five hours of a shift, it repeats every 120 hours (LCM of 2, 3, 4, 5, 6 and 8) = Once every 5 days but only in the third shift. Hence, the pattern repeating in the first five hours of the day is not possible.

Solutions for questions 5 to 8: The given information can be tabulated as below:
[**Note:** The subscript under the circuit name (A, B and C) is to differentiate the two tours in the same circuit that start on different days of the week]

Day	Tour package	
	First day	Last day
Sunday	D	D, B
Monday	D	D
Tuesday	D	D, A_m, C_q
Wednesday	D, A_m, C_p	D, A_n
Thursday	D, A_n, B_x	D
Friday	D, B_y	D
Saturday	D, C_q	D, B_x, C_p

The subscript under the circuit name differentiates the two tours in the same circuit that start on different days.

5. Circuit A starts on two days; hence, two cases arise:

Case (a)		Case (b)
A (Wednesday to Tuesday) 7 days	A (Wednesday to Tuesday) 7 days	A (Thursday to Wednesday) 7 days
D (Wednesday) 1 day	C (Wednesday to Saturday) 4 days	B (Thursday to Saturday) 3 days
B (Thursday to Saturday) 3 days	D (Sunday) 1 day	D (Sunday) 1 day
Wait 3 days	Wait 3 days	Wait 2 days
C (Wednesday to Saturday) 4 days	B (Thursday to Saturday) 3 days	C (Wednesday to Saturday) 3 days
18 days	18 days	17 days

Alternate solution: Starting with circuit A, it is clear that after taking two tours, one has to definitely wait (Wait period is from Sunday to Tuesday). This wait can be minimized if the daily trip is planned in one of these three days. Further, the tour after the wait has to be A or C which starts on a Wednesday. Since, we are starting with A, the last tour has to be C (for minimum wait). Because A ends on Tuesday or Wednesday, D shall not be immediately after A, thus in the order A, B, D and C, with A starting on Thursday, the tour can be completed in 17 days.

6. If we observe the given information, out of all the tours that end and start on two consecutive days, all the tours are available between Tuesday and Thursday. C ends on Tuesday, A starts on Wednesday, which ends on Tuesday, D ends on Wednesday and B starts on Thursday. Hence, the tour shall start with C_q which starts on a Saturday.
7. Only on a Monday, tourists of only one tour come to the office (either start or end the tour).
8. A (Wednesday – Tuesday) + B (Thursday – Saturday) + D (Monday) + C (Wednesday – Saturday).
   The tour shall start on a Wednesday.

Solutions for questions 9 to 12: The kid receives `5 per day ⇒ earns `35 per week but earns a maximum of `25 in the first five days. The statement implies that the kid spends a maximum of `25 in the first five days ⇒ purchases only two items in the first week.

The amount available by next Monday is the sum of savings during first five days and amount earned during weekend.

The kid earns `10 on weekend which is available for next Monday. Thus, from the second week onwards, he can purchase all the items at least once.

Amount available on second Monday will be among `15 or `20 or `10.

Whatever items the kid purchases in the first week, the total amount the kid can spend up to the second week is income of the first week and first five days of the second week, i.e., `35 + `25 = `60.

By repeating the purchase of three items twice, the kid purchases all the items twice.

Starting from the second week, in n weeks the kid purchases all the items at least n times and at most $(n + k)$ times.

In order for the purchases to make a pattern:

n (35) = (n + k) (30)

$\Rightarrow n = 6k$.

$\Rightarrow$ For every 6 weeks, (k = 1), all the items would be purchased seven times.

Pastry = P = `15

Samosa = S = `10

Chocolate = C = `5

Week	Balance + Income weekday	Expenses	Weekend income	Balance	Purchases
	A	B	C	A – B + C	
1	0 + 25	15 + 5 5 + 10	10	15 10 + 10 = 20	C, S
2	20 + 25	15 + 5 + 10 + 15	10	0 + 10 = 10	P, C, S, P
3	10 + 25	5 + 10 + 15 + 5	10	0 + 10 = 10	C, S, P, C
4	10 + 25	10 + 15 + 5	10	5 + 10 = 15	S, P, C
5	15 + 25	10 + 15 + 5 + 10	10	0 + 10 = 10	S, P, C, S
6	10 + 25	15 + 5 + 10	10	5 + 10 = 15	P, C, S
7	15 + 25	15 + 5 + 10	10	10 + 10 = 20	P, C, S
8	20 + 25	15 + 5 + 10 + 15	10	0 + 10	P, C, S, P

9. From the above, the given data is sufficient to determine that the pattern of the purchases is repetitive. Hence, only II is true.

10. From the table, the maximum savings available on any Monday is `20, plus he would receive a pocket money of `5, thus the maximum amount available on any Monday is `25.

11. Given that the kid makes a purchase as soon as he accumulates sufficient money to make his next purchase as per the defined conditions.
With the new condition, the possible combinations in the five days of the week, for the kid to purchase the four items Chocolate (C), Fruit (F), Samosa (S) and Pastry (P) is:
F/C, S/P, C/F,_, P/S (No purchase on Thursday).
Only (D) is definitely true.

12. In the third week, opening balance = `10. Earns `25 during the five weekdays. Spends `35 during five days and earns `10 during weekend.
The kid starts with a balance of `10 every week. The maximum amount the kid has on any Monday is `15.

Solutions for questions 13 to 16: Let us represent the people name with A, B, C, D and E and also the fields to which each book belongs to A, B, C, D and E.

Person	Book
A	D/E
B	Criminology
C	Biotechnology
D	A/E
E	D/A

13. Annie exchanges with Dan and Dan exchanges with Engel so the book possessed by Annie goes to Engel. Hence, Annie purchased book related to Economics.

Don Purchased book related to Architecture and Engel purchased book related to Demographic.

14. Statement (A) is true.
Statement (B) is true.
Statement (C) is true.
Statement (D) is not necessarily true.

15. Condition (A) Annie and Engel books were interchanged. There can be two possibilities with this condition with Annie taking books related to Demography or Architecture.
Condition (B) states that neither Annie nor Engel possess books related to Economics.
Since Annie and Engel did not get the book related to Economics that means Dan possessed the book related to Economics, Annie passed the book related to Architecture and Engel possessed the book related to Demographics.

16. As condition (d) is not violated, the interchange was between any two among Annie, Dan and Engel. From the above table, and the possibility of interchange between any two among the three, six cases arise as shown below. The statements which are consistent in each of the case are listed accordingly.

Statements consistent			
	Interchange between		
Person = Book	**A and D**	**D and E**	**A and E**
A = D E = A D = E	a, d	a, b, c	b
A = E E = D D = A	b, d	a	a, b, c

From the above table, in various cases, the pairs of statements ab, ac, ad, bc and bd are consistent simultaneously while only statements c and d are not consistent simultaneously in any case.

Solutions for questions 17 to 20:

17. A. $29 = 4 + 25 = (2 \times 2) + (2 \times 10) + (1 \times 5)$
Therefore, it is possible.
B. $31 = 6 + 25 = (3 \times 2) + (2 \times 10) + (1 \times 5)$
Therefore, it is possible.
C. $47 = 40 + 7$ or $35 + 12$
Neither of which are possible.

18. X score $33 \Rightarrow 25 + 8 = (1 \times 10) + (3 \times 5) + (4 \times 2)$ or $= (2 \times 10) + (1 \times 5) + (4 \times 2)$
All choices except (B) is not necessarily true.

19. Maximum marks can be obtained as follows:

	Part I	**Part II**	**Total**
Rahul/Beena	3×2	4×10	46
Beena/Rahul	3×2	$3 \times 10 + 1 \times 5$	41

Minimum possible marks:

	Part I	**Part II**	**Total**
Johan/Bijaya	5×2	2×5	20
Bijaya/Johan	4×2	3×5	23

Maximum difference = 87 – 43 = 44.

20. By scoring positive marks in six questions, each of U and V must score two marks each in two questions of Part I. In the remaining four questions, a score of 10 or 5 or 2 is possible. For different marks possible for any of the questions, the difference in marks would be in multiples of ± (10 – 5) or ± (5 – 2), i.e., difference of ± 5 or ± 3 will be seen in their totals. To obtain minimum difference of '1', we have to check if the difference of 1 = + 5 – 3 – 3 or – 5 + 3 + 3 is possible.
The possible marks obtained by U and V in the remaining four questions are as follows.

	Case I	**Case II**	
U	(10 + 5 + 5 + 5)	10 + 5 + 2 + 2	15
V	(10 + 10 + 2 + 2)	(5 + 5 + 5 + 5)	18
Difference	1	1	

The difference is 1.

Solutions for questions 21 to 25: It is given that there are 24 textbooks distributed in four racks. Each rack containing a distinct even number of textbooks. From (2) and (3), it can be concluded that the number of books of Marketing = 12, HR = 6, Operations = 4 and Systems = 2. It is also given that the number of textbooks in each rack remained the same even after misplacement.

From (3), Marketing rack has four textbooks from Operations rack and the rest are from Marketing rack only.

From (4) in HR rack, two books are of HR and the rest four are from a different rack. These textbooks have to be from Marketing rack as Systems rack has only two textbooks.

This implies that the four books from HR rack are placed in Operations rack. Thus, the present position is as follows.

Marketing:	Marketing-8 and Operations-4
Operations:	HR-4
HR:	HR-2 and Marketing-4
Systems:	Systems-2

21. None of the books related to Operations was placed in Human Resource.

22. Two textbooks related to Systems were placed correctly.

23. Four of the books related to Human Resource were in Operations rack.

24. Textbooks from Systems rack are in system rack only.

25. No textbook belonging to Operations rack is placed in System rack.

Challenge Your Understanding
Practice Set 1

Directions for questions 1 to 3: These questions are based on the following information.

Raju starts going to temple 60 days before the commencement of his exams. Raju offers flowers to God on each day. God accepts these flowers on the next day and leaves two of them, but before Raju offers flowers on that day. Raju takes the two flowers left and then offers flowers for that day. The number of flowers taken by God on the third day is 12 and it is known that on any day, the difference between the number of flowers offered by Raju and that taken by God is constant (No flower is taken by God on the first day).

1. On which of the following days does Raju offer 320 flowers?

2. How many flowers does God take in the first 30 days?

3. How many flowers does Raju offer in the first 45 days?

Directions for questions 4 to 7: Answer the questions based on the information given below. Type your answer in the space provided below.

The following table gives the details about the number of people entering and leaving an exhibition ground at different times on a particular day in a 7-hour period.

	3 p.m.–4 p.m.	4 p.m.–5 p.m.	5 p.m.–6 p.m.	6 p.m.–7 p.m.	7 p.m.–8 p.m.	8 p.m.–9 p.m.	9 p.m.–10 p.m.
Number of people entering	300	346	562	648	713	–	–
Number of people leaving	200	380	459	520	629	862	900

Also note that:

(1) People were allowed to enter the ground at 1 minute past '*n*' p.m., where *n* = 3, 4, ..., 9, for only 30 seconds, after which they were not allowed to enter.

(2) People were allowed to leave the ground at 1 minute to '*m*' p.m., where *m* = 4, 5, ..., 10. for only 30 seconds, after which they were not allowed to leave.

(3) The entry was allowed from exactly 3 p.m. and nobody was present in the ground before 3 p.m.

(4) The venue was closed at exactly 10 p.m. and everybody left the ground before 10 p.m.

(5) The number of people entering the ground in each of the time durations from 8 p.m.–9 p.m. and 9 p.m.–10 p.m. is unknown.

4. At any moment from 3 p.m. to 8 p.m., what was the highest number of people present in the ground?_____

5. What is the minimum number of people who entered the ground from 8 p.m. to 9 p.m.? _____

6. What is the least number of people who were in the ground at any moment from 4 p.m. to 8 p.m.? _____

7. What is the minimum number of people entering the ground at 8 p.m.? _____

Directions for questions 8 to 10: These questions are based on the following information given below. Type your answer in the space provided below for each question.

A cube is dipped in a tank of red paint up to half its height. Then, it is reversed and then dipped in green paint up to half its height. Then the top and the bottom faces of the cube are coloured with blue and yellow, respectively. This cube is now cut into 27 smaller and identical cubes.

8. How many small cubes does not have red paint on any of its faces?

9. How many small cubes have two colours on them?

10. How many small cubes have three colours on them?

Directions for questions 11 to 13: These questions are based on the following information.

A survey was conducted among 100 candidates, each of whom passed in at least one paper among Physics, Chemistry and Maths. Among them, 45 failed in Physics, 40 failed in Chemistry, 40 failed in Maths and 40 failed in at least two subjects.

11. How many candidates passed in at most two subjects?

12. How many candidates passed in exactly two subjects?

13. How many candidates passed in all the three subjects?

Directions for questions 14 to 16: These questions are based on the information given below.

The following table gives the details of the number of new books and the number of 2nd editions of the books which is already in circulation both published by ABC publishers.

Year	2000	2001	2002	2003	2004	2005
New books published	140	180	210	220	260	300
2nd edition books published	90	90	120	145	190	160

Total books published = Fiction books published + Non-fiction books published.

For non-fiction books that are published in a year, 2nd editions will be published for exactly 50% of the books in the next year.

For fiction books published in a year, 2nd edition will be published for all the publications exactly two years later. Further in 2005, the 2nd edition of fiction books published is the same as the 2nd edition of non-fiction books published.

Directions: Type in your answer in the space provided in the question.

14. How many new fiction books were published in 1999? _____

15. How many new non-fiction books were published in 2004? _____

16. For how many non-fiction books published between 2002 and 2004 (both the years included), 2nd edition was not published? _____

Directions for questions 17 to 20: These questions are based on the information given below.

A group of four friends, namely P, Q, R, and S together spent a total amount of `9600. Each of them spent some money on shoes, some on clothes and the remaining on books. In total, P spent `200 more than Q but `200 less than R, who in turn spent `200 less than S. The total money spent on clothes is `200 less than that on books and `200 more than that on shoes. Further, it is also known that:

(i) Q spent `400 on clothes and twice of it on shoes.
(ii) The amount spent by P on clothes is the same as that spent by R on shoes.
(iii) The amount spent by S on books is the sum of the amount spent by P on books and the amount spent by S on shoes.
(iv) The amount spent by Q on shoes and that on books is same as that spent by S on clothes and R on clothes, respectively.

Directions: Type in your answer in the space provided in the question.

17. Among the four, what is the least amount spent in total? _____

18. How much did S spend on books? _____

19. How much did P spend on books? _____

20. How much did Q spend on shoes? _____

Directions for questions 21 to 24: Type in your answer in the space provided below each of the question. These questions are based on the following information.

A print media advertising agency has undertaken a readership survey in a habitat of less than 700 houses for formulating a tariff package for print advertisements in vernacular newspapers in that region. The following information is shared:

It is found that each house in the village is a subscriber to at least one of the dailies among JanSamachar, LokVichaar and Veekshan. No other newspaper is under circulation in that village.

The number of subscribers to LokVichaar alone is twice the subscriptions to only LokVichaar and JanSamachar, as well as only LokVichaar and Veekshan.

Subscriptions to only two dailies, one of which is JanSamachar is same as the subscriptions to all the three dailies which are found to be more than 110.

For every subscriber of only JanSamachar and LokVichaar, there are three subscribers of only Veekshan. Only 20% of the houses subscribed to all the three dailies, which is not a multiple of 20.

Subscription to only JanSamachar and LokVichaar is $41\frac{2}{3}\%$ of number of subscriptions to all the three.

21. What is number of subscriptions to the highest circulated newspaper?

22. What is the number of subscriptions to the least circulated newspaper?

23. What is the total number of houses in the village?

24. What is the total number of newspaper subscriptions in the village?

Directions for questions 25 to 27: These questions are based on the following information.

In a group of 50, every member can speak at least one of the four languages, such as English, Hindi, German and Spanish. The number of people who can speak all the languages except Spanish is same as those who speak only Spanish, which in turn is equal to 4. 25 members do not speak German and 7 members speak only German. Number of people who speak exactly two languages is twice that of those who speak exactly three, which in turn is twice that of those who speak all the languages. 15 people speak only one language. 18 people speak English and Hindi, of which 6 people speak no other language. German and Hindi are spoken by 11 people, of which only 1 person does not speak any other language. The number of people who speak Spanish and English is 13, of which the number of people who do not speak any other language is same as those who speak only German and Spanish. The number of people who speak English is 26.

Directions: Type in your answer in the space provided below the question.

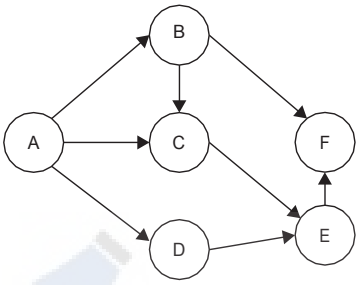
25. How many people speak only Spanish and Hindi? _____

26. How many persons speak only Hindi? _____

27. How many people speak at least three languages? _____

Directions for questions 28 to 31: These questions are based on the following information.

A, B, C, D, E and F are close friends. A has a chocolate factory and he distributes some chocolates to his friends and his friends distribute the chocolates among themselves as shown below.



The following information is also known.

(i) No person receives the same number of chocolates from two different people.
(ii) After the distribution, each person has a different number of chocolates, which are consecutive natural numbers.
(iii) No person gives the same number of chocolates to two different people.
(iv) The number of chocolates with C after the distribution is four and that with A is the least.
(v) A gives six chocolates to D and C gives one chocolate to E.
(vi) The number of chocolates with F is twice that with E.
(vii) No person gives more than 10 chocolates to any other person.
(viii) At least one chocolate is passed between two people who are connected in the network.

Directions: Type in your answer in the space provided below the question.

28. What is the total number of chocolates with A before distribution?_____

29. The number of chocolates with D after distribution is _____

30. The number of chocolates given by A to C is _____

31. The total number of chocolates with A, B and D after distribution is _____

Directions for questions 32 to 35: These questions are based on the following information.

A, B, C, D, E and F are six friends appearing for a Management entrance test. They applied together and were surprised to see that though they were all seated in the same row, their hall ticket numbers were not in serial order. Further, the following information was available.

(i) Neither A nor F is seated at the ends and the people sitting at any ends do not have hall ticket numbers whose last digit is 2.
(ii) A and F are adjacent to each other, while B and E are adjacent to each other and are to the left of A. The remaining two friends are also adjacent to each other. Also, A and F have hall ticket numbers whose first digit is 4.
(iii) Each hall ticket number is of two digits which is a multiple of 6, such that there are three pairs of consecutive multiples of 6. The sum of each pair is a multiple of 10.
(iv) They are seated in such a way that the hall ticket numbers that end with the same digit are in ascending order from left to right.
(v) E is not at any end and the same is true of D, who is not adjacent to A.

32. In how many ways can the six friends be seated?

33. If A's hall ticket number ends with the digit '2', then what is the hall ticket number of F?

34. The lowest of the hall ticket numbers of the six friends is

35. What is the hall ticket number of the person sitting to the immediate right of F?

Directions for questions 36 to 39: These questions are based on the following information.

Six MBA aspirants P, Q, R, S, T and U arrived in Hyderabad to participate in a group discussion (GD) for the 20 IIMs spread across India. The number of calls received by each of them is a multiple of either 3, 4 or 5. They are to be seated around a circular table during the GD. Further, the following information is known about them.

(i) No two of them received the same number of calls. The lowest number of calls that a candidate among them received is 5, while none of them received a call from all the 20 IIMs.
(ii) The candidates are seated in such a manner that the number of calls received by each person increases as we move in anticlockwise direction starting from the candidate who received the lowest number of calls.
(iii) P and S are opposite to each other and together they got a call from each of the 20 IIMs. But no IIM sent calls to both of them.
(iv) The person seated to the immediate left of P is Q, who received the lowest number of calls.
(v) R received 9 calls and is opposite to T.
(vi) The highest number of calls received by a person is an odd number.

36. What is the number of calls received by U?

37. What is the difference between the highest and the lowest number of calls received in the group?

38. What is the number of calls received by the person who sits two places away to the right of T?

39. The ratio of number of aspirants with even number of calls to that of odd number of calls is (Give ratio as decimal number)

Directions for questions 40 to 43: These questions are based on the following information.

A team of agricultural scientists is trying to figure out the banana production planning for the forthcoming year. A report on the same has provided the following information.

Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Gujarat are the five major producers of bananas in India. Each state has a production target (in tons) from among 1000, 2000, 3000, 4000, 5000, 7000 and 9000. Each state has a target area for cultivation, which is one among 500, 1000, 1500, 2000, 3000 and 3500 (in hectares). Further, the team gathered the following information.

(i) Every state has a different targeted yield (in tons per hectares) with Gujarat having the highest target (yield) of 2.5, while Karnataka has the least yield target of 0.86 (Approximately).

(ii) Andhra Pradesh has the lowest production and area targets among the five states with 2000 tons and 1500 hectares, respectively. Although its targeted yield is greater than that of Maharashtra but less than that of Tamil Nadu.

(iii) Tamil Nadu has a yield target of 2 and the current area needs to increase production target by 1000 tons to equate Gujarat's target yield.

(iv) Karnataka has the same production target as Maharashtra but plans to utilize 500 hectares of more land than that of Maharashtra.

(v) The states are ranked 1 to 5 in each of the parameters production target, area target and yield target, with the best rank being 1 and the last rank being 5. If two or more states have same value in production target or area target, the state with higher yield target is given better rank.

Yield target = Production target in tons/ Area target in hectares

Directions: Write the answer in the below each question.

40. What is Gujarat's rank in terms of area target? _____

41. What is the rank of Karnataka in terms of production target? _____

42. If Karnataka targets to move up three ranks and tie with the state currently holding that position in terms of yield, how much more should it produce (in tons) with the current targeted area? _____

43. If Tamil Nadu's actual yield is likely to fall to 50% of the targeted value, then how much area (in hectares) has to be increased or decreased to keep the production at the targeted level? _____

Directions for questions 44 to 47: These questions are based on the following information.

Santiago, Benjamin and Mateo are three friends from Brazil visiting India. Each of them purchased a different item, such as a shawl, Darjeeling tea and a saree from the Rajasthan State Tourism Development Handicraft outlet with each item bearing a different cost. Additionally, they had to pay a tax of 10% on the cost of the item purchased. While exiting the outlet they were required to show the bills of the purchased items, which could not be found.

When asked by the outlet security about the purchases each of them made three statements.

It is known that each of them belongs to a different group among truth teller, alternator and liar.

Truth tellers always speak the truth, liars always lie and alternators alternate between truth and lies in any order.

Santiago:

(i) Benjamin bought a saree.
(ii) Mateo paid a tax of `300.
(iii) I bought an item which is worth `2000.

Benjamin:

(i) Santiago purchased a shawl.
(ii) Mateo paid a tax of `300.
(iii) I bought an item for a price of `2000.

Mateo:

(i) I purchased Darjeeling tea.
(ii) Benjamin paid a tax of `100.
(iii) Santiago purchased an item which is priced for `2000.

Directions: Write your answer in the space provided below each question.

44. What is the total price paid for Darjeeling tea? _____

45. The cost of the saree is how many times the cost of the product purchased by Benjamin? _____

46. If the sum of the cost of product Benjamin purchased and the shawl is equal to the cost of the of product purchased by Mateo, then what is the total money spent by Santiago for the purchase of his product (tax included)? _____

47. What is the total amount spent by all the three at the outlet, if the conditions in the previous question remains the same? _____

Directions for questions 48 to 51: These questions are based on the following data.

A survey was conducted in a community of 350 people regarding three games, such as Chess, Carroms and Chinese Checkers. The following information is obtained in the survey.

(i) Thrice the number of people who play all the three games is equal to the number of people who play Chinese Checkers.
(ii) The number of people who play Chinese Checkers and Carroms is equal to the number of people who play Chess only.
(iii) For every three people who play Chess and Chinese Checkers only, there are five people who play none of the three games.
(iv) In every seven people who play Chinese Checkers, four people play Carroms also.
(v) For every six people who play only Carroms, there is one who plays Chinese Checkers only.
(vi) For every four people who play exactly two games, there is one who plays Carroms and Chinese Checkers only and two people who play none of the three games.

Directions: Fill the space below the questions with appropriate value.

48. How many people play exactly two games?_____

49. How many people play Chess but not Carroms?_____

50. How many people do not play Chinese Checkers?_____

51. How many people play Chess or Carroms? _____

Directions for questions 52 to 55: These questions are based on the following information.

In a colony of 280 families, which use mobile phones of different companies, like Panasonic, Sony Ericsson, Motorola and Nokia, 175 families use Sony Ericsson, 155 families use Panasonic, 165 families use Motorola and 150 families use Nokia. Each of the families use mobile phones of at least one company. The number of families using Sony Ericsson and Motorola is same as those using Nokia and Panasonic which in turn is same as those using mobiles of exactly three different companies, which is 75. Also, it is known that the sum of the number of families using Sony Ericsson and Motorola only, and the number of families using Nokia and Panasonic only is 25. The number of families using mobiles of exactly two companies is 100 more than that using mobiles of exactly one company.

Directions: Fill the space below each question with appropriate value.

52. How many families use mobiles of all the four companies?_____

53. How many families use mobiles of at least two of the four companies but at most three of the four companies? _____

54. How many families use mobiles of exactly one of the four companies? _____

55. If the sum of the number of families using Sony Ericsson, Motorola and Nokia but not Panasonic and the number of families using Sony Ericsson, Motorola and Panasonic but not Nokia is 35, then what is the sum of the number of families who use Nokia only and the number of families using Panasonic only? _____

Directions for questions 56 to 60: These questions are based on the following information.

In a college of 500 students, each student belongs to either the first year or the second year only but not to both. Each student belongs to exactly one of the two streams, such as Commerce and Science, each student is either an NSF member or an SFI member but not both. 90 first year Commerce students are SFI members. There are 270 NSF members. 50 Commerce students are neither first year students nor NSF members. 140 first year students are NSF members. 150 NSF members are either first year students or Commerce students but not both. 120 second year students are not Science students. 100 Science students are either first year students or NSF members but not both.

Directions: Fill the space below each question with appropriate value.

56. Find the number of second year Science students who are SFI members._____

57. Find the number of first year Science students who are not NSF members. _____

58. Find the number of first year Commerce students who are NSF members. _____

59. Find the number of Commerce students who are either NSF members or second year students but not both. _____

60. Find the total number of students who are NSF members or second year students. _____

ANSWER KEYS

1. 53	10. 0	19. 700	28. 21	37. 10	46. 1100	55. 5
2. 2610	11. 85	20. 800	29. 2	38. 8	47. 6600	56. 50
3. 6300	12. 45	21. 429	30. 4	39. 1	48. 100	57. 40
4. 1010	13. 15	22. 330	31. 8	40. 3	49. 90	58. 60
5. 481	14. 60	23. 660	32. 1	41. 4	50. 245	59. 110
6. 65	15. 160	24. 1111	33. 48	42. 4000	51. 285	60. 370
7. 481	16. 195	25. 5	34. 12	43. 2000	52. 25	
8. 11	17. 2100	26. 3	35. 72	44. 2200	53. 215	
9. 24	18. 1300	27. 15	36. 10	45. 1.5	54. 40	

SOLUTIONS

Solutions for questions 1 to 3: Let x be the flowers offered by Raju on the first day. And it is given that God takes none of them on the first day.

. The difference between the number of flowers offered and that taken = $x - 0 = x$.

The flowers offered is x more than the flowers taken.

On the second day, God takes all the flowers that were offered on the first day except two, i.e., $x - 2$.

. The number of flowers offered by Raju on the second day $\Rightarrow x - 2 + x = 2x - 2$

On the third day God takes $(2x - 2) - 2 = 2x - 4$ flowers.

But given is 12.

. $2x - 4 = 12 \Rightarrow x = 8$

The flowers offered and taken is as follows:

Day	1	2	3	4
Offered	8	14	20	26
Taken	0	6	12	18

The flowers offered is in arithmetic progression with a common difference of 6 and also the number of flowers taken is in arithmetic progression with a common difference of 6.

Flowers offered = $2 + 6n$

Flowers taken = $6(n - 1)$

When n = the number of the day.

1. $2 + 6n = 320$

$\Rightarrow 6n = 318 \Rightarrow n = 53$

2. The sum of first n terms in an arithmetic progression $= \frac{n}{2}[2a + (n-1)d]$

Here, $n = 30$, $a = 0$ and $d = 6$

$\Rightarrow$ Sum $= \frac{30}{2}[(30 - 1)6]$

$= 15[29 \times 6] = 2610$

3. The sum of the first n terms in an arithmetic progression $= \frac{n}{2}[2a + (n-1)d]$

Here, $n = 45$, $a = 8$, $d = 6 \Rightarrow$ Sum $= \frac{45}{2}[16 + 44 \times 6]$

$= 45[8 + 132] = 6300$.

Solutions for questions 4 to 7: People enter the ground from n : 01 : 00 p.m. to n : 01 : 30 p.m., where $n = 3, 4 \ldots, 9$, and leave the ground from n : 59 : 00 p.m. to n : 59 : 30 p.m., where $n = 3, 4 \ldots, 9$. From n : 01 : 31 p.m. to n : 59 : 00 p.m., where $n = 3, 4, \ldots, 9$, the number of people in the mall remain constant.

	The number of people entering from n : 01:00 p.m. to n : 01:30 p.m.	The number of people leaving from n : 59:00 p.m. to n : 59:30 p.m.	The number of people present from n : 01:30 p.m. to n : 59:00 p.m.
$n = 3$	300	200	300
$n = 4$	346	380	(300 – 200) + 346 = 446
$n = 5$	562	459	(446 – 380) + 562 = 628
$n = 6$	648	520	(628 – 459) + 648 = 817
$n = 7$	713	629	(817 – 520) + 713 = 1010

4. From the above table, the highest number of people in the ground at any time would be 1010.

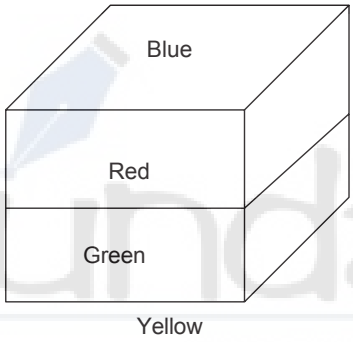
5. The number of people who were present in the ground after 7 : 59 : 30 = 1010 – 629 = 381

As 862 people left between 8 p.m. and 9 p.m., at least 862 – 381 = 481 people must enter the ground from 8 p.m. to 9 p.m.

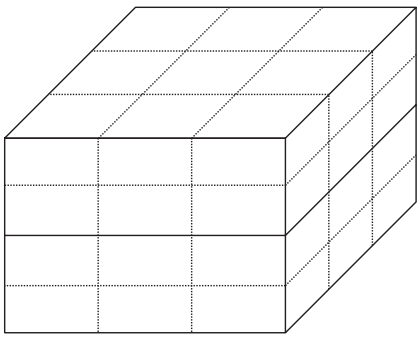
6. The number of people present in the ground from 3 : 59 : 30 to 4 : 01 : 00 = 300 – 200 = 100
The number of people present in the ground from 4 : 59 : 30 to 5 : 01 : 00 = 446 – 380 = 66.
Proceeding similarly, we find that the minimum number of people present at any moment in the ground from 4 p.m. to 8 p.m. was 66.

7. At 8 p.m., 381 people remain in the ground before the entry and we know that at 9 p.m. 862 people left the ground
. Minimum people entering the ground would be 862 – 381 = 481.

Solutions for questions 8 to 10: After painting, the cube would appear as given below.



After cutting the cube into 27 smaller and identical cubes, we get:

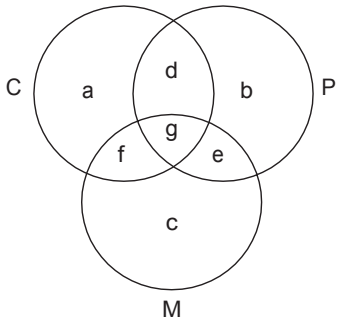


8. The cubes on the bottom plane, the one at the middle of the top face and the middle one does not have red colour on any of its faces. So, the number of cubes which do not have red paint on them is 3 × 3 + 1 + 1 = 11.

9. All the cubes on the outer surface except the centre cubes on the top and the bottom faces, i.e., 24 cubes.

10. None of the cubes have three different colours on them.

Solutions for questions 11 to 13:



Here P, C and M represent those who passed in Physics, Chemistry and Mathematics, respectively.
Given information is as follows:

$a + f + c = 45$ (1)
$b + e + c = 40$ (2)
$a + d + b = 40$ (3)
$a + b + c = 40$ (4)
$(a + b + c) + (d + e + f) + g = 100$ (5)

Adding (1), (2) and (3), we get
$2(a + b + c) + (d + e + f) = 125$
$d + e + f = 125 – 2 \times 40 = 45$ [From (4)]
From (5), $g = 100 – 45 – 40 = 15$

11. Passed in at most two subjects
= Exactly two subjects + Exactly one subject
= 45 + 40 = 85

12. Passed in exactly two subjects = 45

13. Passed in exactly three subjects = 15

Solutions for questions 14 to 16: It is given that the number of 2nd edition of fiction books is same as that of non-fiction books in 2005.
⇒ 80 books are fiction and 80 books are non-fiction.
⇒ 160 of the newly published books in 2004 are non-fiction and 100 are fiction.
⇒ In 2003, 140 are non-fiction and 80 are fiction.
⇒ In 2004, of the 2nd edition, 70 are non-fiction and 120 are fiction. Similarly, we can work out other values.

New publications

	2000	2001	2002	2003	2004	2005
Non-fiction	60	80	90	140	160	Y
Fiction	80	100	120	80	100	$300 – y$

2nd edition

	2000	2001	2002	2003	2004	2005
Non-fiction	x	30	40	45	70	80
Fiction	$90 – x$	60	80	100	120	80

14. As 60 fiction books had a 2nd edition in 2001, all these 60 were published in 1999.

15. The new non-fiction books published in 2004 is 160.

16. Of the total non-fiction books published,
i.e., (90 + 140 + 160) = 390
195 have 2nd edition, but the remaining 195 do not have 2nd edition.

Solutions for questions 17 to 20: Assume that Q spent `x.
P spent `200 more than Q.
⇒ P spent (x + 200)
R spent `200 more than P.
⇒ R spent (x + 200 + 200) = (x + 400)
S spent `200 more than R.
⇒ S spent (x + 400 + 200) = (x + 600)
We have:
P + Q + R + S = 9600
⇒ x + 200 + x + x + 400 + x + 600 = 9600
or x = 2100
. P spent `2300; Q spent `2100;
R spent `2500 and S spent `2700.
Now, assume that amount spent on shoes = x.
Amount spent on clothes = (x + 200)
Amount spent on books = (x + 400)
⇒ x + x + 200 + x + 400 = 9600
or x = 3000
From (i) and the above data, we get

	Shoes	Clothes	Books	Total
P				2300
Q	800	400		2100
R				2500
S				2700
Total	3000	3200	3400	9600

Q spent 2100 – (800 + 400) = 900 on books.
From (iv), we get:
S spent `800 on clothes and
R spent `900 on clothes.
. P's expenditure on clothes = 3200 – (400 + 800 + 900)
Total Q S R
= `1100
Also, from (ii), the table will be

	Shoes	Clothes	Books	Total
P		1100		2300
Q	800	400	900	2100
R	1100	900		2500
S		800		2700
Total	3000	3200	3400	9600

Amount spent by R on books = 2500 – (1100 + 900) = 500.
Let the amount spent by S on books = x
Amount spent by P on books = a
Amount spent by S on shoes = b
From (iii), we get
n = a + b
The total of books purchased by P, Q, R and S is 3400.
Hence, a + 900 + 500 + x = 3400
a + 900 + 500 + x = 3400
or a + x = 2000 (1)
From row S,
b + 800 + x = 2700
or b + x = 1900 (2)
(1) + (2)
⇒ a + b + 2x = 3900
We have: a + b = x
⇒ 3x = 390
(or) x = 1300
a + x = 2000 ⇒ a = 700
b + x = 1900 ⇒ b = 600
Hence the final table will be

	Shoes	Clothes	Books	Total
P	500	1100	700	2300
Q	800	400	900	2100
R	1100	900	500	2500
S	600	800	1300	2700
Total	3000	3200	3400	9600

17. Q spent `2100 only.

18. S spent `1300 on books.

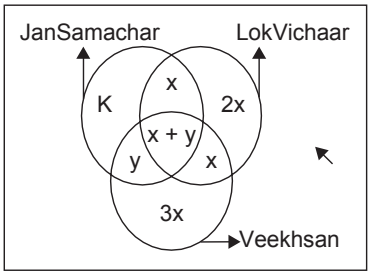
19. P spent `700 on books.

20. Q spent `800 on shoes.

Solutions for question 21 to 24: Given information:
Total number of houses is less than <700.
From (ii), (Only LokVichaar) = 2 × (Only LokVichaar and JanSamachar)
= 2 × (Only LokVichaar and Veekshan).
From (iii), only JanSamachar and (LokVichaar or Veekshan) = (JanSamachar and LokVichaar and Veekshan)
i.e., (Only JanSamachar and Veekshan) + (Only JanSamachar and LokVichaar) = (JanSamachar and LokVichaar and Veekshan)
From (iv), (Only Veekshan) = 3 × (Only JanSamachar and LokVichaar).
20% (Total number of houses) = Subscriptions to all the three dailies -: Any multiple of 20.
⇒ (Total number of houses) = 5 × (Subscriptions to all the three dailies)
(Only JanSamachar and LokVichaar) = $41^2/_3$% of number of subscriptions to all the three.

If we calculate by letting (Only JanSamachar and LokVichaar) = x.

The given information can be represented in the following Venn diagram:



From the above information, we can deduce the following:

$41^2/_3\%(x + y) = x \Rightarrow \frac{125}{300}(x + y) = x \Rightarrow 5y = 7x \Rightarrow y = \frac{7x}{5}$

$\Rightarrow$ Subscriptions to all the three dailies = $\left(x + \frac{7x}{5}\right) = \frac{12x}{5}$

Total number of houses = $5 \times (x + y) = 12x$

$\Rightarrow k + x + 2x + \frac{7x}{5} + \frac{12x}{5} + x + 3x = 12x \Rightarrow k = 5x - \frac{19x}{5}$

$\Rightarrow k = \frac{6x}{5}$

Also, we know that $12x < 700$ and $\frac{12x}{5} > 110 \Rightarrow 550 < 12x < 700 \Rightarrow 48.5 < x < 58.3$

But each of x, y and k are integers and $k = \frac{6x}{5} \Rightarrow x$ is a multiple of 5.

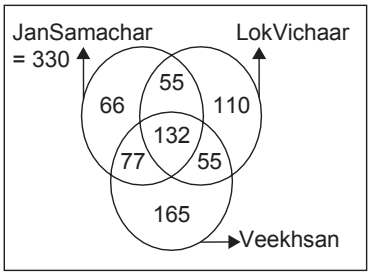
Thus, the possible values for x are $x = 50$ or $x = 55$.

If x =50, then $\frac{12x}{5} = 120$.

This is not possible because subscriptions to all the three dailies is not a multiple of 20.

Therefore, $x = 55$; $\Rightarrow k = 66$ and $y = 77$

The resultant Venn diagram would be as follows:



21. Veekshan is having the highest number of subscriptions = 429.

22. JanSamachar is having the lowest number of subscriptions = 330.

23. Total houses in village = 132 × 5 = 660.

24. Total subscriptions = 330 + 352 + 429 = 1111.

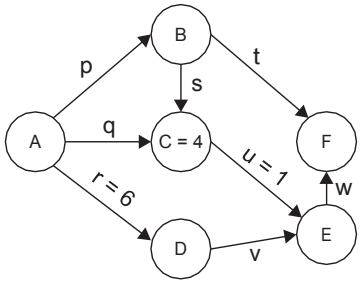
Solutions for questions 25 to 27:

25. 5 people speak only Spanish and Hindi.

26. 3 people speak only Hindi.

27. The number of people who speak at least three languages are 1 + 2 + 3 + 4 + 5 = 15.

Solutions for questions 28 to 31: The network can be represented as follows.



Given that, $r = 6$, $u = 1$, C = 4 and F = 2E.

As C = 4 and the number of chocolates with them are consecutive natural numbers, the maximum number of chocolates with any person can be 8 (As A is the least).

As F = 2E, (E, F) can be (1, 2), (2, 4), (3, 6) or (4, 8).

E cannot be 1 as A has the least number of chocolates or E and F cannot have 4 chocolates (as C = 4).

$\therefore$ E = 3 and F = 6

As the number of chocolates are consecutive natural numbers, there should be five chocolates with A, B or D (E = 3, C = 4 and F = 6).

As A has the least number, he cannot have 5 chocolates.

If D = 5, r = D + v

$\Rightarrow v = 1$

Now $u = v = 1$, which does not satisfy the condition that a person should not receive the same number of chocolates from two different people.

$\therefore$ B = 5

Now D should be either 2 or 7 to form consecutive numbers. As $r = 6$, D cannot be 7.

$\therefore$ D = 2 and A = 1(the least)

$v = r$ – D = 6 – 2 = 4

$w = v$ + E – w = 4 + 1 – 3 = 2

t = F – w = 6 – 2 = 4

Now p = B + s + t = 5 + s + 4

$\Rightarrow p = 9 + s$ and s should be at least 1 and p must be at most 10.

$\therefore s = 1$ and $p = 10$

$q + s$ = C = 4 $\Rightarrow q = 4 + 1 - 1 = 4$

Solutions for questions 28 to 31: Type in your answer in the space provided below the question.

28. The number of chocolates with A before distribution is equal to the total number of chocolates with A, B, C, D, E and F after distribution = 1 + 2 + 3 + 4 + 5 + 6 = 21.

29. D = 2 _____

30. q = 4 _____

31. A + B + D = 1 + 5 + 2 = 8 _____

Solutions for questions 32 to 35: From condition (1), A and F are not seated at the ends, also the people sitting at the ends do not have hall tickets whose number ends with 2.

From condition (2), since neither A nor F is at the ends they form the middle pair.

B/E E/B A/F F/A C/D D/C

Since the last two digits of the hall ticket numbers are multiples of 6: 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96.

Using condition (4), we get

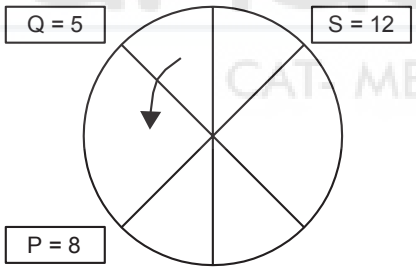
B/E	E/B	A/F	F/A	C/D	D/C
18		42/48	48/42		78

Using condition (5), we get

B	E	A	F	D	C
18	12	42/48	48/42	72	78

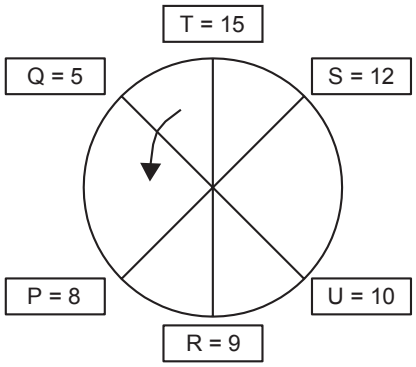
Solutions for questions 36 to 39: From (4), Q is the individual who has received 5 calls (minimum).

Therefore, using 1, 2, and 3 we have:



Calls are any number from of: 3, 6, 9, 12, 15, 18, 4, 8, 12, 16, 5, 10, 15.

With condition (3), P = 8 and S = 12 is the only possibility. Using condition (5), we get



Between 9 and 12 we have only 10, so U = 10. T = 15, 16 or 18 but since it has to be odd, only 15 is possible.

36. U received ten calls.

37. The difference is 15 – 5= 10.

38. P is second to the left of 8, who received eight calls.

39. The ratio is 3 : 3 = 1

Solutions for questions 40 to 43: From (2), we have

AP ⇒ Production target is 2000 tons (least) and area target is 1500 hectares (least).

Hence, from (1), yield target 2.5 for Gujarat's possible with yield target of 5000 tons and area target of 2000 hectares. Similarly, for Karnataka 2.86 = 3000/3500.

From (2), for Andhra Pradesh yield target
= 2000/1500 = 1.33

Tamil Nadu > 1.33 > Maharashtra

From (3), for Tamil Nadu yield target 2 is possible, under the given condition, only for a production target of 4000 tons and area target of 2000 hectares.

From (4), it can be said that for Maharashtra, the production target is 3000 tons, area target is 3000 hectares. Hence, yield target is 1.

The final table is as follows:

State	Yield	Production target	Area target
Gujarat	2.5 (1)	5000 (1)	2000 (3)
Karnataka	0.86 (5)	3000 (4)	3500 (1)
Andhra Pradesh	1.33 (3)	2000 (5)	1500 (5)
Tamil Nadu	2 (2)	4000 (2)	2000 (4)
Maharashtra	1 (4)	3000 (3)	3000 (2)

40. The rank of Gujarat in terms of area target is 3.

41. The rank of Karnataka in terms of production target is 4.

42. Kanataka's 2 × 3500 = 7000
New target = 7000
So, excess target = 7000 – 3000
= 4000

43. New yield = 1, so production is 2000.
⇒ 2000 hectares more required to maintain production target.

Solutions for questions 44 to 47: Let's assume Santiago is TT then all his statements would be true.

	S_1	S_2	S_3
Santiago	T	T	T

	Santiago	Benjamin	Mateo
Product	DT	Saree	Shawl
Cost	2000		3000
Tax @10%	200		300

So, now Benjamin's statement should be analysed (DT stands for Darjeeling tea) using the above table.

	S_1	S_2	S_3
Santiago	T	T	T
Benjamin	?	T	F

Since, there is one true and false statement Benjamin is an alternator.

. S_1 is false ⇒ Mateo purchased Shawl.

Now, the above information is compared with Mateo's statement.

		S_1	S_2	S_3
Truth teller	Santiago	T	T	T
Alternator	Benjamin	F	T	F
Liar	Mateo	F	T	T

Here, S_3 is true. But Mateo must be a liar. We have come across a contradiction. Hence, Santiago cannot be the truth teller.

Let Benjamin be truth teller (TT).

	S_1	S_2	S_3
Benjamin	T	T	T

	Santiago	Benjamin	Mateo
Product	Shawl		
Cost		2000	3000
Tax @10%		200	300

With the above table let us analyse Santiago's statement.

	S_1	S_2	S_3
Benjamin	T	T	T
Santiago	?	T	F

So, Santiago S_1 = F

Therefore, Benjamin bought Darjeeling tea.

	Santiago	Benjamin	Mateo
Product	Shawl	DT	Saree
Cost		2000	3000
Tax @10%		200	300

Now, Mateo's statement can be analysed using the above table.

	S_1	S_2	S_3
Benjamin	T	T	T
Santiago	F	T	F
Mateo	F	F	F

So, Benjamin = Truth teller
Santiago = Alternator
Mateo = Liar

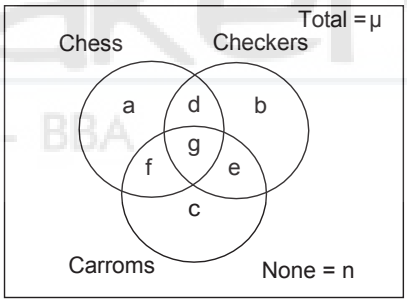
44. `2200 is paid for Darjeeling tea.

45. 1.5 times.

46. `1100 is paid by Santiago.

47. In all, `6600 is spent.

Solutions for questions 48 to 51:



Let us represent the given information in the form of a Venn diagram.

Let the number of people who play Checkers = $21x$

From (iv), $b + d + g + e = 21x$ and $g + e = 12x \Rightarrow b + d = 9x$

From (ii), $g + e = a = 12x$

From (i), $3g = 21x$ (or) $g = 7x \Rightarrow e = 5x$

From (vi), $e : n = 1 : 2$

$\therefore n = 10x$

From (iii), $d : n = 3 : 5$

$\therefore d = 6x \Rightarrow b = 3x$

From (vi), $d + e + f : e = 4 : 1$

$\therefore f = 9x$

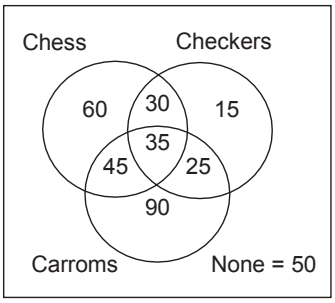
From (v), $c : b = 6 : 1$

$\therefore c = 18x$

$a + b + c + d + e + f + g + n$

$= 12x + 3x + 18x + 6x + 5x + 9x + 7x + 10x = 70x$

Given that $70x = 350$
$\Rightarrow x = 5$



. The final Venn diagram is as follows:

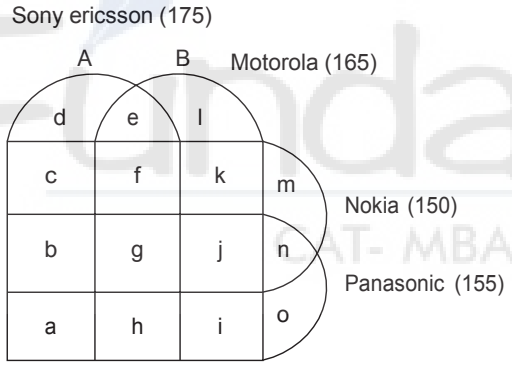
48. 30 + 45 + 25 = 100 people play exactly two games.

49. Chess but not Carroms = 60 + 30 = 90.

50. Do not play Chinese Checkers = Total – Chinese Checkers = 350 – (30 + 15 + 35 + 25) = 300 – 105 = 245.

51. Chess or Carroms = Total – (None + Chinese Checkers only) = 350 – (50 + 15) = 285.

Solutions for questions 52 to 55:



It is given that Sony Ericsson and Motorola = 75
$\Rightarrow e + f + g + h = 75$ (1)
Also,
Nokia and Panasonic = 75 $\Rightarrow b + g + j + n = 75$ (2)
(1) + (2) = $e + b + f + j + h + n + 2g = 150$
Given that exactly three = 75
$\therefore f + b + j + h = 75 \Rightarrow e + n + 2g = 75$
Also, given that sum of the number of families using Sony Ericsson and Motorola only and the number of families using Nokia and Panasonic only is 25.
$\Rightarrow e + n = 25$
$\therefore g = 25$

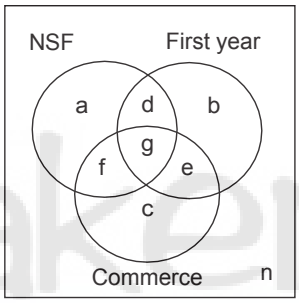
52. All the four = g = 25

53. Exactly one + Exactly two + Exactly three + Exactly four = 280.
Given that: Exactly two = Exactly one + 100
As Exactly four = 25 and Exactly three = 75. Exactly two = 140.
. Exactly two + Exactly three = 215.

54. Exactly two + Exactly three = 215 and Exactly four = 25
. Exactly one = (Exactly one + 100) = 280 – (75 + 25)
$\Rightarrow$ Exactly one = 40

55. Given, $f + h = 35$.
We have, $e + f + g + h = 75 \Rightarrow e + g = 75 - 35 = 40$.
Also, $g = 25 \Rightarrow e = 15$
Also, we know that $e + n = 25 \Rightarrow n = 10$
Sony Ericsson + Motorola = 175 + 165 = 340
$\therefore a + b + c + d + i + j + k + l + 2(e + f + g + h) = 340$
$a + b + c + d + e + f + g + h + i + j + k + l = 340 - 75 = 265$ (1)
Total – (1) = $m + n + o = 280 - 265 = 15$
We have: $n = 10$
$\therefore m + o = 5$
The required value is 5.

Solutions for questions 56 to 60: Consider the following Venn diagram. Group total (GT) = 500



$a + b + c + d + e + f + g + n = 500$ (1)

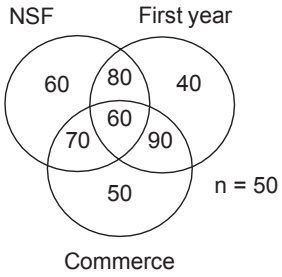
In the above Venn diagram, the number inside each circle is the number of students who belong to that group and the remaining belong to the other group in the category.

Example: Number of NSF members is $a + d + f + g$.
and the number of SFI members is $b + c + e + n$.

Here, 'n' represents the second year Science students who are SFI members. Also, the number of the first year Science students who are NSF members is d.

Given $e = 90$ (2)
$a + d + f + g = 270$ (3)
$c = 50$ (4)
$d + g = 140$ (5)
$d + f = 150$ (6)
$f + c = 120$ (7)
$a + b = 100$ (8)
From (4) and (7), $f = 120 - 50 = 70$ (9)
From (9) and (6), $d = 150 - 70 = 80$ (10)
From (10) and (5), $g = 140 - 80 = 60$
. From (3), $a = 270 - (d + f + g)$
$= 270 - (150 + 60) = 60$
From (8), $b = 100 - 60 = 40$
From the above results, we calculate the final result:
$n = 500 - (270 + 90 + 40 + 50) = 50$

. The final Venn diagram is as follows.
GT = 500



56. The required number is n, i.e., 50.

57. The required number is b, i.e., 40.

58. The required number is g, i.e., 60.

59. The required number is $c + g$, i.e., 50 + 60 = 110.

60. The required number is GT – ($b + e$),
i.e., 500 – 40 – 90 = 370.

Challenge Your Understanding
Practice Set 2

Directions for questions 1 to 4: Answer the questions on the basis of the information given below.

A group of six children, namely Sanjay, Srikanth, Mandira, Jeffery, Charu and Rameez each of a different height are asked to bring as many books as possible from a room in which exactly 21 books from A through U are kept distributed among six shelves, each of which contains a distinct number of books and is at a height equal to the height of exactly one of the six children.

The children bring the books from the room, one after the other, such that no two children are in the room at the same time and each child brings all the books contained in all the shelves which are accessible to him/her, i.e., all the shelves that are at his/her height and below. The following information is further available:

(i) There is at least one book in each shelf and the total number of books in all the shelves that are accessible to at most two children is the same as that in all the shelves that are accessible to at least five children, which in turn is the same as that in all the shelves that are accessible to less than five but more than two children.

(ii) Though Rameez is taller than Jeffery, he returns without bringing any book.

(iii) The number of books that each of Srikanth, Mandira and Sanjay bring is the same.

(iv) Rameez enters the room immediately before Srikanth, who is taller than Mandira.

(v) Though, Charu, who enters the room after Rameez and Srikanth is not the shortest, he does not bring any book.

(vi) Jeffery brings six books, while Sanjay is the last one to enter the room.

1. Who is the third to enter the room?

(A) Mandira (B) Rameez
(C) Srikanth (D) None of these

2. How many of the children are shorter than Charu?

(A) Two (B) One
(C) Three (D) Four

3. What is the number of books kept in the shelf which is at the height of Srikanth?

(A) Two (B) Three
(C) Four (D) Five

4. If the children are ranked according to their heights, such that the tallest child is ranked 1st, then who brings as many books as his/her respective rank in terms of height?

(A) Mandira (B) Sanjay
(C) Srikanth (D) Jeffery

Directions for questions 5 to 7: These questions are based on the following information.

Top 64 players participated in a knock out tennis tournament. This tournament has five knock out rounds before the final, i.e., first round, second round, third round, quarter finals and semi-finals. In the first round, the highest seeded player (Seed 1) plays the lowest seeded player (Seed 64) and this match is designated as Match 1 of the first round; the 2nd seeded player plays the 63rd seeded player and this match is designated as Match 2 of the first round and so on. Thus, for instance Match 32 of the first round is to be played between the 32nd seeded and the 33rd seeded players. In the second round, the winner of Match 1 of the first round plays the winner of Match 32 of the first round and this match is designated as Match 1 of the second round. Similarly, the winner of Match 2 of the first round plays the winner of Match 31 of the first round and this match is designated as Match 2 of the second round. Thus, for instance, Match16 of the second round is to be played between the winner of Match 16 of the first round and the winner of Match 17 of the first round. The same pattern is followed for later rounds as well. An upset is said to be taken place if a lower seeded player beats a higher seeded player.

5. What is the maximum possible number of upsets in the tournament?

(A) 64 (B) 63
(C) 127 (D) 32

6. If there is no upset in the tournament, with whom does Seed 3 play in the quarterfinals?

(A) Seed 6 (B) Seed 2
(C) Seed 4 (D) Seed 5

7. If Seed 43 reaches the third round, who among the following players could he have played in that round?

(A) Seed 52 (B) Seed 36
(C) Seed 54 (D) Seed 38

Directions for questions 8 to 10: These questions are based on the following information.

Each of the three people, namely Mamta, Madhuri and Mithu, belong to different city among Hyderabad, Delhi and Mumbai and also each work in a different city among the cities mentioned above. A person, who belongs to a city, does not work in the same city. When they were asked about themselves, they gave the following replies.

Mamta: I belong to Delhi. Mithu does not work in Delhi.
Madhuri: I work in Delhi. Mithu belongs to Mumbai.
Mithu: I do not work in Delhi. Mamta belongs to Mumbai.

It is also known that, each of them alternates between truth and lie in any order.

8. If Mamta works in Delhi, where does Mithu belong to?
(A) Hyderabad
(B) Delhi
(C) Mumbai
(D) Hyderabad or Delhi

9. If the first statement of the person, who belongs to Delhi is true, where does Mamta work?
(A) Mumbai (B) Delhi
(C) Hyderabad (D) Either (A) or (B)

10. Who belongs to Hyderabad?
(A) Madhuri (B) Mamta
(C) Mithu (D) Either (A) or (B)

Directions for questions 11 to 15: These questions are based on the following data.

In a medical college, the courses being offered in a semester are Anatomy, Physiology, Pathology, Ophthalmology, Microbiology, Pharmacology, Biochemistry, Forensic Medicine and Cardiology. Every student is expected to enrol for 6 subjects, subject to the following conditions:

(i) The student must always choose only one subject between Anatomy and Pathology.
(ii) The student must enrol for two and only two subjects from among Physiology, Ophthalmology and Cardiology.
(iii) The student must also opt for Anatomy, Physiology and Biochemistry, if he or she enrols for Pharmacology.
(iv) The student cannot opt for Microbiology, if he or she has not chosen Pathology or Biochemistry.
(v) The student who does not enrol for Physiology or Pathology cannot choose Forensic Medicine.

11. If a student enrols for Cardiology and Forensic Medicine, then he or she must enrol for
(A) Biochemistry and Microbiology
(B) Anatomy and Pharmacology
(C) Ophthalmology and Microbiology
(D) Biochemistry and Pharmacology

12. If a student enrols for Microbiology, then the courses he or she cannot opt for are
(A) Pathology and Physiology
(B) Microbiology and Biochemistry
(C) Forensic Medicine and Microbiology
(D) Anatomy and Pharmacology

13. The two courses which can never be taken up together are
(A) Pharmacology and Microbiology
(B) Physiology and Pathology
(C) Biochemistry and Ophthalmology
(D) Cardiology and Pathology

14. If a student enrols for Microbiology and Forensic Medicine, then he or she must enrol for
(A) Ophthalmology
(B) Cardiology
(C) Pharmacology
(D) Either (A) alone or (B) alone

15. If a student chooses Ophthalmology and Cardiology, then the maximum number of courses that he or she can enrol for are (given that the condition regarding number of courses to be selected could be violated)
(A) Six (B) Five
(C) Four (D) Three

Directions for questions 16 to 19: These questions are based on the following information.

A logician is telling his wife about four pieces of jewellery he has just seen in an exhibition. 'I have seen a watch, a ring, a necklace and a brooch. The heavier of the necklace and the brooch is the costliest, while the costlier of the watch and ring is the lightest. The cheaper of the ring and the brooch is the heaviest, while the heavier of the necklace and the ring is the cheapest. Also, if the brooch is costlier than the necklace, then it is lighter than the watch'. His intelligent wife immediately ranks them in terms of their cost and weight and says, 'We cannot determine the ranks of two of the pieces in one of the comparisons'.

16. Which of the following pairs is the wife of the logician talking about?
(A) Necklace and Brooch
(B) Brooch and Watch
(C) Watch and Ring
(D) Ring and Necklace

17. The logician then gave his wife an additional statement which was sufficient to determine the complete rank-list in both the comparisons. Which one of the following statements did the logician give his wife?
(A) If the ring is lighter than the necklace, then the necklace is costlier than the brooch.
(B) If the necklace is lighter than the brooch, then the brooch is costlier than the watch.
(C) If the watch is cheaper than the ring, then the ring is heavier than the watch.
(D) If the ring is not lighter than the watch, then the watch is costlier than the brooch.

18. Which of the following is the costliest?
(A) Necklace (B) Brooch
(C) Watch (D) Either (A) or (B)

19. Which of the following is the lightest?
(A) Ring (B) Watch
(C) Necklace (D) Either (B) or (C)

Directions for questions 20 to 24: These questions are based on the following information.

A group of six football teams from Maharashtra, Tamil Nadu, West Bengal, Delhi, Karnataka and Andhra Pradesh participated in a tournament. After the first two rounds, it is known that every team played with two different teams, one in each round and won one of the matches and lost the other.

Each team scored a different number of goals, such as 2, 3, 4, 5, 6 and 7 in the first round of tournament and each team scored a different number of goals, such as 1, 3, 4, 5, 6 and 8 in their second round of tournament. We know the following information about their scores.

(i) West Bengal scored nine goals in total, but it scored less number of goals in the match they won with respect to that in the match they lost.
(ii) The number of goals scored by Tamil Nadu in the first round is the same as that conceded by it in the second round.
(iii) The number of goals conceded by Karnataka is the same in both the rounds and in both the matches the difference of goals between the winner and the loser is two.
(iv) The total number of goals scored in each of the two matches of Maharashtra is 10 but the total number of goals scored by Maharashtra is not 10.
(v) Delhi is the only team that scored the same number of goals in both the matches. But in total, it scored less number of goals than any of the other teams.

20. What is the maximum number of goals scored in any match?
(A) 14 (B) 11
(C) 12 (D) 13

21. Which team scored the least number of goals in a match?
(A) Delhi (B) Karnataka
(C) Andhra Pradesh (D) West Bengal

22. Which team scored the maximum number of goals in both the matches together?
(A) West Bengal (B) Tamil Nadu
(C) Karnataka (D) Maharashtra

23. Against which team did Delhi win the match in the first two rounds?
(A) West Bengal (B) Maharashtra
(C) Tamil Nadu (D) Andhra Pradesh

24. What is the number of goals scored by Maharashtra in the match it won?
(A) Six (B) Five
(C) Seven (D) Four

Directions for questions 25 to 28: These questions are based on the following information.

Harish, Mahesh, Divya, Rohini, Dilip and Seema are a group of people, who are performing in six cities across India. The cities are Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad. All six of them can sing, dance and play music. In each of the six cities they perform all the three activities one after the other. They stage three shows in each city and in each show, they perform one of the activity. Each of them has a fixed partner and perform only with their partners in any city or any show or in any activity. Each pair performs only one activity in a city. Further the following information is known.

(1) Divya sings in Delhi but does not dance in Bangalore.
(2) Rohini sings in Hyderabad and Harish who dances in Delhi sings in Chennai.
(3) Seema plays music in Delhi and Rohini plays music in Mumbai.
(4) Harish does not sing in Kolkata and Mahesh do not sing in Hyderabad but sings in Bangalore.
(5) Divya plays music in two cities only and Harish sings in three cities.
(6) In Chennai, Dilip is one of the dancers.

25. Which pair dances in Mumbai?
(A) Harish – Mahesh (B) Dilip – Divya
(C) Rohini – Seema (D) Cannot be determined

26. Which of the following is true?
(A) Harish and Mahesh will dance in Kolkata.
(B) Rohini and Seema dance only in two cities.
(C) Dilip and Divya play music in Bangalore.
(D) None of the above

27. If Harish and Mahesh play music in Kolkata, then who plays music in Hyderabad?
(A) Harish and Mahesh
(B) Dilip and Divya
(C) Rohini and Seema
(D) Cannot be determined

28. Which of the following statement is sufficient to know the complete schedule?
(A) Harish and Mahesh dance in Kolkata.
(B) Dilip and Divya play music in Hyderabad.
(C) Rohni and Seema dance in Kolkata.
(D) Harish and Mahesh dance in Hyderabad.

Directions for questions 29 to 33: These questions are based on the following information.

The Dean of a college, Prof. Himanshu, asked Prof. Deodhar to provide him with the analysis of the results of recently completed semester exams in the college, which was written by 108 students. Prof. Deodhar analysed the performance of students in five different subjects, such as Business Statistics (BS), Micro Economics (ME), Supply

Chain Management (SCM), Marketing Management (MM) and Consumer Behaviour (CB). The following are some of his observations.

(i) The students who passed in MM failed in all other subjects except CB.
(ii) The students who did not fail in BS, passed in ME.
(iii) The number of students who failed in four subjects is seven less than those who did not pass in ME. The number of students who passed in three subjects is 18.
(iv) The students who failed in CB passed in ME and none passed in both the subjects.
(v) The number of students who passed only in ME is 17 and those passed in MM is 13.
(vi) The number of students who passed in SCM is 46 and the number of students who passed only in CB is 10.

29. How many students passed in exactly two subjects?
(A) 46 (B) 52 (C) 41 (D) 63

30. How many students who passed in BS also passed in at least one of the other subjects?
(A) 22 (B) 40
(C) 18 (D) 57

31. How many students passed in all subjects except ME and MM?
(A) 21 (B) 11 (C) 10 (D) 0

32. How many students passed in SCM but not in BS?
(A) 18 (B) 28
(C) 38 (D) None of these

33. Which of the following statements is/are true?
I. The number of students who passed in at least two subjects is 81.
II. The number of students who passed in only SCM and ME is 17.
(A) Only I (B) Only II
(C) Both I and II (D) Neither I nor II

Directions for questions 34 to 38: These questions are based on the following information.

In the year 2012, KBC Inc., started a GK training institute for general public. It offers certifications in five grades. (In each grade there may be students who newly enrolled or students promoted from a lower grade or students retained from the same grade of previous year.)

A consultant who wanted to perform an audit of the institute's performance collected the following data:

New Enrolments:

(i) In the first year, 50 students each have enrolled in each of the grades. The number of enrolments in Grade I is the same every year.
(ii) In grades II, III, IV and V, there were no new enrolments in a grade whenever the number of students retained in that grade is more than or equal to the number of promotees to that grade. In all other cases, their number is equal to the difference of numbers of the students retained and the students promoted.
(iii) No student has left the institute.

Retention of Students:

(iv) The number of students retained in any grade is at most 50 and is a multiple of 10.
(v) Year 2015 has the lowest number of students retained, i.e., 140.
(vi) In any year, no two grades have the same number of retained students.
(vii) For any grade, no two years have the same number of retained students.

Promotions:

(viii) Every student who is not retained is awarded the grade certificate and is promoted to the next higher grade for the next year.
(ix) In no grade among I, II, III and IV, in any year, all the students have been promoted. In Grade V, only in 2014 all the students have been issued certificates.

Further, the following incomplete table is shared by one of the employees:

	2012	2013				2014				2015				2016			
	T	N	R	P	T	N	R	P	T	N	R	P	T	N	R	P	T
Grade I	50				100		40				30						70
Grade II	50				40						20		120		50		
Grade III	50						30										
Grade IV	50			30	60												
Grade V	50		30					10					20		10		40

N = New enrolments
R = Number of students retained from the same grade previous year
P = Students of one lower grade promoted from previous year
T = Total number of students

Directions: Type in your answer in the space provided below the question.

34. How many Grade V certifications were issued in all, during the given period?_____

35. What is the highest number of new enrolments in any grade across all years? _____

36. How many new enrolments were made in the year 2014? _____

37. What was the total strength of the students in the year 2015? _____

38. In which year KBC Inc. had seen the highest 'New total enrolments'? _____

Directions for questions 39 to 42: These questions are based on the following information.

A, B, C, D and E are five friends each of whom answered five questions in an examination. Each question has five answer choices a, b, c, d and e. The answers marked by the five friends are given in the following table:

	Q.no.1	Q.no 2	Q.no. 3	Q.no. 4	Q.no. 5
A	b	c	a	e	d
B	b	e	b	b	d
C	e	c	b	e	a
D	b	c	a	b	d
E	b	b	a	e	d

The following information is known regarding them:

(i) Each person has answered at least one question correct/right in the examination.

(ii) Only one person has got all the answers correct in the examination.

(iii) But for B and E, no two among the others have got the same number of questions correct in the examination.

(iv) Each question has only one correct answer.

39. Which of the following person has got all the questions correct?

(A) A (B) B
(C) D (D) C

40. What is the right choice/answer for Question 2?

(A) e (B) c
(C) b (D) a

41. How many questions were answered correctly by B?

(A) Two (B) One
(C) Four (D) Three

42. Which of the following combination is correct?

(A) A – 1 (B) D – 5
(C) B – 5 (D) C – 5

Directions for questions 43 to 45: These questions are based on the following information.

There are 10 boxes, each containing n balls. Each of the balls in nine boxes weigh 1 kg whereas each of the balls in the remaining box weighs 2 kg. A spring balance is used to weigh these balls and m is the minimum number of weighing required to find the box that contains the 2 kg balls.

43. If $n = 10$, then $m =$

(A) One (B) Two
(C) Three (D) Four

44. If $n = 2$, then $m =$

(A) Two (B) Three
(C) Four (D) Five

45. If $n = 3$, then $m =$

(A) Two (B) Three
(C) Four (D) Five

Directions for questions 46 to 48: These questions are based on the following information.

A group of five friends, namely A, B, C, D and E purchased exactly one fruit basket from among the five fruit baskets, such as P, Q, R, S and T. Each of the five baskets contained four apples or five bananas or six oranges or seven mangoes or eight guavas. No two baskets contained the same variety of fruits. Q contained six fruits in it. Each of the five friends, then transferred at least one and at most two fruits from her respective basket to each of the other baskets. None of the friends transferred any fruit that they received from another. After all the transfers, it is observed that

(i) R has no guavas in it.

(ii) P has a total of ten fruits, at least three of which are mangoes.

(iii) T has six fruits in all, none of which is an apple.

46. How many fruits were there in S initially?

(A) Six (B) Seven
(C) Four (D) Five

47. Which fruit is present in all the baskets after all the transfers?

(A) Banana (B) Orange
(C) Mango (D) Both Orange and Mango

48. Which of the following statements is true?

(A) The baskets having the same total number of fruits after all the transfers have an equal number of each kind of fruit.

(B) The two baskets which have a difference of four in the total number of fruits after all the transfers have an equal number of fruits of exactly three kinds.

(C) After all the transfers, no two baskets have an equal number of fruits of more than two kinds.

(D) The basket which was initially having the highest total number of fruits, now has the lowest total number of fruits.

Directions for questions 49 to 52: Answer these questions on the basis of the information given below.

The company XYZ Ltd. recruited 80 trainees, of which it was observed that every trainee has

(i) Exactly one qualification among
  (a) B.E. (b) M.Sc.

(ii) At least one feature among the following two
  (a) He is from a reputed college.
  (b) He has a good academic record.

(iii) Experience in exactly one of the following two domains
  (a) Programming (b) Testing

Further it is also known that:

(a) 20 trainees who are B.Es have good academic record as well as experience in Testing. These trainees form 50% of those with experience in Testing.

(b) No trainee with experience in Programming has both the features mentioned in (ii), i.e., being from a good college and having a good academic record.

(c) 30 trainees were M.Scs, of which 15 have experience in Programming.

(d) Of the trainees with experience in Testing, 15 were from a reputed college and they have good academic record.

(e) In total, 45 trainees have good academic record, of which two-thirds were B.Es and one-third have experience in Programming.

49. How many of the trainees with experience in Programming are B.Es and also have good academic record?
(A) 8 (B) 10
(C) 12 (D) Cannot be determined

50. How many trainees with experience in Testing have good academic record and also are B.Es and are from a reputed college?
(A) 5 (B) 7
(C) 12 (D) Cannot be determined

51. How many M.Scs are from a reputed college but have neither a good academic record nor any experience in Programming?
(A) 5 (B) 6
(C) 7 (D) Cannot be determined

52. If 18 B.Es have good academic record but are not from a reputed college, how many M.Scs are from a reputed college and with good academic record?
(A) 3 (B) 4
(C) 5 (D) Cannot be determined

Directions for questions 53 to 56: These questions are based on the following information.

A group of six people, namely Anand, Bindu, Charu, Dilip, Indu and Kiran stay in rooms numbered from 1 through 6. There are two types of products, such as books and mobiles. Among them, three people bought books and the others bought mobiles. The books are Maths, Physics and Chemistry and the mobiles are Nokia, LG and Samsung. The following is also known.

(1) No two people with consecutive room numbers bought the same type of product.
(2) Charu stays in room number 6 and Anand in room number 3.
(3) Bindu and Charu bought the same type of product; Anand and Dilip bought different types of product.
(4) Indu bought LG mobile and Bindu bought Maths book.
(5) The person who stays in room number 4 bought Chemistry book.
(6) The person in room number 5 bought Nokia mobile.

53. Who bought the Chemistry book?
(A) Anand (B) Charu
(C) Dilip (D) Kiran

54. Who stays in room number 2?
(A) Bindu (B) Dilip
(C) Indu (D) Kiran

55. The person who is in room number 1 bought_____.
(A) LG mobile (B) Maths book
(C) Samsung mobile (D) Physics book

56. The person who bought Samsung mobile is in the room number adjacent to that of_____.
(A) Indu
(B) Charu
(C) The person who bought Physics book.
(D) The person who bought Maths book.

Directions for questions 57 to 59: These questions are based on the following information.

A group of people, namely Ram, Shyam, Tarun and Uday belong to Zig-zag island. In that island, there are four different types of people. Yes-Yes type, who always speak truth, No-No type who always lie, Yes-No type who speak truth first followed by a lie and No-Yes type people who speak a lie first followed by a true statement.

No two people belong to the same category. The following are the statements made by them.

Ram:	Shyam is No-No type.
	Uday is Yes-No type.
Shyam:	Tarun is No-No type.
	I am Yes-Yes type.
Tarun:	I am Yes-No type.
	Shyam is Yes-No type.
Uday:	Tarun is No-No type.
	Shyam is No-No type.

57. Who belongs to Yes-No type?
(A) Ram (B) Shyam
(C) Uday (D) Tarun

58. Who belongs to No-No type?
(A) Ram (B) Shyam
(C) Uday (D) Tarun

59. Who belongs to No-Yes type?
(A) Ram (B) Shyam
(C) Tarun (D) Uday

Directions for questions 60 to 63: These questions are based on the following information.

In a cricket trophy, a group of six teams, such as Australia, India, New Zealand, South Africa, Sri Lanka, England are competing against each other.

Matches are held in 2 stages. In Stage-1, each team plays 3 matches and in the Stage-2, each team plays 2 matches. Each team plays against the other only once. Tie breakers are used to avoid draw matches.

The observations after Stage-1 and Stage-2 are as given below:

STAGE-1:
(i) One team won all the matches in this stage.
(ii) Two teams lost all the matches played in this stage.
(iii) England lost to Australia but won against Sri Lanka and New Zealand.
(iv) South Africa lost to India but won against Sri Lanka and New Zealand.
(v) India won at most 2 matches.
(vi) New Zealand did not play against the top-team in Stage-1.

STAGE-2:
(i) The top-team of Stage-1 lost all the remaining matches.
(ii) Of the two teams at the bottom after Stage-1, one team won both matches, while other lost both matches.
(iii) In all, 3 teams lost both matches in Stage-2.

60. The team which lost the highest number of matches is
(A) Sri Lanka
(B) New Zealand
(C) South Africa
(D) Sri Lanka and England

61. The team (s) that lost exactly two matches in the event is/are
(A) India (B) Australia
(C) New Zealand (D) Australia and India

62. The total number of teams that lost two matches in any stage is
(A) Two (B) Three
(C) Four (D) One

63. The team which won against Australia can be
(A) India (B) South Africa
(C) New Zealand (D) Both (B) and (C)

Directions for questions 64 to 67: These questions are based on the following information.

The Sports Authority of India (SAI), in its 'catch them young' drive selected 215 sprinters, from all over the country to be trained for the 2020 Olympics in three events, such as in 100 m, 200 m and 400 m. These sprinters were divided into three categories A, B and C.

'A' – The sprinters who are suitable for all the three events.
'B' – The sprinters who are suitable for only two events.
'C' – The sprinters who are suitable for only one event.

Further it is known that:
(1) The number of sprinters in categories A, B and C is 35, 60 and 120, respectively.
(2) Every sprinter is trained in at least one of the three events.
(3) From the sprinters in each category, an equal number of sprinters are trained in every possible combination of events, for which the sprinters of that category are suitable.

64. How many sprinters are trained in exactly two events?
(A) 60 (B) 45
(C) 30 (D) 50

65. If during training, 60% of the sprinters of Category A who are trained in only the 400 m were selected for training in the 100 m as well, then how many sprinters are trained only in the 100 m and the 400 m events?
(A) 21 (B) 15
(C) 18 (D) 24

66. It is known that VISAS can be issued to only 35 athletes to participate in the Olympics. If SAI wants to put its athletes to optimum utilization, then how many times the names of the Indian athletes appear in the list of participants in these three events together?
(A) 60 (B) 85
(C) 75 (D) 50

67. In view of the conditions imposed in the previous question, what is the least possible number of athletes who participate in the 200 m sprint event?
(A) 35 (B) 20
(C) 15 (D) 10

Directions for questions 68 to 70: These questions are based on the information given below.

A group of five friends, namely Tushar, Bhupen, Jemmy, Arpit and Manas went to a shop with `75, `150, `40, `300 and `200, respectively. Five materials, such as Pen, Bracelet, Perfume, Wristwatch and Teddy Bear are available in that shop and the costs per unit of the above items are `20, `30, `50, `70 and `100, respectively. Each of the five people bought at least one of the items and on each item they together spent at least `100. At the end of their shopping,

the shopkeeper received `610 in total. None of them bought more than one quantity of any item.

68. Who among them was left with the maximum amount of money at the end of the shopping?
(A) Bhupen (B) Arpit
(C) Manas (D) Tushar

69. Who among them did not buy the Bracelet?
(A) Tushar
(B) Bhupen
(C) Jemmy
(D) More than one of the above

70. Which of the following is false regarding the exact amount which they were left with?
(A) Exactly two among them was left with `30 each.
(B) Exactly one among them was left with `20.
(C) None of them was left with `40.
(D) Exactly two among them was left with `20 each.

Directions for questions 71 to 74: Answer the following questions based on the information given below.

Six teams (P, Q, R, S, T and U) are taking part in a cricket tournament. Matches are scheduled in two stages. Each team plays three matches in Stage-I and two matches in Stage-II. No team plays against the same team more than once in the event. No ties are permitted is any of the matches. The observations after the completion of Stage-I and Stage-II are as given below.

Stage-I:
- One team won all the three matches.
- Two teams lost all the matches.
- S lost to P but won against R and U.
- T lost to Q but won against R and U.
- Q lost at least one match.
- U did not play against the top team of Stage-I.

Stage-II:
- The leader of Stage-I lost the next two matches.
- Of the two teams at the bottom after Stage-I, one team won both matches, while the other lost both the matches.
- One more team lost both matches in Stage-III.

71. The two teams that defeated the leader of Stage-I are
(A) U and S (B) T and U
(C) Q and S (D) T and S

72. The only team(s) that won both matches in Stage-II is (are)
(A) Q (B) T and U
(C) P, T and U (D) Q, T and U

73. The teams that won exactly two matches in the event are
(A) S and U (B) S and T
(C) T and U (D) S, T and U

74. The team(s) with the most wins in the event is (are)
(A) Q and T (B) P and R
(C) U (D) T

Directions for questions 75 to 78: Answer the questions on the basis of the information given below.

Two person, Arjun and Madhu were involved in buying and selling of gold over five trading days. At the beginning of the first day, the price of a gram of gold was `1000, while at the end of the fifth day it was priced at `1100. At the end of each day, the gold price (per gram) went up by `100 or it came down by `100. Both Arjun and Madhu took buying and selling decisions at the end of each trading day. The beginning price of gold on a given day was the same as the ending price of the previous day. Arjun and Madhu started with the same quantity of gold and amount of cash and had enough of both. Below are some additional facts about how Arjun and Madhu traded over the five days.

- Each day, if the price went up, Arjun sold 10 grams of gold at the closing price. On the other hand, each day if the price went down, he bought 10 grams at the closing price.
- If on any day, the closing price was above `1100, then Madhu sold 10 grams of gold, while if it was below `900, he bought 10 grams, all at the closing price.

Directions: For the multiple choice questions, select the correct alternative from the given choices. For the non-multiple choice questions, write your answer in the space provided.

75. If Arjun sold 10 grams of gold on three consecutive days, while Madhu sold 10 grams only once during the five days, the price of gold (per gram) at the end of day 3 was `._____

76. If Arjun ended up with `13000 more cash than Madhu at the end of day 5, the price of gold (per gram) at the end of day 4 was `. _____

77. If Madhu ended up with 20 grams of gold more than Arjun at the end of day 5, the price of a gram of gold at the end of day 3 was `. _____

78. If Madhu ended up with `1000 less cash than Arjun at the end of day 5, what was the difference in the quantity of gold with Madhu and Arjun (at the end of day 5)?
(A) Madhu had 10 grams more than Arjun.
(B) Madhu had 20 grams more than Arjun.
(C) Arjun had 10 grams more than Madhu.
(D) Both had the same quantity of gold.

Directions for questions 79 to 82: These questions are based on the information given below:

In factory XYZ, the factory raw material passes through five stages during processing. The five stages of processing require machines A, B, C, D and E, respectively. The processing

can be done only in the above-mentioned order. The capacity and time taken for processing by each machine is as given below.

Machine	Max capacity	Time taken
A	50 kgs	4 hours
B	25 kgs	3 hours
C	10 kgs	1 hours
D	20 kgs	1 hours
E	50 kgs	4 hours

Time taken by each machine to process the material is called a cycle.

Machine A needs a break of two hours after every cycle.

Machine B and E can run continuously. Machine C needs a break of 1 hour after a maximum of three cycles. After every break it can run for three continuous cycles.

Machine D needs a break of 1 hour after a maximum of two cycles.

A machine takes the same time to process irrespective of the capacity used.

There is 100 kg raw material in the factory which needs to be processed.

Directions: For the multiple choice questions, select the correct alternative from the given choices. For the non-multiple choice questions, write your answer in the space provided.

79. The minimum time taken to process the 100 kg raw material is hours._____

80. By doubling the capacity of which of the following machines can the maximum time be reduced?

(A) Machine B (B) Machine D
(C) Machine E (D) Machine C

81. By doubling the capacity of any one machine, the processing time can be reduced by a maximum of _____ hours.

82. If the raw material available was only 50 kgs, then the minimum time required to process it is_____hours.

Directions for questions 83 to 86: These questions are based on the following information.

A group of eight lecturers, from A to H are scheduled to teach five subjects, such as Maths, Physics, Chemistry, Biology, and English during a week starting on Monday and ending on Friday such that each lecturer teaches only one subject and is scheduled to teach only once during the week. At least 1 and at the most 2 lecturers teach each subject. Each day has two slots, whereas it is only the morning slot and the afternoon slot such that no subject is taught more than once in the same slot (morning or afternoon) during the week. In addition to that, the same subject is not taught twice during a single day. No two lectures are scheduled simultaneously.

Further:

(i) A and C are scheduled to teach on the same day. G and H are scheduled to teach on the same day.
(ii) C and F teach the same subject. Also, E and H teach the same subject.
(iii) B teaches Chemistry and D teaches Biology. No one else teaches the subjects B and D teach.
(iv) D and E alone are scheduled to teach on their respective days.
(v) F teaches Maths during the morning slot on Friday.
(vi) Biology is taught during the morning slot on Tuesday.
(vii) Maths is taught immediately after the day D teaches. Physics is taught both immediately before and immediately after the day D teaches.
(viii) G is scheduled to teach before A, not necessarily immediately.

83. Which subject does E teach?

(A) Maths (B) Physics
(C) English (D) Cannot be determined

84. Which subject is not taught during the morning slot?

(A) Chemistry (B) English
(C) Physics (D) Maths

85. Which of the following slots is free (i.e., no lecture is scheduled)?

(A) Monday – Morning slot
(B) Wednesday – Afternoon slot
(C) Thursday – Morning slot
(D) Thursday – Afternoon slot

86. Which of the following pairs of subjects is not taught on the same day?

(A) English and Physics
(B) English and Maths
(C) Chemistry and Maths
(D) Maths and Physics

Directions for questions 87 to 91: Answer the questions on the basis of the information given below.

Kalyan, Laxman, Mohan, Naveen, Pranav, Qureshi, Rahul, Sanjay, Uday and Watson are the only ten people working in the HR department of a company. There is a proposal to form a team from within the members of the department, subject to the following conditions.

- A team must include exactly one among Pranav, Rahul and Sanjay.
- A team must include either Mohan or Quereshi but not both.

- If a team includes Kalyan, then it must also include Laxman and vice versa.
- If a team includes one among Sanjay, Uday and Watson, then it must also include the other two.
- Laxman and Naveen cannot be the members of the same team.
- Laxman and Uday cannot be the members of the same team.

Directions: For the multiple choice questions, select the correct alternative from the given choices. For the non-multiple choice questions, write your answer in the space provided.

87. Who cannot be a member of a team of Size 3?
(A) Laxman (B) Mohan
(C) Naveen (D) Pranav

88. Who can be a member of a team of Size 5?
(A) Kalyan (B) Laxman
(C) Mohan (D) Pranav

89. What is the maximum possible size of the team?_____

90. What could be the size of a team that includes Kalyan?
(A) 2 or 3 (B) 2 or 4
(C) Only 4 (D) Only 2

91. What is the number of ways in which a team can be constituted so that the team includes Naveen? _____

Directions for questions 92 to 96: Answer the questions independently of each other.

A group of 21 sports people from four southern states (Kerala, Karnataka, Tamil Nadu and Andhra Pradesh) are selected to receive the Arjuna Award. Each of the 21 people had represented India in one of the four disciplines, such as in Athletics, Basketball, Football and Cricket. The following facts about the sports people are known.

(i) The number of Basketball players was exactly half the number of sports people in each of the three other disciplines.

(ii) There was no Basketball player from Kerala. Otherwise, every state, including Kerala sent at least one sports person in each discipline.

(iii) None of the states had more than three sports person in any discipline.

(iv) Had there been one less sports person from Tamil Nadu, then there would have been twice as many sports people from Karnataka than each of the other states.

(v) Selvan and Muthuraj are two Football players among the 21 selected. They are from Tamil Nadu

92. Which of the following cannot be determined from the information given?
(A) Number of Basketball players from Karnataka.
(B) Number of athletes from Andhra Pradesh.
(C) Number of athletes from Tamil Nadu.
(D) Number of cricket players from Kerala.

93. Which of the following combinations is not possible?
(A) 2 Football players from Karnataka and 2 athletes from Kerala were among those selected.
(B) 2 Football players from Karnataka and 1 athlete from Kerala were among those selected.
(C) 3 cricket players from Karnataka and 1 athlete from Kerala were among those selected.
(D) Exactly 1 Football player from each of Kerala and Karnataka were among those selected.

94. If Arjun is the only Football player from Karnataka, then which of the following is not true about the number of sports people from the four states?
(A) There is one athlete from Kerala.
(B) There is one cricket player from Kerala.
(C) There are two athletes from Karnataka.
(D) There are three cricket players from Karnataka.

95. If the number of Football players from Karnataka is equal to the number of cricketers from that state, then what is the number of Cricket players from Karnataka?
(A) Two (B) Three
(C) One (D) Cannot be determined

96. Which of the following is true about the number of Football players from Tamil Nadu?
(A) It is twice the number of athletes from Kerala.
(B) It is twice the number of Football players from Kerala.
(C) It is twice the number of Cricket players from Kerala.
(D) None of these

Directions for questions 97 to 101: These questions are based on the following information:

A group of five students Anil, Sunil, Pavan, Naveen and Sravan appeared for an exam consisting of five questions. Each question is having five answer choices A, B, C, D and E and only one of them is the correct answer choice. The answers given by them is as follows.

Q. No.	Anil	Sunil	Pavan	Naveen	Sravan
1	B	C	D	B	C
2	A	D	B	A	C
3	C	A	D	A	D
4	A	B	C		A
5	E	B	B	E	C

It is also given that four marks are awarded to each correct answer while one mark is deducted for every wrong answer. No marks are awarded or deducted for the questions that are not attempted.

Further, it is known that:

(i) Naveen did not attempt the fourth question and the total score of Anil is zero.

(ii) Only one student answered the first question correctly, only one student answered the second question correctly, two students answered the third question correctly, only one student answered the fourth question correctly while two students answered the fifth question correctly.

(iii) Naveen's score is the highest among the five students and choice (A) is the correct answer for exactly one question.

(iv) The number of questions for which the correct answer choice is (B) is the maximum.

Directions: For the multiple choice questions, select the correct alternative from the given choices. For the non-multiple choice questions, write your answer in the space provided.

97. Who scored the lowest number of marks?

(A) Anil
(B) Sunil
(C) Pavan
(D) Sravan

98. What is the total marks scored by Naveen?_____

99. Which pair of students scored the same number of marks?

(A) Pavan and Sravan
(B) Anil and Sunil
(C) Anil and Sravan
(D) Pavan and Sunil

100. The difference between the highest score and the lowest score is_____.

101. If Naveen had marked the fourth question with an answer choice that he has not marked in any other question who would be scoring the second highest?

(A) Naveen
(B) Pavan
(C) Anil
(D) Both (A) and (B)

Directions for questions 102 to 104: These questions are based on the data given below.

A survey was conducted among 200 mobile subscribers of three different companies Airtel, IDEA and Cellone. It was found that 50 members do not subscribe to Cellone, 75 members do not subscribe to Airtel and 100 members do not subscribe to Idea. 125 subscribed to at least two of the three companies.

Directions: Type in your answer in the space provided in the question.

102. The number of customers who subscribe to exactly one service is_____.

103. The number of customers who subscribe to exactly two services is_____.

104. The number of customers who subscribe to exactly three services is_____.

Directions for questions 105 to 109: Answer the questions on the basis of the information given below.

Five friends met at a restaurant one evening. Each one brought some money. They had only `10 notes and `5 coins with them. Each had a different number of notes and coins. The number of notes they had were 2, 6, 8, 9 and 12. While the number of coins they had were 0, 3, 4, 8 and 12. Below are some more facts.

(i) The number of coins with Harish was three times the number of coins with the person who had six notes.

(ii) Three people, including the one who had eight coins, did not keep a wallet.

(iii) Dinesh did not keep a wallet

(iv) The one who had only two notes with him, did not have any coins or a wallet.

(v) Arpit had notes and coins and also had a wallet.

(vi) Manjeet, who did not have a wallet, had half as many coins as the person who had twice as many notes as he had.

(vii) Sohan had four more notes than Harish, but Harish had four more coins than Sohan.

105. Which of the following statements is true?

(A) Manjeet had 3 coins.
(B) Arpit had no coins.
(C) Harish had 4 coins.
(D) Sohan had 8 coins.

106. Which of the following statements is true?

(A) Manjeet had 8 notes.
(B) Arpit had 9 notes.
(C) Sohan had 6 notes.
(D) Dinesh had 9 notes.

107. Which of the following statements is true?

(A) Dinesh had 6 notes, no coins and no wallet.
(B) Sohan had 12 coins and 8 notes but no wallet.
(C) Harish had 8 notes and 12 coins but no wallet.
(D) Manjeet had 6 notes and 4 coins but no wallet.

108. Which of the following is the ratio of number of coins to that of notes with Arpit?
(A) 1 : 1 (B) 3 : 8
(C) 1 : 3 (D) 2 : 3

109. Which of the following statements is true?
(A) Sohan has twice as many coins as the number of notes that Mahesh has.
(B) Mahesh has twice as many coins as the number of notes that Arpit has.
(C) Harish has twice as many coins Mahesh has.
(D) Mahesh has twice as many notes as the number of coins that Arpit has.

***Directions for questions 110 to 113*:** These questions are based on the following information.

A school allows its students to choose their courses according to certain restrictions. Each course has a certain number of credits. The respective credits for each course are given below.

For example: Hindi has 2 credits; Physics has 4 credits and so on.

Each student must pick exactly one course from Group 1, exactly two courses from Group 2 and exactly two courses from Group 3. The courses and their respective credits are shown in the tables below.

Group 1		
Hindi	English	French
2	3	1

Group 2			
Physics	Biology	Chemistry	Maths
4	4	3	5

Group 3			
Sports	Arts and Crafts	Music	Dance
5	3	3	3

110. Manju chose courses with a total of 17 credits. If she did not pick Hindi, then which of the following courses cannot be picked together?
(A) French and Physics
(B) English and Chemistry
(C) French and Music
(D) English and Sports

111. If Ajay picked French and Chemistry and his aim is to choose maximum possible number of credits, then which course should not be picked by him?
(A) Music (B) Dance
(C) Biology (D) Maths

112. Surabhi has chosen a total of 18 credits. Which of the following is a possible combination of courses she picked?
(A) French and Chemistry
(B) Hindi and Biology
(C) English and Maths
(D) Both (B) and (C)

113. Madhuri has picked Maths and Music. She wants to choose a total of 19 credits. Which of the following pairs of courses can she pick?
(A) Hindi and Chemistry
(B) English and Biology
(C) English and Chemistry
(D) French and Sports

Directions for questions 114 to 117: These questions are based on the following data.

Five colleagues from different divisions of a company met in the club discussing their Sunday's winnings at cards games.

(i) Mathur and the person from Engineering division together had won `1500.
(ii) Sastry and Saxena together won `1400.
(iii) Saxena and the senior Vice President together won `1200.
(iv) Verma and the Production Manager had together won `1000.
(v) The General Manager and the International Trading Division person together won `900.
(vi) The Foods Division man and the Soaps Division person together won `700.
(vii) The Vice President and the Oil Seeds Division person together won `600.
(viii) Rao and the Soaps Division person together won `400.
(ix) The Deputy General Manager together with the only person in Churidar-kurta won `800.
(x) The two people in three-piece suit together won `1100.
(xi) The person in Safari-suit has won more than the person in two-piece suit.

114. Which of the following statements are false?
I. The Production Manager is in Soaps Division.
II. The Deputy General Manager is in Oil Seeds Division.
III. Rao is the Vice President.
(A) Only I and II (B) Only II and III
(C) Only III and I (D) All three statements.

115. How much have Rao and Saxena together earned (in `)?
(A) 900 (B) 1100
(C) 1300 (D) None of these

116. Which of the following statements are not true?

I. The Vice President and the Senior Vice President together have earned more than the Production Manager and the General Manager put together.

II. The person from Foods Division earned less than the person from the Oil Seeds Division.

III. The person from International Trading earned the same amount as the person in two-piece suit.

(A) I and II
(B) II and III
(C) III and I
(D) All three statements

117. Who has won the maximum amount?

(A) Mathur (B) Saxena
(C) Verma (D) Rao

Directions for questions 118 to 121: Answer the questions on the basis of the following information.

In the manufacturing unit of a company, seven machines are used to manufacture a particular product. These machines are named as M1, M2, M3, M4, M5, M6 and M7. On observing the working of these machines, the following facts were known.

M1: It started first and the next two machines to start were M4 and M3. When it was stopped, M2 and M7 started running. M5 was stopped with it.

M2: It started with M7 at the time when M1 was already running. One more machine was running at that time.

M3: It was operated for a short duration and M1, M4 and M5 were running at that time.

M4: It was stopped immediately after M3 was stopped.

M5: It was used with M1, M2, M3, M4 and M7 for the first time, when it was started again, M2 and M7 were running.

M6: It was operated for a small duration. M2 and M5 were running during that time.

M7: Nothing is known about it.

Directions: For the multiple choice questions, select the correct alternative from the given choices. For the non-multiple choice questions, write your answer in the space provided.

118. Which of the two, M2 or M5 was started first?

(A) M2
(B) M5
(C) Both started together
(D) Cannot be determined

119. Which machine was running with M1 when M2 was started?

(A) M3 (B) M4
(C) M5 (D) M6

120. The number of machines that were operated with M7 is_____.

121. Which were the two machines that were the last to be stopped?

(A) M2 and M6 (B) M6 and M7
(C) M5 and M6 (D) M2 and M5

Directions for questions 122 to 125: Answer the questions on the basis of the information given below.

Physicists have assigned a number called Einstein number (named after the famous physicist Albert Einstein). Only Einstein himself has an Einstein number of zero. Any physicist who has written a research paper with Einstein has an Einstein number of 1. For other physicists, the calculation of his/her Einstein number is illustrated below:

Suppose that a physicist M has co-authored papers with several other physicists. From among them, physicist N has the smallest Einstein number. Let the Einstein number of N be n. Then M has an Einstein number of $n + 1$. Hence, any physicist with no co-authorship chain connected to Einstein has an Einstein number of infinity.

In a seven-day long mini-conference organized in memory of Einstein, a close group of eight physicists, namely P, Q, R, S, T, U, V and W, discussed some research papers. At the beginning of the conference, P was the only participant who had an infinite Einstein number. Nobody had an Einstein number less than that of U.

(i) On the third day of the conference U co-authored a paper jointly with P and R. This reduced the average Einstein number of the group of eight physicists to 3. The Einstein numbers of Q, S, T, V and W remained unchanged with the writing of this paper. Further, no other co-authorship among any three members would have reduced the average Einstein number of the group of eight to as low as 3.

(ii) At the end of the third day, five members of this group had identical Einstein numbers while the other three had Einstein numbers distinct from each other.

(iii) On the fifth day, T co-authored a paper with U which reduced the group's average Einstein number by 0.5. The Einstein numbers of the remaining six were unchanged with the writing of this paper.

(iv) No other paper was written during the conference.

122. How many participants in the conference did not change their Einstein number during the conference?

(A) two (B) three
(C) four (D) five

123. The person having the largest Einstein number at the end of the conference must have had how many Einstein number (at that time)?

(A) Five (B) Seven
(C) Nine (D) Fourteen

124. How many participants had the same Einstein number at the beginning of the conference?
(A) Two (B) Three
(C) Four (D) Five

125. What could be the maximum possible number of people with distinct Einstein numbers at the beginning of the third day of the conference?
(A) Five (B) Six
(C) Two (D) Three

ANSWER KEYS

1. (B)	19. (B)	37. 470	55. (A)	73. (A)	91. 6	109. (D)
2. (C)	20. (D)	38. 2012	56. (D)	74. (A)	92. (D)	110. (D)
3. (A)	21. (C)	39. (C)	57. (C)	75. 1100	93. (D)	111. (C)
4. (D)	22. (B)	40. (B)	58. (D)	76. 1000	94. (C)	112. (D)
5. (B)	23. (D)	41. (D)	59. (A)	77. 900	95. (C)	113. (C)
6. (A)	24. (C)	42. (B)	60. (A)	78. (D)	96. (D)	114. (C)
7. (D)	25. (B)	43. (A)	61. (B)	79. 25	97. (D)	115. (D)
8. (C)	26. (C)	44. (B)	62. (C)	80. (D)	98. 6	116. (D)
9. (A)	27. (B)	45. (A)	63. (D)	81. 2	99. (D)	117. (B)
10. (B)	28. (C)	46. (D)	64. (B)	82. 18	100. 11	118. (B)
11. (A)	29. (D)	47. (C)	65. (C)	83. (C)	101. (C)	119. (C)
12. (D)	30. (B)	48. (D)	66. (C)	84. (A)	102. 75	120. 3
13. (A)	31. (D)	49. (B)	67. (B)	85. (C)	103. 75	121. (D)
14. (D)	32. (B)	50. (D)	68. (A)	86. (B)	104. 50	122. (D)
15. (B)	33. (C)	51. (A)	69. (C)	87. (A)	105. (D)	123. (B)
16. (B)	34. 120	52. (A)	70. (D)	88. (C)	106. (B)	124. (B)
17. (D)	35. 130	53. (C)	71. (B)	89. 5	107. (D)	125. (A)
18. (A)	36. 100	54. (A)	72. (D)	90. (C)	108. (C)	

SOLUTIONS

Solutions for questions 1 to 4: The number of books are 21 (i.e., A through U). It is given that at least one book is kept in each shelf and the number of books in different shelves are distinct. Hence, the number of books in different shelves are 1, 2, 3, 4, 5 and 6.

Let us indicate the six different shelves by I, II, III, IV, V and VI, respectively in decreasing order.

It is given that the sum of the number of books in shelves I and II (i.e., accessible to five or more children) is equal to the sum of the number of books in shelves V and VI, and also III and IV.

⇒ The sum of the number of books at levels III and IV = I and II = V and IV = 7.

From (vi), Jeffery brought six books, from (ii), Rameez did not bring any book, from (v), Charu did not bring even one book.

⇒ Srikanth, Mandira and Sanjay together brought fifteen books. From (iii), each of Srikanth, Mandira and Sanjay brought five books.

From (vi), Sanjay is the last one to enter the room and he brought five books.

⇒ Sanjay is the tallest among the six and he brought all the books kept at the highest level only.

Hence, Sanjay is the tallest and the number of books at level I is five.

⇒ Number of items at level II is two.

⇒ Each of Mandira and Srikanth brought books kept at two different levels of height, i.e., 3 + 2 or 4 + 1.

⇒ Mandira and Srikanth together brought books kept at four different levels of height.

⇒ Jeffery brought all the books kept at only one level of height.

Since, Mandira and Srikanth brought books kept at different levels, neither of them is the shortest.

From (ii), Rameez is not the shortest.

From (v), Charu is not the shortest.

Hence, Jeffery is the shortest but still he brought 6 items.

⇒ Jeffery is the first to enter the room.

From (iv), Srikanth is taller than Mandira.

⇒ Mandira entered the room before Srikanth.

From (v), Charu entered the room after Rameez and Srikanth.

⇒ Charu entered after Mandira, Rameez and Srikanth.

Hence, Charu is the fifth to enter the room.

Since, Charu could not bring any book, he is not the second tallest.

⇒ Mandira is the second or the third to enter the room.

Since, six books are in shelf VI, the number of books at level V is one since five books are at level I, the number of books at level II is true.

Hence, we obtain the number of books at different levels as follows.

I – 5
II – 2
III – 3/4
IV – 4/3
V – 1
VI – 6

Since, Mandira and Srikanth brought five books each and Srikanth is taller than Mandira, Mandira is the fourth tallest and the number of books in shelf IV is four. Similarly, Srikanth is the second tallest and the number of books in shelf III is three.

⇒ Rameez is the third or the fifth tallest.

Since Rameez entered the room before Srikanth he must be the second or the third to enter the room.

⇒ Mandira and Rameez are the second and the third to enter the room in any order.

Since, Mandira is the fourth tallest and she brought books kept in two different shelves. Rameez who could not bring any book is shorter than Mandira. Hence, Rameez is the fifth tallest.

⇒ Charu is the third tallest. From (v), Rameez is the third to enter the room.

Hence, the final arrangement is as follows.

Order of entering the room	Name	Rank in height	Number of books brought
1	Jeffery	6	6
2	Mandira	4	5
3	Rameez	5	0
4	Srikanth	2	5
5	Charu	3	0
6	Sanjay	1	5

1. Rameez is the third to enter the room.

2. As Charu is the third tallest, there are three children shorter than him.

3. Two books are kept in the shelf which is at the height of Srikanth.

4. Jeffery's rank in height is six and he brought six books.

Solutions for questions 5 to 7: As it is a knockout tournament for eliminating any single player, one match is needed. Now only one of the 64 players has to be the winner. Hence, the remaining 63 players are to be eliminated. Therefore, 63 matches are required.

5. If each match is an upset, we will get a maximum of 63 upsets.

6. As there are no upsets, all the top 8 players will reach quarter finals. In the quarter-finals, Seed 1 plays Seed 8, Seed 2 plays Seed 7, Seed 3 plays Seed 6, Seed 4 plays Seed 5.

7. In the first round, Seed 43 plays Seed 22. In the second round, Seed 43 plays with the winner of the match between Seed 11 and Seed 54. In the third round, Seed 43 and the winner of the matches between 59th and 6th seeded players or the winner of 27th and 38th seeded players are played.

. 43rd seeded player would have played with 6th or 27th or 38th or 59th seeded player in the third round.

Solutions for questions 8 to 10: First, let us observe the second statements made by Madhuri and Mithu. Clearly, both of them cannot be true simultaneously. First, let us assume the second statement made by Madhuri is true, so the second statement of Mithu is false, which implies the first statement of Mithu is true.

. The second statement of Mamta is true.

Therefore, we get:

Case (1):

Name	I	II	Belongs to	Working in
Mamta	F	T	Hyderabad	Delhi
Madhuri	F	T	Delhi	Mumbai
Mithu	T	F	Mumbai	Hyderabad

Now, let us assume that the second statement of Madhuri is false. So, her first statement is true.

. The second statement of Mamta is true and also, the first statement of Mithu is true. So, we get:

Case (2):

Name	I	II	Belongs to	Working in
Mamta	F	T	Hyderabad	Mumbai
Madhuri	T	F	Mumbai	Delhi
Mithu	T	F	Delhi	Hyderabad

8. In Case (1), Mithu belongs to Mumbai.

9. In Case (2), the first statement of the person from Delhi is true. So, Mamta works in Mumbai.

10. Mamta belongs to Hyderabad.

Solutions for questions 11 to 15:

11. If a student enrols for Forensic Medicine, he must enrol for Physiology and Pathology.
Pathology enrolled ⇒ No Anatomy and hence, no Pharmacology.
Since Physiology and Cardiology are taken ⇒ Cannot enrol for Ophthalmology.
Hence, choices (B), (C) and (D) are eliminated and choice (A) does not violate any condition.

12. If a student takes up Microbiology, then he must also take Pathology and Biochemistry. This implies that Anatomy cannot be chosen. Since Anatomy cannot be chosen, even Pharmacology cannot be selected.

13. Since Pathology and Anatomy cannot be selected together, those courses, requiring these two as prerequisites, cannot be selected together. Hence, Microbiology or Forensic Medicine cannot be taken with Pharmacology.

14. If a student enrols for Microbiology and Forensic Medicine, then he must also enrol for Biochemistry, Physiology and Pathology.
Since Pathology is taken, Anatomy and Pharmacology cannot be taken.
Since he has to take Physiology, he cannot take both Ophthalmology and Cardiology but only one of these two.

15. If D chooses Ophthalmology and Cardiology, then he cannot choose Physiology.
⇒ He cannot choose Pharmacology or Forensic Medicine. He cannot enrol for 3 courses. Also, out of Anatomy and Pathology, he can enrol only for one course. Hence, he cannot enrol totally for 4 courses.
⇒ He can take up a maximum of 5 courses.

Solutions for questions 16 to 19:

Statement I:
Costlier of watch and ring is the lightest.
Let us assume that ring is the lightest.
Statement II:
Heavier of necklace and ring is the cheapest.
Statement III:
Heavier of necklace and brooch is the costliest.
Statement IV:
Cheaper of ring and brooch is the heaviest.
If ring is the lightest, it cannot be the heaviest.
⇒ Brooch is the heaviest [statement IV].
⇒ Brooch is the costliest [statement III].
⇒ Necklace is the cheapest [statement II].
But brooch is the heaviest.
⇒ Brooch is heavier than ring.
⇒ Brooch is cheaper than ring [statement IV].
'Brooch is the costliest' and 'Brooch is cheaper than ring' are contradicting each other. Hence, our assumption is wrong.
⇒ Ring is not the lightest.
⇒ Watch is the lightest.
Statement V:
If brooch is costlier than necklace, then it is lighter than watch. But we know that watch is the lightest.
⇒ Necklace is not lighter than watch.
⇒ Brooch is not costlier than necklace.
⇒ Necklace is costlier than brooch.
⇒ Necklace is the costliest [statement III].
⇒ Necklace is heavier than brooch.
⇒ Brooch is not the heaviest.
⇒ Ring is the heaviest [statement IV].
⇒ Ring is the cheapest [statement II].
Let us now rank the pieces of jewellery and show them in the following table.

Rank	Cost	Weight
1	Necklace	Ring
2	Brooch (or) Watch	Necklace
3	Brooch (or) Watch	Brooch
4	Ring	Watch

In the above table, 1st rank represents the costliest or the heaviest as the case may be.
Observation:
We do not know the rank of brooch and watch in terms of cost.

16. The logician's wife is talking about brooch and watch.

17. If we know the comparison between brooch and watch in terms of cost, we can determine the ranks list in both the comparisons.

18. Necklace is the costliest.

19. Watch is the lightest.

Solutions for questions 20 to 22: From the given information.
I round scores – 2, 3, 4, 5, 6, 7
II round scores – 1, 3, 4, 5, 6, 8.
From (5), if Delhi scored 4 goals in each round, then the team which scored one goal in 2nd round can never score more goals than Delhi, which contradicts (5).
. Delhi score of 3 goals in each of the first two rounds.
From (4), the only possibility of getting 10 goals in a match is 6 and 4 in 2nd round. Now, as the total number of goals of Maharashtra is not 10, in the first match the number of goals scored must be 7 and the number of goals conceded must be 3. [3 goals are scored by Delhi is known for us].

. In the first round, Delhi and Maharashtra played and Maharashtra won.

. Delhi won in the second round.

It must have conceded 1 goal in the second round.

. In the second round, as the total number of goals scored is 10 in the match which Maharashtra played, Maharashtra loses it by scoring 4 goals and conceding 6 goals.

From (3) and the above results, as Maharashtra conceded 6 goals in the second round; Karnataka cannot concede 6 goals each in the first two rounds. If Karnataka conceded 5 goals each in the first two matches, then in the first match it has scored either 5 + 2 or 5 – 2 goals, i.e., either 7 or 3 goals, which is not possible as Maharashtra and Delhi scored 7 and 3 goals, respectively in the first round matches.

For the same reason as above, it cannot concede 3 goals each in the first two matches.

. Karnataka conceded 4 goals each in the first two matches.

It scored one of (4 + 2) and (4 – 2) are the number of goals in the first round and in the second round.

In the second round, no team scored 2 goals.

. Karnataka scored 2 goals in the first round and 6 goals in the second round.

From (1) and the above results, as West Bengal scored a total of 9 goals, it must have scored 4 and 5 goals in the first two matches [It cannot have scored 6 and 3 goals as Delhi scored 3 goals in each of the first two rounds]. In the second round as Maharashtra scored 4 goals, West Bengal have scored 4 goals and 5 goals in the first and the second rounds, respectively. As Karnataka conceded 4 goals in the first round, it played against West Bengal in the first round.

As West Bengal won in the first round, it should lose in the second round.

. It should concede 8 goals in the second round.

From (2) and the above results, Tamil Nadu cannot score 6 goals in the first round, if so it has to concede 6 goals in the second round, which is not possible as Maharashtra conceded 6 goals in the second round.

. Tamil Nadu must have scored 5 goals in the first round and conceded 5 goals in the second round.

It had scored 8 goals in the second round. (West Bengal scored 5 goals and conceded 8 goals in the second round)

. Tamil Nadu has to lose in the first round. So, it must have conceded 6 goals in the second round.

AP scored 6 goals and Tamil Nadu conceded 6 goals in the first round and Andhra Pradesh scored 1 goal and conceded 3 goals in the second round.

. The final table for the 1st round will be as follows:

(1) AP – Tamil Nadu
6 5

(2) West Bengal – Karnataka
4 2

(3) Delhi – Maharashtra
3 7

2nd round:

(1) AP - Delhi
1 3

(2) Karnataka - Maharashtra
6 4

(3) West Bengal – Tamil Nadu
5 8

20. Maximum number of goals scored in any match is 5 + 8 = 13.

21. Andhra Pradesh scored the least number of goals (1) in the second round match.

22. Tamil Nadu scored 5 + 8 = 13 goals in the first two rounds, which is the maximum.

23. Against Andhra Pradesh, Delhi won the match in the first two rounds.

24. Maharashtra scored 7 goals in the match it won.

Solutions for questions 25 to 28: We can get the following table from the given information.

	Sing	Dance	Play music
Delhi	Divya	Harish	Seema
Mumbai			Rohini
Kolkata	~ Harish	Dilip	
Chennai	Harish	~ Divya	
Bangalore	Mahesh		
Hyderabad	Rohini		
	~ Mahesh		

In Delhi, as Harish is not performing with Divya or Seema they are not his partners. In Chennai, as Dilip is not performing with Harish, they are not partners.

If Rohini is Harish's partner then Harish can sing in Chennai and Hyderabad only, but Harish has to sing in three cities. So, Mahesh is Harish's partner and they will be singing in Chennai, Bangalore and Mumbai.

Now, Divya and Rohini or Divya and Dilip can be partners.

If Divya and Rohini are partners, then they will play music in at least three cities (Chennai, Bangalore, Mumbai). As Divya plays music in only two cities, Divya and Dilip have to be partners.

So, Seema and Rohini are partners.

We will get the final performances as below.

	Sing	Dance	Play music
Delhi	D, D	H, M	R, S
Mumbai	H, M	D, D	R, S

(*Continued*)

	Sing	Dance	Play music
Kolkata	D, D/R, S	H, M/D, D/R, S	H, M/D, D/R, S
Chennai	H, M	D, D	R, S
Bangalore	H, M	R, S	D, D
Hyderabad	R, S	D, D/H, M	D, D/H, M

D, D ⇒ Dileep and Divya
H, M ⇒ Harish and Mahesh
R, S ⇒ Rohini and Seema

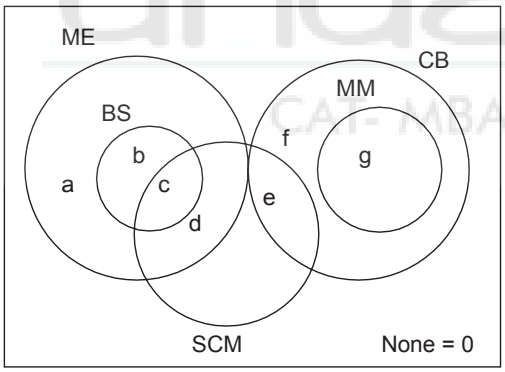
25. Dilip and Divya dance in Mumbai.

26. Dilip and Divya play music in Bangalore is true.

27. If Harish and Mahesh play music in Kolkata and since Divya plays music in two cities, then Dilip and Divya will play music in Hyderabad.

28. If Rohini and Seema dance in Kolkata then Dilip and Divya will Sing in Kolkata. So, Harish and Mahesh will play music in Kolkata. As Divya plays music in at least two cities she has to play music in Hyderabad. So Rohini and Seema will dance in Kolkata. This statement is sufficient to know the complete schedule. Choice (C)

Solutions for questions 29 to 33: From (1), (2) and (4), the information can be represented as follows:



From (3), the number of students who failed in four subjects is equal to the number of student who passed in only one subject = $a + f$.

The number of students who failed in Micro Economics = $e + f + g$

$a + f = e + f + g - 7 \Rightarrow a + 7 = e + g$ (1)

From (4), $c = 18$ (2)

From (6), $c + d + e = 46$

$\Rightarrow d + e = 28$ (3)

From (5), $a = 17$ and $g = 13$, $f = 10$

$a = 17$, $g = 13$

$\Rightarrow e = 11$ (from (1)) $\Rightarrow d = 17$ (From (3))

As $a + b + c + d + e + f + g = 108 \Rightarrow b = 22$

29. The number of students who passed in exactly two subjects = $b + d + e + g = 22 + 17 + 11 + 13 = 63$.

30. The required number of students = $b + c = 22 + 18 = 40$.

31. No student passed in all the subjects except ME and MM.

32. The required number of students = $d + e = 17 + 11 = 28$.

33. (I) $b + d + e + g + c = 22 + 17 + 11 + 13 + 18 = 81$ is true
(II) d = 17 is true
. Both (I) and (II) are true.

Solutions to questions 34 to 38: The table in the given data can be filled in completely, by filling in the data year wise using the given conditions.

From (i), N = 50 for Grade I across all years 2012 to 2016.

From (ii), for any grade either P = N + R or, N = 0, if R > P, thus for all grades except Grade I, N = 0 if P = 0 or P = 10; R is always a multiple of 10.

From (ix), all students of only Grade V of 2014 are promoted, therefore, R -: 0 except for Grade V in 2015.

Therefore, from (iv), value of R for all five grades in a year will be five different values among 10, 20, 30, 40 and 50. Thus the total number of students retained in any year will be 10 + 20 + 30 + 40 + 50 = 150 except for the year 2015, where Grade V has R = 0 and from (v), the lowest number of students retained in a year is 140. Thus, in the year 2015, the values of R are five different values among 0,20,30,40 and 50.

Further, from (vii), for any grade across each of the years 2013, 2014, 2015 and 2016, the value of R will be four different values among 10,20,30,40 and 50.

Across all years promotees in Grade I, i.e., 'P' will be zero, i.e., for Grade I, P = 0.

Enrolments in 2013:

	'12	2013				
	T	**N**	**R**	**P**	**T**	
I	50	**50**	**50**	**0**	100	N is 50; ⇒ R = 100 – 50 = 50
II	50	**0**	**40**	**0**	40	P = 50 – 50 = 0; ⇒ R > P ⇒ N = 0
III	50	**0**	**20**	**10**	**30**	P = 50 – 40 = 10 ⇒ N = 0; R = 20 as 30 from previous year are promoted.
IV	50	**20**	**10**	30	60	R = 10 (only possibility), N = 30 – 10
V	50	**10**	30	**40**	**80**	P = 50 – 10 = 40; N = 40 – 30 = 10; T = 80

Enrolments in 2014:

	'13	2014				
	T	**N**	**R**	**P**	**T**	
I	100	**50**	40	**0**	**90**	N is 50; ⇒ T = 50 + 40 = 90
II	40	**50**	**10**	**60**	**120**	P = 100 – 40=60; ⇒ R cannot be 30(III), 40(I), 20(2015) or 50(2016); so, R = 10 ⇒ N = 50; T = 120
III	**30**	**0**	30	**30**	**60**	P = 40 – 10 = 30 ⇒ N = 30 – 30 = 0; T = 30 + 30 = 60
IV	60	**0**	**50**	**0**	**50**	P = 30 – 30 = 0 ⇒ N = 0; 10 promoted ⇒ R = 50 ⇒ T = 50
V	**80**	**0**	20	10	**30**	R = 20 (only possibility). R > P ⇒ N = 0; T = 20 + 10 = 30

Enrolments in 2015:

	'14	2015				
	T	**N**	**R**	**P**	**T**	
I	**90**	**50**	30	**0**	**80**	N is 50; ⇒ T = 50 + 30 = 80
II	**120**	**40**	20	**60**	120	P = 90 – 30 = 60; ⇒ N = 60 – 20=40
III	**60**	**50**	**50**	**100**	**200**	R = 50 (only possibility); ⇒ N = 100 – 50 = 50 and T = 200
IV	**50**	**0**	**40**	**10**	**50**	R cannot be 10(2013) or 50(2014); R = 40; P = 60 –50 = 10; R > P ⇒ N = 0; T = 50
V	**30**	**10**	**0**	**10**	20	R = 0 in 2015 (given); P = 50 – 40 = 10; ⇒ N = 20 –10 = 10

Enrolments in 2016:

	'14	2015				
	T	**N**	**R**	**P**	**T**	
I	**80**	**50**	**20**	**0**	**70**	N is 50; ⇒ R = 70 – 50 = 20
II	120	**10**	50	**60**	**120**	P = 80 – 20 = 60; N = 60 – 50 = 10; T = 10 + 50 + 60 = 120
III	**200**	**30**	**40**	**70**	**140**	R = 40 (only possibility). P = 120 – 50 = 70; N = 70 – 40 = 30; T = 140
IV	**50**	**130**	**30**	**160**	**320**	R = 30 (only possibility). P = 200 – 40 = 160; N = 160 – 30=130 ⇒ T = 320
V	20	**10**	**10**	**20**	40	P = 50 – 30 = 20; N = 20 – 10 = 10

Thus, the complete data will be as follows.

	2012	2013				2014				2015				2016			
Grade	**T**	**N**	**R**	**P**	**T**	**N**	**R**	**P**	**T**	**N**	**R**	**P**	**T**	**N**	**R**	**P**	**T**
I	50	50	50	0	100	50	40	0	90	50	30	0	80	50	20	0	70
II	50	0	40	0	40	50	10	60	120	40	20	60	120	10	50	60	120
III	50	0	20	10	30	0	30	30	60	50	50	100	200	30	40	70	140
IV	50	20	10	30	60	0	50	0	50	0	40	10	50	130	30	160	320
V	50	10	30	40	80	0	20	10	30	10	0	10	20	10	10	20	40
Certifications				20				60				30				10	

34. Total Grade V certifications issued = The total number of completed Grade V.
= (50 – 30) + (80 – 20) + (30 – 0) + (20-10) = 20 + 60 + 30 + 10 = 120.

35. 130 enrolments for Grade IV in 2016 is the highest.

36. In all total, 100 new enrolments made in 2014.

37. The total strength of students in the year 2015 = 80 + 120 + 200 + 50 + 20 = 470.

38. From the above total it can be seen that the highest new enrolment KBC Ltd. had seen is in 2012. Ans: (2012)

Solutions for questions 39 to 42: From the following given information.

Case (1):

Let us assume that A is the person who answered all the questions correctly.

Then the answers of the remaining person would be as follows.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
B	✓	X	X	X	✓
C	X	✓	X	✓	X
D	✓	✓	✓	X	✓
E	✓	X	✓	✓	✓

From (iii), A is not the person who answered all questions correctly.

Case (2):

Let us assume that B is the person who answered all the questions correctly.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
A	✓	X	X	X	✓
C	X	X	✓	X	X
D	✓	X	X	✓	✓
E	✓	X	X	X	✓

From (iii), B is not the person who answered all questions correctly.

Case (3):

Let us assume that C is the person who answered all the questions correctly.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
A	X	✓	X	✓	✓
B	X	X	✓	X	X
D	X	✓	X	X	X
E	X	X	X	✓	X

From (iii), C also cannot be the person who answered all questions correctly.

Case (4):

Let D be the person who answered all questions correctly. Then the answers of the remaining people would be as follows.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
A	✓	✓	✓	X	✓
B	✓	X	X	✓	✓
C	X	✓	X	X	X
E	✓	X	✓	X	✓

From (ii) and (iii), D is the person who has got all the questions correct in the examination.

39. D is the person who has got all the questions correct.

40. The right choice for question 2 is 'c'.

41. B answered 3 questions correctly.

42. D - 5 is the correct combination.

Solutions for questions 43 to 45:

43. When n = 10, we have to take one ball from the first box, two from the second and so on.
If the total weight is 1 kg more, then the required box is the first. If it is 2 kg more, then it is the second box and so on.
. Only one weighing is required.

44. Take one ball each from the first five boxes and two balls each from the remaining. If the weight is 1 kg more, then the required box is in the first five. If it is 2 kg more, then it is in remaining five. Now, number of these boxes is from 1 to 5. Take one ball each from first two and two balls each from the next two. If the weight is same, then the required box is the fifth one. If it is 1 kg more, then it is between the first two. If it is 2 kg more, then it is between the next two. Now, one more weighing is required to find the required box.
. A total of 3 weighing is required.

45. Take one ball each from the first three, two balls each from the next three and three balls each from the next three. If the weight is same, then the 10th box is the required one. If it is 1 kg more, then it is between the first three. Similarly, we can find for the other groups.
Now, number of these three boxes and one more weighing is required (similarly as described earlier).
. Two weighings are sufficient.

Solutions for questions 46 to 48: From the given information, it can be understood that each basket received at least one fruit or at most two fruits from each of the other baskets.

From (i), R has no guava in it, implies that the guavas which were there in R (eight in number) have been transferred to other baskets.

⇒ P, Q, S and T now contain 2 guavas each.

From (ii), P has at least three mangoes implies that P was originally having mangoes as every basket received at least one fruit from each of the other baskets. It is also mentioned that P now has ten fruits in all.

As there are only four apples, P could have received only one apple. Hence, the other six fruits in P consist two bananas, two oranges and 2 guavas.

. P = One apple + Three mangoes + Two bananas + Two oranges + Two guavas = 10 fruits.

From (iii), T has no apple in it but has six fruits in all. This implies that T was initially having apples in it. We know that T received two guavas.

As two out of five bananas are transferred to P, none of the other baskets can receive more than one banana.

Out of seven mangoes contained in P only four are transferred to other baskets. This implies that each basket received only one mango. Hence, the other two fruits in T are oranges.

. T = One banana + Two guavas + One mango + Two oranges = 6 fruits.

As there are six oranges in all and two oranges are transferred to each of T and P, R received only one orange.

. R = One mango + One apple + One banana + One orange = 4 fruits.

The basket which was initially containing oranges does not contain any orange now. Similarly, the one initially containing bananas now does not contain banana.

Hence, S initially contained bananas and Q does not contain any orange now.

Thus, we get the following arrangement.

Basket (Initially)		After changes					
		A	B	O	M	G	Total
P	7 Mangoes	1	2	2	3	2	10
Q	6 Oranges	1	1	0	1	2	5
R	8 Guavas	1	1	1	1	0	4
S	5 Bananas	1	0	1	1	2	5
T	4 Apples	0	1	2	1	2	6

46. S initially contained five fruits.

47. Mango is contained in all the baskets.

48. The fourth statement is true.

Solutions for questions 49 to 52: It is given that:

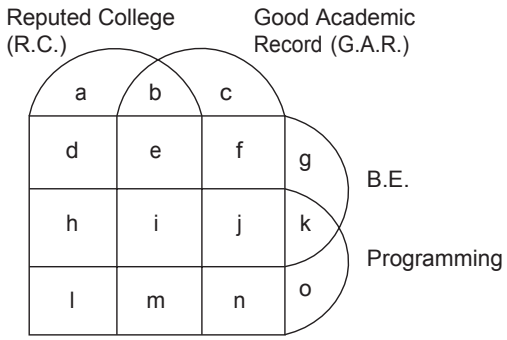
Each of the trainees are B.Es or M.Scs but not both.

⇒ B.Es + MSCs = 80

Similarly, the number of people with experience in Programming + Testing = 80.

Further, each person is either from a reputed college or with good academic background.

Let us represent the given data as follows.



Here, the features of trainees represented by '*a*' represents neither B.Es nor programmers.

. They are MScs and testers.

a = (M.Sc., Testing, R.C.)

b = (M.Sc., Testing, R.C., G.A.R.)

c = (M.Sc., Testing, G.A.R.)

d = (Testing, R.C., B.E.)

e = (R.C., G.A.R., B.E., Testing)

f = (G.A.R., Testing, B.E.)

g = 0 as every person must have either G.A.R. or R.C.

Similarly, *k* = 0 and *o* = 0.

Similarly, the features of *h*, *i*, *j*, *l*, *m* and *n* can be written.

Now, it is given that:

$a + b + c + d + e + f = 40$
Testing = 40 and $e + f = 20$ } From statement (a)

$i = m = 0$
$h + j = 25$ } From statement (b)

$l + n = 15$
and $a + b + c + l + n = 30$ } From statement (c)

$b + e = 15$ From statement (d)

$b + c + e + f + j + n = 45$
$e + f + j = 30$
$j + n = 15$ } From statement (e)

As $e + f = 20$ and $e + f + j = 30$

$j = 10$

As $j + n = 15$, $n = 5$

As $h + j = 25$, $h = 15$

As $l + n = 15$, $l = 10$

As 50 trainees are B.Es:

$d + e + f + h + j = 50$,

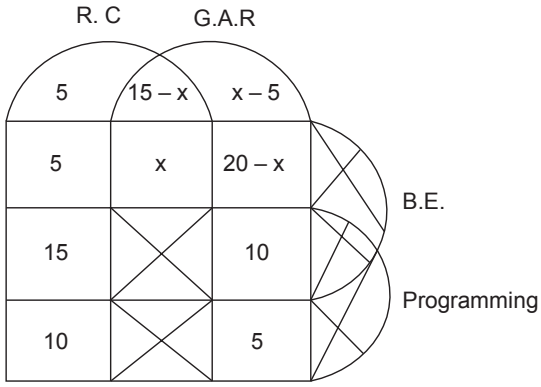
As $h + j = 25$

$d + e + j = 25$,

$\Rightarrow d = 5$

Similarly, $b + c = 10 \Rightarrow a = 5$

Let $e = x$



49. $j = 10$

50. Here, x cannot be determined.

51. $d = 5$

52. As $10 + 20 - x = 18$
$x = 12 \Rightarrow 15 - x = 3$

Solutions for questions 53 to 56: Given that no two people with consecutive room numbers bought the same type of product and the people with even numbered room numbers bought one type of products and others bought another type of products.

Given that B and C bought the same type of products. Also, A stays in odd numbered room and C stays in even numbered room.

⇒ A and C bought different types of products.

As A and D bought different types of products, B, C and D bought the same type of products, i.e., books as Bindu bought Maths book) and A, I and K bought mobiles.

As A stays in 3 and I, who bought LG cannot be in 5, K is in 5 and bought Nokia mobile. Hence, A bought Samsung and I is in 1.

As C stays in 6 and the person in 4 bought Chemistry book, B stays in 2 (she bought maths book), C bought Physics and D stays in 4.

Room no.	Name	Item bought
1	Indu	LG
2	Bindu	Maths
3	Anand	Samsung
4	Dilip	Chemistry
5	Kiran	Nokia
6	Charu	Physics

53. Dilip bought the Chemistry book.

54. Bindu stays in room number 2.

55. The person in room number 1 bought LG mobile.

56. The person who bought Samsung mobile is adjacent to the person who bought Maths book.

Solutions for questions 57 to 59: Among Tarun and Uday, at least one statement must be false.

Let the first statement of Ram be true, then Shyam will be of No-No type.

Let Ram be Yes-Yes type.

So, Ram's second statement 'Uday is Yes-No' must be true.

⇒ 'Tarun is No-No' type. As Uday is 'yes – No' type.

But Shyam and Tarun both cannot be of the same type, so Ram's first statement must be false.

⇒ Now Ram, Tarun and Uday each have at least one false statement. Hence, Shyam must be Yes-Yes type and Tarun must be No-No type.

We know that Ram's first statement is false.

. Ram is No-Yes type and Uday is Yes-No type.

57. Uday belongs to Yes-No type.

58. Tarun belongs to No-No type.

59. Ram belongs to No-Yes type.

Solutions for questions 60 to 63: Given that England lost to Australia but won against Sri Lanka and New-Zealand. And South Africa lost to India but won against Sri Lanka and New-Zealand. These results can be written as:

Team \ Playing against	Australia	India	Sri Lanka (SL)	England (Eng)	South Africa (SA)	New Zealand (NZ)
Australia	X			W		
India		X			W	
Sri Lanka			X	L	L	
England	L		W	X		W
South Africa		L	W		X	W
New Zealand				L	L	X

Hence, Eng and SA won two matches each and lost one match each.
But from the Stage-1 observations:
Two teams lost all matches and therefore, they are SL and NZ.
India lost 1 match and Australia won all 3 matches. So, NZ did not play Australia.

Team \ Playing against	Australia	India	Sri Lanka	England	South Africa	New Zealand
Australia	X	W	W	W	NS	NS
India	L	X	NS	NS	W	W
Sri Lanka	L	NS	X	L	L	NS
England	L	NS	W	X	NS	W
South Africa	NS	L	W	NS	X	W
New Zealand	NS	L	NS	L	L	X

NS-next stage

Now in the second stage. Australia lost both the matches.
Australia played against NZ and SA where NZ and SA won.
Hence, SL lost the next 2 matches it played and NZ won both the matches in Stage-2.
. The other team that lost both the games in Stage-2 is England.
Now after Stage-2, the results are as follows:

Wins	Loses	Team \ Playing against	Australia	India	Sri Lanka	England	South Africa	New Zealand
3	2	Australia	X	W	W	W	L	L
4	1	India	L	X	W	W	W	W
0	5	Sri Lanka	L	L	X	L	L	L
2	3	England	L	L	W	X	L	W
4	1	South Africa	W	L	W	W	X	W
2	3	New Zealand	W	L	W	L	L	X

60. From the above table, Sri Lanka lost all the matches.

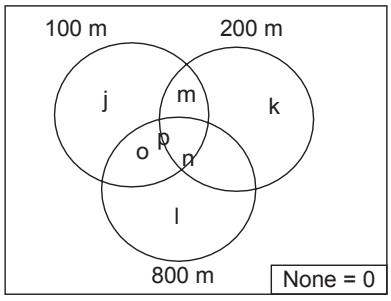
61. Australia lost 2 matches.

62. In Stage-1, New Zealand and Sri Lanka lost two each in Stage-2, Australia and England lost two each.

63. South Africa and New Zealand played in Stage-2 with Australia.

Solutions for questions 64 to 67: It is given that total 215 sprinters are selected.
Sprinters in category A – 35
Sprinters in category B – 60
Sprinters in category C – 120
As each sprinter is trained in one or the other events, the number of sprinters who are not trained in any of the events is zero.
The sprinters of Category A are trained in at most three events, i.e., one event, two events or three events.

Similarly, the sprinters of Category B are trained in one of two events, the sprinters of Category C are trained in only one event.
The base Venn diagram is as follows.

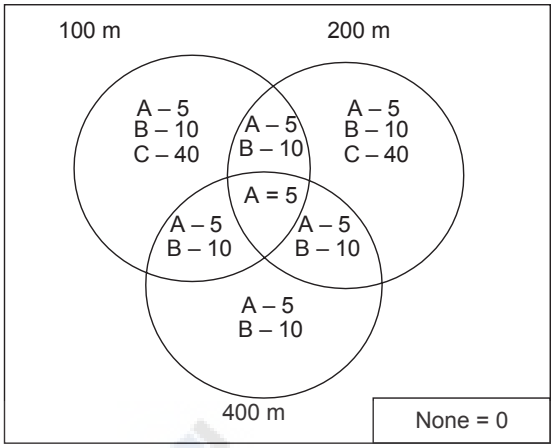


The diagram represents all the possible combination of events. As it is given that equal number of sprinters are trained in all the possible combination of events.

For sprinters in Category A = $j = k = l = m = n = o = p = \frac{35}{7} = 5$

For sprinters in Category B = $j = k = l = m = n = o = \frac{60}{6} = 10$

For sprinters in Category C = $j = k = l = \frac{120}{3} = 40$



64. The number of sprinters who are trained in exactly two events = 3(5 + 10) = 45.

65. The number of sprinters who are trained for only 400 m from Category A is 5. 60% of 5 is 3. Now the number of sprinters who are trained in only 100 m and 400 m is 10 + 5 + 3 = 18.

66. Here we have to select those 35 athletes who can participate in the maximum possible number of events.
Take the five athletes from Category A, who are trained in the three events. The names of these five athletes appear fifteen times. Take the fifteen athletes from Category A, who are trained in two events. The names of these fifteen athletes appear thirty times. Take the fifteen athletes from Category B, who are trained in two events. The names of these fifteen athletes appear thirty times. Hence, the names of athletes appear 15 + 30 + 30 = 75 events.
This value holds good for other possible combination also.

67. The thirty athletes can be selected from the region common to 100 m and 400 m only, 200 m and 400 m only and the region common for all the three. In such case, the number of athletes who can participate in 200 m is 20.

Solutions for questions 68 to 70: Total expense = `610
They spent at least `100 per item.
. They have to buy at least 5 pens, 4 bracelets, 2 perfumes, 2 wristwatches and 1 teddy bear.
Then total cost = `560.
None of them purchased more than one of any items.
They cannot buy more than 5 pens.
. They bought 3 perfumes.
One of them bought each one of the five items.
Total cost to buy each one of the five items
= (20 + 30 + 50 + 70 + 100) = 270.
So, it can be Arpit only.
Now one of them bought a pen, a bracelet, a perfume and a wristwatch.
Total cost of those = 20 + 30 + 50 + 70 = 170.
. Manas is that person.
Jemmy can buy one pen only.
Similarly, Tushar can buy a pen and a bracelet.
. Bhupen will buy a pen, a bracelet and a perfume.
The following distribution table represents the final result.

	Tushar	Bhupen	Jemmy	Arpit	Manas
Pen	✓	✓	✓	✓	✓
Bracelet	✓	✓	X	✓	✓
Perfume	X	✓	X	✓	✓
Wristwatch	X	X	X	✓	✓
Teddy bear	50	100	20	270	170
Expenditure	25	50	20	30	30
Remaining					

68. Bhupen is left with the maximum amount of money.

69. Jemmy did not buy bracelet.

70. The fourth statement is false.

Solutions for questions 71 to 74:

Stage I:

As P, Q, S and T won at least one match, R and U lost all the three matches.

As Q, S and T lost at least one match, P won all the three matches.

In Stage I, there are a total of 9 matches and so 9 wins. Q, S and T won two matches each.

As P (the top team in Stage-I) did not play against U, P played matches against Q and R.

. The ninth match was between Q and U.

So, the nine matches that have taken place are as follows.

Won	Lost	Won	Lost	Won	Lost
P	S	S	R	S	U
Q	T	T	R	T	U
P	Q	P	R	Q	U

Stage-II:

As each team played a total of five matches, in Stage-II, the matches that take place between the following pairs of teams.

P – T, P – U, Q – R, Q – S, T – S and R – U

Given that, in Stage-II, three teams lost all the two matches.

Given that P lost both the matches in Stage-II.

. Each of T and U won the two matches.

⇒ R and S lost the two matches.

. Q also won two matches.

71. T and U defeated P (the top team in Stage-I).

72. Only Q, T and U won both their matches in Stage-II.

73. S and U won exactly two matches in the event.

74. Q and T won exactly four matches each in the event.

Solutions for questions 75 to 78:

75. As Arjun sold gold on three consecutive days while Madhu sold gold on only one day, the only possibility is that the price of one gram at the end of day 1, day 2, day 3, day 4 and day 5 was `900, `1000, `1100, `1200 and `1100 respectively, i.e., on three consecutive days it increased and on the closing day it closed above `1100.

76. As the price at the beginning of the first day was `1000 and at the end of the fifth day was `1100, it means that the price increased by `100 on three days and decreased by `100 on two days. Therefore, effectively Arjun sold 10 grams of gold. If Arjun ended up with `13,000 more, it means that he sold 10 grams more than Madhu. Therefore, Madhu effectively sold zero grams of gold. As she could not both buy and sell 10 grams of gold in this 5-day period, she did not buy or sell any gold during this 5-day period. Therefore, on day 4, the price (per gram) of gold can only be `1000.

77. Since Arjun sold on three days and bought on two days, he would have ended up with 10 grams less than what he started with and since he ended up with 20 grams less than what Madhu had, Madhu would have bought 10 grams and it is possible only if the price of gold (per gram) on the five days are `900, `800, `900, `1000 and `1100, respectively.

78. If Madhu ended up with `1000 less than Arjun at the end of day 5, it can only be because the quantity of gold with them is equal as gold is only bought and sold in multiplies of 10 grams and if the difference in the quantity with them is 10 grams, the difference in amounts with them must be close to `10,000.

Solutions for questions 79 to 82:

79. Machine A will take 10 hours (4 hours + 2 hours break + 4 hours), Machine B will start after 4 hours from start when 50 kgs raw material is passed. B will work from fourth hour to 16th hour (4 cycles). Machine C will start from the 7th hour, work for 2 cycles taken a break, work for 3 cycles, break and continue till 20th hour. Machine D should start in 9th hour from start when 20 kgs of raw material reaches from C. Last cycle of D will be 20th to 21st hour. E should start when a minimum of 50 kgs of material resells from D, i.e., at 16th hour. Second cycle of E should start from 21st hour as only then all raw materials will reach C. Last cycle of E will be from 21st to 25th hour.

. It will take minimum 25 hours to process 100 kg raw material.

80. The processing rate of A, B, C, D and E including breaks is as follows.

A = 100/10 kg/hr, B =100/12 kg/hr, C =100/13 kg/hr, D = 100/8 kg/hr, E = 100/8 kg/hr

If capacity of A, B, D or E is doubled it wouldn't affect the time taken as the immediate next step is at most of equal speed, if not slower. If capacity of C is changed, there may be a decrease in processing time.

81. By doubling the capacity of C, the total time taken will be 23 hours. [Last cycle of D can complete in 18th to 19th hour and last cycle of E from 19th to 23rd hour].

The minimum time taken with old capacity was 25 hours. Difference = 2 hours.

82. If the raw material was only 50 kgs. A would be fourth from start till 4th hour, B till 10th hour, C till 13th hour from start, D would work three cycles last been 13th hour to 14th hour. E will work only one cycle from 14th to 18th hour.

Solutions to questions 83 to 86: This given information can be tabulated as follows:

	Morning slot		Afternoon slot	
Day	**Name**	**Subject**	**Name**	**subject**
Monday				
Tuesday	D	Biology	X	X
Wednesday				
Thursday				
Friday	F	Maths		

Since there are 8 lecturers who teach only once during the week, two slots will be free. From (iii), (iv) and (vi), it can be concluded that one of those slots is Tuesday – afternoon slot.

From (vii), Maths should be taught on Wednesday. Since no subject is taught more than once in the same slot, Maths is taught on Wednesday afternoon. Also, from (vii), Physics is taught on both Monday and Wednesday.

. Physics is taught on Wednesday–morning slot and Monday–afternoon slot.

From (ii) and (iii), C and F teach the same subject. E and H teach the same subject. B teaches Chemistry and D teaches Biology and no one else teaches Biology or Chemistry.

. A and G teach the same subject and C and F teach Maths.

C is scheduled on Wednesday afternoon.
From (i), A is also scheduled on Wednesday.
. A teaches Physics on Wednesday – morning.
G also teaches Physics on Monday – afternoon.
From (i), H is also scheduled on Monday.
. H teaches English on Monday–morning.
From (ii) and (iii), E also teaches English and nobody else is scheduled to teach on the day E teaches.
. E teaches English on Thursday – afternoon and Thursday – morning slot is free.
Finally, B teaches Chemistry on Friday – afternoon.
The resulting table is as follows.

Day	Morning slot		Afternoon slot	
	Name	Subject	Name	Subject
Monday	H	English	G	Physics
Tuesday	D	Biology	X	X
Wednesday	A	Physics	C	Maths
Thursday	X	X	E	English
Friday	F	Maths	B	Chemistry

83. E teaches English.

84. Chemistry is not taught during the morning slot.

85. Thursday – morning slot is free.

86. English and Maths are not taught on the same day.

Solutions for questions 87 to 91:

87. If Laxman is included in the team, then the size of the team would be at least four. All others can be a member of a team of size 3.

88. A team of five must include Sanjay, Uday and Watson which means one of Mohan and Qureshi must be a member of the team along with Naveen.

89. The size of the largest possible team is five as exactly two of Pranav, Rahul and Sanjay, exactly one of Mohan and Qureshi and either Naveen and Uday or Kalyan and Laxman must not be selected.

90. The size of a team that includes Kalyan can only be four as Laxman, exactly one of Qureshi and Mohan and exactly one of Pranav and Rahul must be selected.

91. A team which includes Naveen can be constituted in six ways as given.
(1) Mohan, Rahul, Naveen
(2) Qureshi, Rahul, Naveen
(3) Mohan, Pranav, Naveen
(4) Qureshi, Pranav, Naveen
(5) Mohan, Sanjay, Uday, Watson, and Naveen
(6) Qureshi, Sanjay, Uday, Watson and Naveen

Solutions for questions 92 to 96: The following table can be made from the available information.

Games	Kerala	Karnataka	Tamil Nadu	Andhra Pradesh	Total
Athletes			1	1	6
Basketball	0	1	1	1	3
Football			2	1	6
Cricket			1	1	6
Total	4	8	5	4	21

92. Only the number of Cricket players from Kerala cannot be determined.

93. Since Tamil Nadu and Andhra Pradesh had a total of 3 Football players. Kerala and Karnataka should together have a total of 3 Football players.

94. Since Karnataka had a total of 8 sports people selected and if there is only Football player, there should be 3 Athletes and 3 Cricket players.

95. The number of Cricket players is one.

96. None of the given statements is true.

Solutions for questions 97 to 101: It is given that five students, namely Anil, Sunil, Pavan, Naveen and Sravan answered five questions. Each question has five answer choices A, B, C, D and E.

	Anil	Sunil	Pavan	Naveen	Sravan
1	B	C	D	B	C
2	A	D	B	A	C
3	C	A	D	A	D
4	A	B	C		A
5	E	B	B	E	C

As only one student answered the first question correctly, the correct choice for the first question cannot be B or C.
Hence, the correct choice for the first question is choice (D) and that is correctly marked by Pavan.
As only one student answered the second question correctly, the correct choice for the second question cannot be A. The correct choice is B or C or D.
As two students answered the third question correctly, the correct answer is either A or D.
As only one student answered the fourth question correctly, the correct answer is not A, it is either B or C.
As two students answered the fifth question correctly, the correct answer is either B or E.
From (iii), the correct choice for the third question is A.
As Naveen scored the maximum marks, the correct choice for the 5th question is E.

From (iv), the correct choice for the second and the fourth questions is B.

The above information can be represented as follows.

Q. No.	Correct choice	Correctly marked by
1	D	Pavan
2	B	Pavan
3	A	Sunil, Naveen
4	B	Sunil
5	E	Anil, Naveen

The marks scored by them is as follows.

	Questions attempted	Correct	Wrong	Net score
Anil	5	1	4	0
Sunil	5	2	3	5
Pavan	5	2	3	5
Naveen	4	2	2	6
Sravan	5	0	5	–5

97. Sravan scored the least.

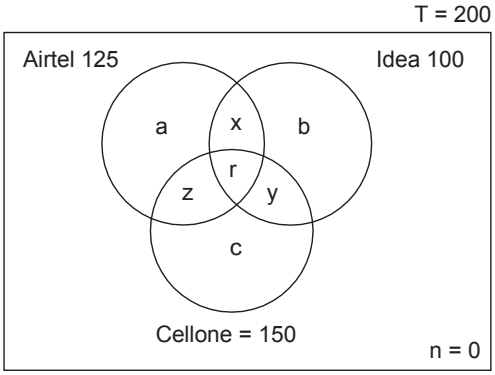
98. Naveen scored 6 marks.

99. Sunil and Pavan scored equal marks.

100. Highest score (Naveen) = 6
Lowest Score (Sravan) = –5
Diff = 6 – (–5)
= 6 + 5
= 11

101. The correct choice for question 4 is B. Naveen marked it as either C or D. In both the cases he get '– 1' score. Hence, his net score becomes 5.
Naveen, Pavan and Sunil are the highest scorers with 5 marks each.
Anil is the second highest with a score of zero.

Solutions for questions 102 to 104:



50 members do not subscribe to Cellone which implies that 150 subscribe to Cellone.

$$a + b + x = 50 \quad (1)$$

75 do not subscribe to Airtel which implies that 125 subscribe to Airtel.

$$b + y + c = 75 \quad (2)$$

100 do not subscribe to Idea which implies that 100 subscribe to Idea.

$$a + z + c = 100 \quad (3)$$

125 subscribe to at least two companies.

$$x + y + z + r = 125 \quad (7)$$

Airtel subscribers = $a + x + r + z = 125$ (4)

Idea subscribers = $b + x + r + y = 100$ (5)

Cellone subscribers = $c + z + r + y = 150$ (6)

(4) + (5) + (6)

$\Rightarrow$ $a + b + c + 2(x + y + z) + 3r = 375$ (8)

$a + b + c + x + y + z + r = 200$ (9)

Subtracting (9) from (8), we get:

$$x + y + z + 2r = 175 \quad (10)$$

Subtracting (10) from (7), we have:

$$r = 50$$

Hence, $x + y + z = 75$.

(1) + (2) + (3) $\Rightarrow 2(a + b + c) + x + y + z = 225$

But $x + y + z = 75$

$\Rightarrow 2(a + b + c) = 150$

$\Rightarrow a + b + c = 75$

102. 75 customers subscribe to exactly one service.

103. 75 customers subscribe to exactly two services.

104. 50 customers subscribe to exactly three services.

Solutions for questions 105 to 109: Given that the number of notes they had are 2, 6, 8, 9 and 12, and the number of coins they had are 0, 3, 4, 8 and 12. Now, from (vi), we know that the number of coins Manjeet had is half of the number of coins somebody else had. This is possible only when if he had 4 coins. Now, condition (i) will satisfy only when Harish had 12 coins (thrice of 4). Thus, Manjeet had six notes. From (vii), we can say that Sohan had 8 coins. Also, only the pair 8 and 12 (notes) satisfy the condition (vii). Thus, Sohan had 12 notes and Harish had 8 notes.

Now, from (ii), (iii) and (vi) we can say that Dinesh, Manjeet and Sohan do not keep a wallet. Hence, Harish and Arpit had a wallet.

From (iv) and (v), we can say that Dinesh had two notes and no coins.

Thus, Arpit had 9 notes and 3 coins.

So, we get the following table:

Person	Notes	Coins	Wallet
Harish	8	12	✓
Dinesh	2	0	X
Manjeet	6	4	X
Arpit	9	3	✓
Sohan	12	8	X

105. Sohan had 8 coins is true.

106. Arpit had 9 notes is true.

107. Manjeet having 6 notes, 4 coins but no wallet is true.

108. Arpit has three coins and nine notes, i.e., 1 : 3.

109. Only choice (D) is true.

Solutions to questions 110 to 113: Exactly one course should be picked from Group 1. Therefore, the number of credits that can be picked from Group 1 are 1 or 2 or 3.

Exactly 2 courses are to be picked from Group 2. Therefore, the numbers of credits that can be picked from Group 2 are

3 + 4/4 + 4/5 +3/5 + 4.

. 7/8/9 credits can be picked from Group 2. 8 credits can be picked in 2 ways. 7 credits can be picked in 2 ways. 9 credits can be picked in 2 ways. Exactly 2 courses are to be picked from Group 3. Therefore, the numbers of credits that can be picked from Group 3 are 3 + 3/3 + 5.

. 6/8 credits can be picked from Group 3.

6 credits can be picked in 3 ways.

8 credits can be picked in 3 ways.

110. Manju picked 17 credits but did not choose Hindi. Therefore, her possible credits from each Group are:

	Group 1	Group 2	Group 3
Case (i)	1	8	8
Case(ii)	3	8	6

Choice (A): If she picks French, then as per case (i), she has to pick 8 credits from Group 2. It is possible to pick Physics (along with Biology).

Choice (B): If she picks English, as per case (ii), she has to pick 8 credits from Group 2. She can choose Chemistry and Maths.

Choice (C): If she picks French, as per case (i), she needs 8 credits from Group 3. She can pick Sports and Music.

Choice (D) If she picks English, as per case (ii), she needs to pick 6 credits from Group 3. Therefore, she cannot pick Sports.

111. Ajay has already picked French and Chemistry. Group 1 is done. If he wants to maximize his credits, he has to pick Maths from Group 2 and Sports from Group 3 along with any one of the other three (Music/Dance/Arts and Crafts).

Choice (A), (B), and (D) are possible.

Choice (C) is not possible since Biology cannot be picked from Group 2.

112. Surabhi has chosen 18 credits. The possible combinations are:

	Group 1	Group 2	Group 3
Case (i)	1	9	8
Case (ii)	2	8	8
Case (iii)	3	7	8
Case (iv)	3	9	6

Choice (A): As per case (i), if she chooses French, she needs 9 credits from Group 2. It is not possible to get 9 credits by picking Chemistry.

Choice (B): As per case (ii), if she chooses Hindi, she needs 8 credits from Group 2. She can choose Biology and Physics.

Choice (B) is possible.

Choice (C): As per case (iii) or (iv), if she chooses English, she will need either 7 or 9 credits from Group 2. She can pick Maths and either Physics or Biology to get 9 credits.

Choice (C) is also possible.

. Choice (D) is the answer.

113. Madhuri needs 19 credits and she has already picked Maths and Music. The possible numbers of credits she can choose from each group are:

	Group 1	Group 2	Group 3
Case (i)	2	9	8
Case (ii)	3	8	8

Choice (A): As per case (i) if she picks Hindi, she needs 9 credits from Group 2. Since Madhuri has already picked Maths, choosing Chemistry will only give her 8 credits from Group 2. This choice is not possible.

Choice (B): As per case (ii), if she picks English, she needs 8 credits from Group 2. Since Maths is already chosen, she cannot choose Biology. This choice is also not possible.

Choice (C): As per case (ii), if she picks English, she needs 8 credits from Group 2. She has already chosen Maths. Therefore, Chemistry can be picked. This choice is possible.

Choice (D): French cannot be picked either in case (i) or in case (ii).

Solutions for questions 114 to 117: From the statements, we can make out that there are ten different amounts and each is the combined earnings of two people. Since there are five people and taking two at a time we can make ${}^5C_2$ or $(5 \times 4)/2$, i.e., 10 amounts. Since there are ten amounts given, it means they are all possible combinations of the five people taking two at a time. Also, since none of the ten amounts are equal, we can conclude that no two out of the five people had the same amount. Let us denote the five amounts with the five of them as a, b, c, d and e in descending order, i.e., a is the largest amount and e is the smallest amount. When we make combinations of two at a time out of five given items, each item occurs in four combinations. So, if we add up all the ten amounts, it should be equal to four times the sum of five amounts, i.e., $(a + b + c + d + e)$. If we add all the amounts given, it comes to `9600. Hence,

$$a + b + c + d + e = 2400 \quad \textbf{(i)}$$

Since a, b, c, d and e are in descending order, among the amounts that we can make taking two at a time, $a + b$ will be the largest, $a + c$ will be the second largest, $d + e$ will be the smallest and $c + e$ will be the second smallest. From this data and looking at the amounts given, we have:

$$a + b = 1500 \quad \textbf{(ii)}$$
$$a + c = 1400 \quad \textbf{(iii)}$$
$$d + e = 400 \quad \textbf{(iv)}$$
$$c + e = 600 \quad \textbf{(v)}$$

From the five equations (i), (ii), (iii), (iv) and (v), we can very easily get the values of the five variables [For example: Add (ii) and (iv) together and subtract it from (i) to get c] as

$$a = 900;\ b = 600;\ c = 500;\ d = 300;\ e = 100$$

Once we know the five amounts, we proceed as below (by taking the statements given regarding the amounts earned) to identify the names, designations, etc. As we get all the required information one by one, we shall fill up the following table.

Amount	Name	Division	Designation	Dress
900 (a)	Saxena	Engineering	Production Manager	Safari
600 (b)	Mathur	Foods	General Manager	3-piece
500 (c)	Sastry	Oil Seeds	Deputy General Manager	3-piece
300 (d)	Verma	International Trading	Senior Vice President	Churidar kurta
100 (e)	Rao	Soaps	Vice President	2-piece

Since Mathur and the person from Engineering division together won 1500 and since we know $a + b = 1500$, we can then write:

$$\text{Mathur + Engineering division} = a + b \quad (1)$$

Similarly, since Sastry and Saxena together earned 1400 and we know that $a + c = 1400$, we can write:

$$\text{Sastry + Saxena} = a + c \quad (2)$$

By comparing the two equations (1) and (2), we find that 'a' is common on the RHS in both equations. Then looking at the LHS, because Mathur is not common, we can conclude that Mathur is 'b' and 'a' belongs to the person from Engineering division. Fill this information in the appropriate cells in the table.

Similarly, Saxena and the Senior Vice President earn 1200 together and we know $a + d = 1200$, we can write:

$$\text{Saxena + Senior Vice President} = a + d \quad (3)$$

From equations (2) and (3), where 'a' is common on the RHS of both equations and Saxena common on the LHS of both equations, we can conclude that 'a' belongs to Saxena. Then from equation (2), 'c' belongs to Sastry. Form equation (3), 'd' belongs to the Senior Vice President. This information also should be filled in the table.

In this manner, we can write down the equations for all the other seven amounts also and make similar conclusions and fill in the table completely.

$$\text{Verma + Production Manager} = a + e \quad (4)$$

$$\text{General Manager + International Trading division} = b + d \quad (5)$$

$$\text{Foods division + Soaps division} = b + e \quad (6)$$

$$\text{Vice President + Oil Seeds division} = c + e \quad (7)$$

$$\text{Rao + Soaps division} = d + e \quad (8)$$

$$\text{Deputy General Manager + Churidar} = c + d \quad (9)$$

$$\text{3-piece suit + 3-piece suit} = b + c \quad (10)$$

From (4), we get Production Manager is 'a' (since Verma cannot be 'a') and hence, Verma is 'e'. Thus Rao will be 'd' who is the only person left out. From (8), Soaps division is 'e'; from (6), Foods division is 'b'; from (7), VP is 'e' (because Oil Seeds division cannot be 'e') and Oil seeds division is 'c'; from (5), International Trading division is 'd' (because 'd' cannot be GM since he is already Senior Vice President) and so 'b' is General Manager; the only slot left for Deputy General Manager is 'c'. Hence, from (9) we get 'd' as Churidar-kurta; from (10) 'b' and 'c' are 3-piece suit.

The last condition in the problem states that Safari-suit person won more than the person in 2-piece suit; the only two people left are 'a' and 'e'; so 'a' is Safari-suit and 'e' is 2-piece suit. This completes the table.

Once we have the table filled, we can answer the questions easily.

114. Only I and III are false.

115. None of these.

116. All the three statements are not true.

117. Saxena won the maximum amount.

Solutions for questions 118 to 121: From the facts about M1 we can observe that M1 was the first to start. After then, M3 and M4 started. M2 and M7 were started before M1 and M5 were stopped. Also, we can say that M3 and M4 were stopped before M1 was stopped.

From the facts about M3, we can say that M3 was started after M4 and M5 were started.

From the facts known of M4, we can say that M3 was the first to be stopped and M4 was the next.

Now, from the facts of M2, we can say that M2 was started with M7 and at that time M3 and M4 had already stopped.

The information is tabulated as follows

Machines	Order of starting	Machines running with it	Order of stopping
M1	1	M2, M3, M4, M5, M7	
M2	5 (with M7)	M1, M5	
M3	3	M1, M4, M5	1
M4	2	M1, M3, M5	2
M5	4	M1, M3, M4	
M6			
M7	5(with M2)	M2, M7	

Now, from the information about M5, we can say that at the first time it was stopped, M2 and M7 were running. And when it was started again only M2 and M7 were running. Also, from the information known about M6 as it was operated with M5, we can say that no other machine was started or stopped when M5 was not running (between its two shifts of operations).

Now, from the information known about M6 we can say that M7 was stopped before M6 was started. After that M6 was stopped. Thus, M2 and M5 were the last to stop.

Thus, we get the following arrangement:

Machine	Order of starting	Machines running with it	Order of stopping
M1	1	M2, M3, M4, M5, M7	3 (with M5)
M2	5(with M7)	M1, M5, M6, M7	7/6
M3	3	M1, M4, M5	1
M4	2	M1, M3, M4	2
M5 (A)	4	M1, M2, M3, M4, M7	3 (with M1)
M5 (B)	6	M2, M6, M7	6/7
M6	7	M2, M5	5
M7	5(With M2)	M1, M5, M2)	4

118. M5 was started first.

119. M1 and M5 were running at the time M2 was started.

120. Three machines_____00M1, M5 and M2 were operated with M7.

121. M2 and M5 were the last to stop.

Solutions for questions 122 to 125:

122. Only P, R and T who co-authored a paper with U had a change in their Einstein numbers. The other 5 participants did not have a change in their Einstein number.

123. It is given that on the third day, U co-authored a paper jointly with P and R. They would have reduced the Einstein number of P and R to $x + 1$ where x was U's Einstein number. As P had an infinite Einstein number at the beginning and as no co-authorship among any three other numbers would have made the average Einstein number to as low as 3, it means R initially did not have an Einstein number $x + 1$.
Now, since it is given that five of them had the same Einstein number at the end of day 3 and that the average of all the eight was 3 and as the three (other than the five) had Einstein number distinct from each other, the only possibility is that U had an Einstein number 1, five of them including P and R had an Einstein number 2 and the other two had an Einstein number which added up to 24 – 10 – 1, i.e., 13.
Now as it is given, that T co-authored a paper with U, the average of the group reduced by 0 × 5, i.e., the total reduced by 0 × 5 × 8 = 4 and that of T became 2 or it was initially 4 + 2 = 6, which means the eighth person had an Einstein number 13 – 6, i.e., 7.

124. Only three of the five participants who had an Einstein number of 2 at the end of day 3 had the same Einstein number at the beginning of the conference.

125. At the end of the third day each of P and R, have Einstein number $x + 1$, where x is the Einstein number of U. It is given that five scientists have the same number at the end of the third day it implies that three among Q, S, T, V and W also have $x + 1$, at the beginning of day one. But for these three, the rest of the five can have distinct Einstein numbers.

1 Series

Chapter

Learning Objectives

In this chapter, you will:

- Learn about Number series and Letter series
- Learn about different types of series, like
  - Difference series
  - Product series
  - Squares/Cubes series
  - Miscellaneous series
  - Combination of two or more series types
- Learn different ways to identify patterns and find the missing term in a series
- Learn how to convert alphabets into their equivalent number and vice-versa

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Series

Number and Letter Series form an important part of the 'Reasoning' section in various competitive examinations. There are two or three broad categories of questions that appear in various exams from this particular chapter.

In the first category of questions, a series of numbers/letters is given with one number/letter (or two numbers/letters) missing, represented by a blank or a question mark. The given series of numbers/letters will be such that each one follows its predecessor in a certain way, i.e., according to a definite pattern. Students are required to find out the way in which the series is formed and hence, work out the missing number/numbers or letter/letters to complete the series. Under these questions, there are a large variety of patterns that are possible, and the student requires a proper understanding of various patterns to be able to do well in these types of questions.

Number Series

For better understanding, we will classify this into the following broad categories.

1. Difference series
2. Product series
3. Squares/Cubes series
4. Miscellaneous series
5. Combination series

Difference Series

The difference series can be further classified as follows.

1. Number series with a constant difference.
2. Number series with an increasing or decreasing difference.

In the number series with a **constant difference**, there is always a constant difference between two consecutive numbers. For example, the numbers of the series 1, 4, 7, 10, 13, ... are such that any number is obtained by adding a constant figure of 3 to the preceding term of the series.

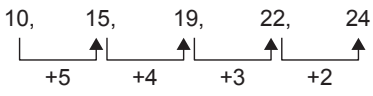
If we have to find the next number in the above series, we need to add 3 to the last term 13. Thus, 16 is the next term of the series.

Under the series with constant difference, we can have series of odd numbers or series of even numbers also.

In the series with **increasing/decreasing difference**, the difference between consecutive terms keeps increasing (or decreasing, as the case may be). For example, let us try to find out the next number in the series 2, 3, 5, 8, 12, 17, 23, ...

Here, the difference between the first two terms of the series is 1; the difference between the second and third terms is 2; the difference between the third and the fourth terms is 3 and so on. That is, the difference between any pair of consecutive terms is one more than the difference between the first number of this pair and the number immediately preceding this number. Here, since the difference between 17 and 23 is 6, the next difference should be 7. So, the number that comes after 23 should be (23 + 7) = 30.

We can also have a number of series where the difference is in decreasing order (unlike in the previous example where the difference is increasing). For example, let us find out the next term of the series 10, 15, 19, 22, 24

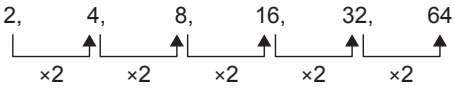


Here the differences between 1st and 2nd, 2nd and 3rd, 3rd and 4th numbers, etc., are 5, 4, 3, 2, and so on. Since the difference between 22 and 24 is 2, the next difference should be 1. So, the number that comes after 24 should be 25.

Product Series

A product series is usually a number series where the terms are obtained by a process of multiplication. Here also, there can be different types of series. We will look at these through examples.

Consider the series 2, 4, 8, 16, 32, 64, ...

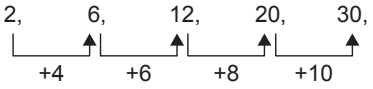


Here, each number in the series is multiplied by 2 to get the next term. So, the term that comes after 64 is 128. **So, each term is multiplied by a fixed number to get the next term.** Similarly, we can have a series where we have numbers obtained by **dividing** the previous term with a constant number. For example, in the series 64, 32, 16, 8, ..., each number is obtained by dividing the previous number by 2 (or in other words, by multiplying the previous term by $^1/_2$). So, here, the next term will be 4 (obtained by dividing 8 with 2).

Consider the series 4, 20, 80, 240, ...

Here, the first term is multiplied by 5 to get the second term; the second term is multiplied by 4 to get the third term; the third term is multiplied by 3 to get the fourth term. Hence, to get the fifth term, we have to multiply the fourth term by 2, i.e., the fifth term is 480. **So, each term is multiplied by a decreasing factor (or it could also be an increasing factor) to get the next term.** That is, with whatever number a particular term is multiplied to get the next term, this latest term is multiplied by a number different from the previous multiplying factor to get the next term of the series. All the multiplying factors follow a certain pattern (normally of increasing or decreasing order).

Consider the series 2, 6, 12, 20, 30, ...



This can be looked at a series of increasing differences. The differences of consecutive pairs of terms are 4 (between 2 and 6), 6 (between 6 and 12), 8 (between 12 and 20), 10 (between 20 and 30) and so on. Hence, the difference between 30 and the next term should be 12 and so the next term will be 42. But this series can also be looked at as a product series.

2,	6,	12,	20,	30
↓	↓	↓	↓	↓
1 × 2	2 × 3	3 × 4	4 × 5	5 × 6

The first term is the product of 1 and 2; the second term is the product of 2 and 3; the third term is the product of 3 and 4; the fourth term is the product of 4 and 5; the fifth term is the product of 5 and 6. Hence, the next term will be the product of 6 and 7, that is 42.

Squares/Cubes Series

There can be series where all the terms are related to the squares of numbers or cubes of numbers. With squares/cubes of numbers as the basis, there can be many variations in the pattern of the series. Let us look at the various possibilities of series based on squares/cubes.

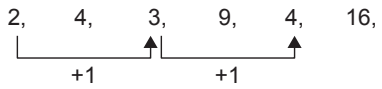
Each term of the series may be the square of a natural number, such as 1, 4, 9, 16, ...

1,	4,	9,	16
↓	↓	↓	↓
1^2	2^2	3^2	4^2

The numbers are squares of 1, 2, 3, 4 ..., respectively. The number which follows 16 (which is the square of 4) will be 25 (which is the square of 5).

The terms of the series may be the squares of odd numbers (For example: 1, 9, 25, 49, ...) or even numbers (For example: 4, 16, 36, 64, ...).

The terms of the series could be such that a number and its square are both given one after the other and such pairs are given in some specific pattern. For example, take the series 2, 4, 3, 9, 4, 16, ...



Here, 2 is followed by its square 4; then comes the number 3 (which is one more than 2) followed by its square 9 and so on. Hence, the next number in the series is 5 and the one after that is its square, i.e., 25.

Similarly, each term could be the square root of its predecessor. For example, in the series 81, 9, 64, 8, 49, 7, 36, ..., 81 is the square of 9, 64 the square of 8, and so on. Therefore, the next number which follows in the series should be the square root of 36, i.e., 6.

The terms of the series could be the squares of natural numbers increased or reduced by certain number. For example, in the series 3, 8, 15, 24, ...

3,	8,	15,	24
↓	↓	↓	↓
$2^2 - 1$	$3^2 - 1$	$4^2 - 1$	$5^2 - 1$

We have {Squares of natural numbers - 1} as the terms. The first term is $2^2 - 1$; the second term is $3^2 - 1$; the third term is $4^2 - 1$ and so on. Hence, the next term will be $6^2 - 1$, i.e., 35 [Please note that the above series can also be looked at as a series with increasing differences. The differences between the 1st and 2nd terms, the 2nd and 3rd terms, and so on are 5, 7, 9, and so on. Hence, the next difference should be 11 giving us the next term as 35]. There could also be a series with (squares of natural numbers + some constant).

Like we have seen series with squares of numbers, we can have similar series with cubes of numbers. For example, take the series 1, 8, 27, 64, ...

1,	8,	27,	64
↓	↓	↓	↓
1^2	2^3	3^3	4^3

Here, all the terms are cubes of natural numbers. So, the next term will be 5^3, i.e., 125.

Consider the series 2, 9, 28, 65, ...

2,	9,	28,	65
↓	↓	↓	↓
$1^3 + 1$	$2^3 + 1$	$3^3 + 1$	$4^3 + 1$

Here, the terms are (Cubes of natural numbers + 1). The first term is $1^3 + 1$; the second term is $2^3 + 1$; the third term is $3^3 + 1$ and so on. Hence, the next term will be $5^3 + 1$, i.e., 126.

Miscellaneous Series

There are series that do not come under the other patterns and are of general nature but are important and are fairly common. Even here, sometimes, there can be a specific pattern in some cases.

Take the series 3, 5, 7, 11, 13, ... This is a series of consecutive PRIME NUMBERS. It is an important series and the student should look out for this as one of the patterns. The next term in this series is 17.

There can also be variations using prime numbers. Take the series 9, 25, 49, 121, ... In this series, the terms are squares of prime numbers. Hence, the next term is 13^2, i.e., 169.

Take the series 15, 35, 77, ... The first term is 3 × 5; the second term is 5 × 7; the third term is 7 × 11. Here, the terms are product of two consecutive prime numbers. So, the next term will be the product of 11 and 13, i.e., 143.

Take the series 8, 24, 48, 120, 168, ... Here, the 2nd term is 3 times the first term and the 3rd term is 2 times the 2nd term, but after that it does not follow this pattern any more. If you look at the terms carefully, you will find that the terms are (one less than squares of prime numbers). Hence, the next term will be $17^2 - 1$, i.e., 288.

Consider the series 1, 4, 9, 1, 6, 2, 5, 3, ...

At first sight there is nothing we can say about the series. This is actually a series formed by squares of natural numbers. However, if any of the squares is in two or more digits, each of the digits is written as a separate term of the series. Thus, the first terms are 1, 4 and 9, the squares of 1, 2 and 3, respectively. After this, we should get 16 (which is the square of 4). Since this has two digits 1 and 6, these two digits are written as two different terms 1 and 6 in the series. Similarly, the next square 25 is written as two different terms 2 and 5 in the series. So, the next square 36 should be written as two terms 3 and 6. Of these, 3 is already given. So, the next term of the series is 6.

Consider the series 1, 1, 2, 3, 5, 8, ...

1,	1,	2,	3,	5,	8
		↓	↓	↓	↓
		1 + 1	1 + 2	2 + 3	3 + 5

Here, each term, starting with the third number, is the sum of the two preceding terms. After taking the first two terms as given (1 and 1), then onwards, to get any term, we need to add the two terms that come immediately before that position. Hence, to get the next term of the series, we should take the two preceding terms 5 and 8 and add them up to get 13. So, the next term of the series is 13. The term after this will be 21 (= 8 + 13).

Combination Series

A number of series which has more than one type of (arithmetic) operation performed or more than one series combined together is a combination series. The series that are combined can be two series of the same type or could be different types of series as described above. Let us look at some examples.

First let us look at those series which are formed by more than one arithmetic operation performed on the terms to get the subsequent terms.

Consider the series: 2, 6, 10, 3, 9, 13, 4, 12, ... Here, the first term 2 is multiplied by 3 to get the second term, and 4 is added to get the third term. The next term is 3 (one more than the first term 2) and it is multiplied by 3 to get 9 (which is the next term) and then 4 is added to get the next term 13. The next term 4 (which is one more than 3) which is multiplied with 3 to get 12. Then 4 is added to this to get the next number 16.

Consider the series: 1, 2, 6, 21, 88, ... Here, we can observe that 88 is close to 4 times 21. It is in fact $21 \times 4 + 4$. So, if we now look at the previous term 21, it is related to the previous term 6 as $6 \times 3 + 3$. Now we get the general pattern, to get any term, multiply the previous term with k and then add k where k is a natural number with values in increasing order from 1. So, to get the second term, the first term has to be multiplied with 1 and then 1 is added. To get the third term, the second term is multiplied with 2 and then 2 is added and so on. Hence, after 88, the next term is $88 \times 5 + 5$, i.e., 445.

Now, let us look at a series that is formed by combinning two (or more) different series. The two (or more) series can be of the same type or of differenttypes described above.

Consider the series: 8, 12, 9, 13, 10, 14, ... Here the 1st, 3rd, 5th, ... terms which are 8, 9, 10, ... form one series whereas the 2nd, 4th, 6th, etc., terms which are 12, 13, 14 form another series. Here, both series that are being combined are two simple constant difference series. Therefore, the missing number will be the next term of the first series 8, 9, 10, ... which is equal to 11.

Consider the series: 0, 7, 2, 17, 6, 31, 12, 49, 20, ... Here, the series consisting of 1st, 3rd, 5th, ... terms (i.e., the series consisting of the odd terms) which is 0, 2, 6, 12, 20, ... is combined with another series consisting of 2nd, 4th, 6th, ... terms (i.e., the series consisting of the even terms) which is 7, 17, 31, 49, ... The first series has the differences in increasing order 2, 4, 6, 8, 10 and so on. The second series also has the difference in increasing order 10, 14, 18, ... Since, the last term 20 belongs to the first series, a number from the second series should follow next. The next term of the second series will be obtained by adding 22 to 49, i.e., 71.

Consider the series: 1, 1, 4, 8, 9, 27, ... Here, the series of squares of natural numbers is combined with the series of cubes of natural numbers. The next term in the series will be $4^2 = 16$.

Consider the series: 2, 4, 5, 9, 9, 16, 14, ?, 20, ... Here, we have to find out the term that should come in place of the question mark. The odd terms form one series 2, 5, 9, 14, 20, ... where the difference is increasing. The differences are 3, 4, 5, 6, ... This series is combined with the series of even terms 4, 9, 16, ... where the terms are squares of numbers 2, 3, 4, ... Hence, the

term that should come in place of the question mark is the next term of the second series which is 5^2, i.e., 25.

A General Approach to Number Series

The best way of approaching the number series questions is to first observe the difference between terms. If the difference is constant, it is a constant difference series. If the difference is increasing or decreasing by a constant number, then it is a series with a constant increasing or decreasing difference. If there is no constant increasing or decreasing difference, then try out the product series approach. For this, first divide the second term with the first term, third with the second and so on. If the numbers obtained are the same, then it is a product series. Alternatively, try writing each term of the series as a product of two factors and see if there is any pattern that can be observed. If still there is no inference, but the difference is increasing or decreasing in a rapid manner, then check out the square series. If the increase is very high, and it is not a square series, then try out the cube series.

If the difference is alternately decreasing and increasing (or increasing for some time and alternately decreasing), then it should most probably be a mixed series. Therefore, test out the series with alternate numbers. If still the series is not solved, then try out the general series.

Letter Series

The questions here are similar to the questions in Number Series Type I. Instead of numbers we have letters of the alphabet given here. We have to first identify the pattern that the series of letters follow. Then, we have to find the missing letter based on the pattern already identified. In Letter Series, in general, we have a series with constant or increasing or decreasing differences. The position of the letters in the English alphabet is considered to be the value of the alphabet in questions on Letter Series. Also, when we are counting, after we count from A to Z, we again start with A, i.e., we treat the letters as being cyclic in nature. Like in Number Series, in this type of Letter Series also, we can have a 'combination' of series, i.e., two series are combined and given. We need to identify the pattern in the two series to find out the missing letter. Sometimes, there will be some special types of series also. Let us look at a few examples to understand questions on Letter Series.

Solved Examples

1. Find the next letter in the series.
D, G, J, M, P,____.
(A) Q (B) R
(C) S (D) T

Sol: Three letters are added to each letter to get the next letter in the series.
D^{+3}, G^{+3}, J^{+3}, M^{+3}, P^{+3}, S
P + 3 and P = 16 and 16 + 3 = 19 and the 19th letter in the alphabet is S.

2. Find the next letter in the series.
A, B, D, H,____.
(A) L (B) N
(C) R (D) P

Sol: Each letter in the given series is multiplied with 2 to get the next letter in the series.
A × 2 ⇒ 1 × 2 = 2 and the 2nd letter is B. B × 2
Similarly, H × 2 ⇒ 8 × 2 = 16 and the 16th letteris P.

3. What is the next letter in the series?
B, D, G, K, P, ____
(A) S (B) V
(C) W (D) X

Sol: B^{+2}, D^{+3}, G^{+4}, K^{+5}, P^{+6}, _____
P + 6 = 16 + 6 = 22 and the 22nd letter is V.

4. I, X, J, W, K, V, L,____.
(A) M (B) U
(C) S (D) T

Sol: The given series is an alternate series.
I^{+1}, J^{+1}, K^{+1}, L is one series and X^{-1}, W^{-1}, V^{-1}, ____ is the other series.
X - 1 = W, W - 1 = V and V - 1 = 22 - 1 = 21 and the 21st letter is U.

exercises

Directions for questions 1 to 5: Complete the following series.

1. 10, 130, 1430, 10010, 50050, _____
(A) 100100 (B) 110100
(C) 150150 (D) 150100

2. 361, 529, 841, 961, _____
(A) 1249 (B) 1269
(C) 1349 (D) 1369

3. 50, 51, 77.5, 156, 391, _____
(A) 1173 (B) 1174
(C) 1175 (D) 1369.5

4. 20, 35, 60, 105, 190, _____
(A) 365 (B) 360
(C) 355 (D) 350

5. 8, 4, 4, 6, 12, 30, _____
(A) 75 (B) 95
(C) 90 (D) 105

Directions for questions 6 to 10: Find the wrong number in the series.

6. 12, 33, 55, 84, 114, 147, 183
(A) 55 (B) 84
(C) 33 (D) 147

7. 1850, 1050, 650, 400, 350, 300, 275
(A) 650 (B) 350
(C) 400 (D) 275

8. 12, 31, 72, 95, 114, 131, 144
(A) 31 (B) 12
(C) 72 (D) 114

9. 24, 25, 29, 36, 54, 79, 115
(A) 24 (B) 29
(C) 79 (D) 36

10. 5, 10, 17, 33, 65, 129, 257
(A) 5 (B) 10
(C) 17 (D) 65

Directions for questions 11 to 15: In each of these questions a number of series is given. After the series, a number is given along with (a), (b), (c), (d) and (e). You have to completethe series starting with the number given to find the values of (a), (b), (c), (d) and (e) applying the same pattern followedin the given series. Then answer the questions given below.

11. 4, 40, 89, 153, 234, 334
20 (a) (b) (c) (d) (e)
(A) 169 (B) 250
(C) 196 (D) 269

12. 24, 12, 12, 18, 36, 90, 270
32 (a) (b) (c) (d) (e)
What is the value of (b) in the series?
(A) 16 (B) 24
(C) 75 (D) 48

13. 5, 6, 14, 45, 184, 925, 5556
10 (a) (b) (c) (d) (e)
What is the value of (a) in the series?
(A) 24 (B) 75
(C) 9 (D) 11

14. 0.75, 3, 12, 48, 192, 768, 3072
5 (a) (b) (c) (d) (e)
What is the value of (e) in the series?
(A) 1280 (B) 4680
(C) 5120 (D) 80

15. 16, 52, 84, 112, 136, 156, 72
30 (a) (b) (c) (d) (e)
What is the value of (c) in the series?
(A) 66 (B) 30
(C) 126 (D) 80

Directions for questions 16 to 20: In each of the following series two wrong numbers are given, out of which one differs by a margin of 1, i.e., + 1 or -1 and the other with a greater margin. From the given choices choose the number that differs by the greater margin. The first and the last numbers in the series are always correct.

16. 434, 629, 774, 874, 938, 972, 990
(A) 629 (B) 774
(C) 874 (D) 972

17. 5, 7, 18, 73, 499, 5487, 71314
(A) 7 (B) 18
(C) 73 (D) 499

18. 5300, 4300, 3571, 3061, 2716, 2501, 2375
(A) 4300 (B) 3571
(C) 3061 (D) 2716

19. 21491, 3071, 511, 102, 30, 9, 4
(A) 9 (B) 30
(C) 102 (D) 509

20. 201600, 100800, 33605, 8400, 1679, 28040
(A) 280 (B) 1679
(C) 8400 (D) 33605

Directions for questions 21 to 30: Complete the following series.

21. MTD, NSA, PVE, PVC, SXF, RYE, _____
(A) VXY (B) VZG
(C) UVW (D) UWV

22. ABFL, BDLX, CFRJ, DHXV, _____
(A) EICH (B) EJDI
(C) EJDH (D) FICH

23. DMP, IOM,____, SSG, XUD
(A) MPI (B) MQI
(C) NPJ (D) NQJ

24. X, P, J, F, ___
(A) A (B) B
(C) C (D) D

25. IJLO, STVY, CDFI, MNPS, ___
(A) WYAB (B) WWAC
(C) WXZC (D) WXAC

26. EUILN, DWFPI,____, CXEQH, GSKJP
(A) FTJKO (B) FUILM
(C) EULIM (D) ETJKO

27. C1B, G12E, K3H, O26K, _____
(A) T5O (B) U5P
(C) S5N (D) R5M

28. $\frac{C}{12}, \frac{E}{30}, \frac{G}{56}, \_\_\_\_, \frac{K}{132}, \frac{M}{182}$
(A) $\frac{I}{80}$ (B) $\frac{I}{80}$
(C) $\frac{I}{90}$ (D) $\frac{I}{90}$

29. XTV, UQS, RNP, OKM, ___
(A) HLJ (B) JHL
(C) HJL (D) LHJ

30. LMZ, NYO, XPQ, RSW, ___
(A) TUV (B) TVU
(C) VTU (D) SVQ

ANSWER KEYS

1. (C)	6. (A)	11. (B)	16. (D)	21. (B)	26. (A)
2. (D)	7. (C)	12. (A)	17. (B)	22. (C)	27. (C)
3. (B)	8. (A)	13. (D)	18. (C)	23. (D)	28. (D)
4. (C)	9. (D)	14. (C)	19. (B)	24. (D)	29. (D)
5. (C)	10. (B)	15. (C)	20. (D)	25. (C)	30. (B)

SOLUTIONS

Solutions for questions 1 to 5:

1. The given logic is as follows.
$10^{\times 13}$, $130^{\times 11}$, $1430^{\times 7}$, $10010^{\times 5}$, $50050^{\times 3}$, $\underline{150150}$.

2. The given logic is as follows.
361, 529, 841, 961, $\underline{1369}$.
$(19)^2$ $(23)^2$ $(29)^2$ $(31)^2$ $(37)^2$

3. The given logic is as follows.
$50^{(\times 1+1)}$, $51^{(\times 1.5+1)}$, $77.5^{(\times 2+1)}$, $156^{(\times 2.5+1)}$, $391^{(\times 3+1)}$, $\underline{1174}$.

4. The given logic is as follows.
$20^{(\times 2\ -\ 5)}$, $35^{(\times 2\ -\ 10)}$, $60^{(\times 2\ -\ 15)}$, $105^{(\times 2\ -\ 20)}$, $190^{(\times 2\ -25)}$, $\underline{355}$.

5. The given logic is as follows.
$8^{\times 0.5}$, $4^{\times 1}$, $4^{\times 1.5}$, $6^{\times 2}$, $12^{\times 2.5}$, $30^{\times 3}$, $\underline{90}$.

Solutions for questions 6 to 10:

6. The given logic is as follows.
12^{+21}, 33^{+24}, $\underline{57}^{+27}$, 84^{+30}, 114^{+33}, 147^{+36}, 183
Hence, the wrong number in the series is 55.

7. The given logic is as follows.
1850^{-800}, 1050^{-400}, 650^{-200}, $\underline{450}^{-100}$, 350^{-50}, 300^{-25}, 275
Hence, the wrong number in the series is 400.

8. The given logic is as follows.
12^{+31}, $\underline{43}^{+29}$, 72^{+23}, 95^{+19}, 114^{+17}, 31^{+13}, 144
Hence, the wrong number in the series is 31.

9. The given logic is as follows.

$24^{(+1=1^2)}$, $25^{(+4=2^2)}$, $29^{(+9=3^2)}$, $\underline{38}^{(+16=4^2)}$, $54^{(+25=5^2)}$, $79^{(+36=6^2)}$, 115

Hence wrong number in the series is 36.

10. The given logic is as follows.

$5^{(+4=2^2)}$, $\underline{9}^{(+8=2^3)}$, $17^{(+16=2^4)}$, $33^{(+32=2^5)}$, $65^{(+64=2^6)}$, $129^{(+128=2^7)}$, 257

Hence wrong number in the series is 10.

Solutions for questions 11 to 15:

The given logic is as follows.

4^{+6^2}, 40^{+7^2}, 89^{+8^2}, 153^{+9^2}, 234^{+10^2}, 334

11. The new series will be as follows.

20 (a) (b) (c) (d) (e)

20^{+6^2}, 56^{+7^2}, 105^{+8^2}, 169^{+9^2}, 250^{+10^2}, 350

∴ The value of (d) is 250.

12. The given logic is as follows.

$24^{\times 0.5}$, $2^{\times 1}$, $12^{\times 1.5}$, $18^{\times 2}$, $36^{\times 2.5}$, $90^{\times 3}$, 270

The new series will be as follows.

32 (a) (b) (c) (d) (e)

$32^{\times 0.5}$, $16^{\times 1}$, $16^{\times 1.5}$, $24^{\times 2}$, $48^{\times 2.5}$, 120

∴ The value of (b) is 16.

13. The given logic is as follows.

$5^{(\times 1 + 1)}$, $6^{(\times 2 + 2)}$, $14^{(\times 3 + 3)}$, $45^{(\times 4 + 4)}$, $184^{(\times 5 + 5)}$, $925^{(\times 6 + 6)}$, 5556

The new series will be as follows.

10 (a) (b) (c) (d) (e)

$10^{(\times 1 + 1)}$, $11^{(\times 2 + 2)}$, $24^{(\times 3 + 3)}$, $75^{(\times 4 + 4)}$, $304^{(\times 5 + 5)}$, 1525

∴ The value of (a) is 11.

14. The given logic is as follows.

$0.75^{\times 4}$, $3^{\times 4}$, $12^{\times 4}$, $48^{\times 4}$, $192^{\times 4}$, $768^{\times 4}$, 3072

The new series will be as follows.

5 (a) (b) (c) (d) (e)

$5^{\times 4}$, $20^{\times 4}$, $80^{\times 4}$, $320^{\times 4}$, $1280^{\times 4}$, 5120

∴ The value of (e) is 5120.

15. The given logic is as follows.

16^{+36}, 52^{+32}, 84^{+28}, 112^{+24}, 136^{+20}, 156^{+16}, 172

The new series will be as follows.

30 (a) (b) (c) (d) (e)

30^{+36}, 66^{+32}, 98^{+28}, 126^{+24}, 150^{+20}, 170

∴ The value of (c) is 126.

Solutions for questions 16 to 20:

16. The given logic is as follows.

$434 + (14)^2 = \underline{630}$.

$630 + (12)^2 = 774$.

$774 + (10)^2 = 874$.

$874 + (8)^2 = 938$.

$938 + (6)^2 = \underline{974}$.

$974 + (4)^2 = 990$.

Hence, the wrong numbers are 629 and 972, where 972 has greater difference.

17. The given logic is as follows.

$5^{\times 2-3}$, $7^{\times 3-5}$, $\underline{16}^{\times 5-7}$, $73^{\times 7-11}$, $\underline{500}^{\times 11-13}$, $5487^{\times 13-17}$, 71314

Hence, the wrong numbers are 18 and 499, where 18 has greater difference.

18. The given logic is as follows.

5300^{-10^3}, 4300^{-9^3}, 3571^{-8^3}, $\underline{3059}^{-7^3}$, 2716^{-6^3}, $\underline{2500}^{-5^3}$, 2375

Hence, the wrong numbers are 3061 and 2501, where 3061 has greater difference.

19. The given logic is as follows.

$21491^{(+6 \div 7)}$, $3071^{(-5 \div 6)}$, $511^{(+4 \div 5)}$, $\underline{103}^{(-3 \div 4)}$, $\underline{25}^{(+2 \div 3)}$, $9^{(-1 \div 2)}$, 4

Hence, the wrong numbers are 102 and 30, where 30 has greater difference.

20. The given logic is as follows.

$201600^{\div 2}$, $100800^{\div 3}$, $\underline{33600}^{\div 4}$, $8400^{\div 5}$, $\underline{1680}^{\div 6}$, $280^{\div 7}$, 40

Hence, the wrong numbers are 33605 and 1679, where 33605 has greater difference.

Solutions for questions 21 to 30:

21. The alternate groups are in different series.

MTD, PVE, SXF are in on series.

Pattern for the first letters:

M^{+3}, P^{+3}, S^{+3}, V

Pattern for the second letters:

T^{+2}, V^{+2}, X^{+2}, Z

Pattern for the third letters:

D^{+1}, E^{+1}, F^{+1}, G

Hence, the next pair is VZG.

22. In this series the first letter in all the groups form a series of consecutive letters. Hence, the first letter in the next group is E. The other letter in each group is related as follows.

A^{x2}	B^{x3}	F^{x2}	L
B^{x2}	D^{x3}	L^{x2}	X
C^{x2}	F^{x3}	R^{x2}	J

D^{x2} H^{x3} X^{x2} V

Hence, the next group is obtained as follows.

E^{x2} J^{x3} D^{x2} H

Hence, the next group in the series is EJDH.

23. The given series is a mixed series.

Pattern for the first letters:

D^{+5}, I^{+5}, $\underline{N}^{+5}$, S^{+5}, X

Pattern for the second letters:

M^{+2}, O^{+2}, $\underline{Q}^{+2}$, S^{+2}, U

Pattern for the third letters:

P^{-3}, M^{-3}, J^{-3}, G^{-3}, D

Hence, the missing pair is NQJ.

24. X^{-8}, P^{-6}, J^{-4}, F^{-2}, __

The values that are subtracted are consecutive even numbers in decreasing order starting from 8. Hence, the next letter in the series is F - 2 = D.

25. The given logic is as follows.

I^{+1} J^{+2} L^{+3} O^{+4}, S^{+1} T^{+2} V^{+3} Y^{+4}, C^{+1} D^{+2} F^{+3} I^{+4},

M^{+1} N^{+2} P^{+3} S^{+4}, $\underline{W+1\ X+2\ Z+3\ C}$

Hence, WXZC is the next group in the series.

26. The given series is a mixed series.

Pattern for the first letters:

E^{-1}, D^{+2}, $\underline{F}^{-3}$, C, $^{+4}$G

Pattern for the second letters:

U^{+2}, W^{-3}, $\underline{T}^{+4}$, X^{-5}, S

Pattern for the third letters:

I^{-3}, F^{+4}, J^{-5}, E^{+6}, K

Pattern for the fourth letters:

L^{+4}, P^{-5}, $\underline{K}^{+6}$, Q^{-7}, J

Pattern for the fifth letters:

N^{-5}, I^{+6}, $\underline{O}^{-7}$, H^{+8}, P

Hence, the missing group is FTJKO.

27.

3	2	7	5	11	8	15	11				
C	1	B,	G	12	E,	K	3	H,	O	26	K,
(3 – 2)	(7 + 5)	(11 – 8)	(15 + 11)								

Pattern for the first letters:

C^{+4}, G^{+4}, K^{+4}, O^{+4}, $\underline{S}$

Pattern for the second letters:

B^{+3}, E^{+3}, H^{+3}, K^{+3}, $\underline{N}$

Hence, the required group is, S(19 – 14)N ⇒ S5N.

28. $\frac{C(3)}{3x(3+1)}, \frac{E(5)}{5x(5+1)}, \frac{G(7)}{7x(7+1)}$

$\frac{I(9)}{9x(9+1)}, \frac{K(11)}{11x(11+1)}, \frac{M(13)}{13x(13+1)}$

Pattern for the letters:

Letters in consecutive odd positions.

Hence, $\frac{I}{90}$ is the missing term in the series.

29. The given series is a mixed series.

Pattern for the first letters:

X^{-3}, U^{-3}, R^{-3}, O^{-3}, $\underline{L}$

Pattern for the second letters:

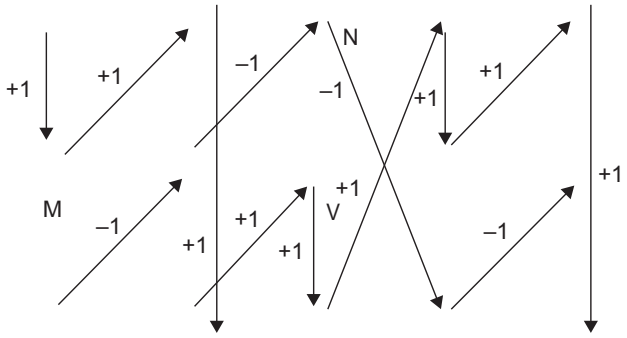
T^{-3}, Q^{-3}, N^{-3}, K^{-3}, $\underline{H}$

Pattern for the third letters:

V^{-3}, S^{-3}, P^{-3}, M^{-3}, J

Hence, the next group in the series is LHJ.

30. In the given series each group is related to its previous group and the letters within the group are related to each other as follows.



Hence, the missing group in the series is TVU.

2 Analogies

Chapter

Learning Objectives

In this chapter, you will:

- Learn about analogy – a similar relationship between two or more entities
- Learn about number analogies and verbal analogies
- Learn about the different kinds of relationships between elements in number analogy questions like:
  - Multiples
  - Square/square roots
  - Cube/cube roots
  - Prime numbers

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Analogies

Analogy means 'similarity' or 'similar relationship'. In these type of questions regarding the number or letter or verbal analogies, a pair of entities that has a certain relationship is given. This number/letter/pair is followed by a third number/letter/word. The student is expected to identify the relationship between the pair given and find out a FOURTH element such that the relationship between the third and the fourth is similar to the relationship that exists between the first and the second (In some cases, it may not be the fourth one that has to be found out. The fourth one will be given and the student has to find out one of the other three, whichever is not given).

Number Analogies

Typical relationships between the numbers in a given pair can be any of the following:

- One number is a multiple of the other.
- One number is the square or square root of the other.
- One number is the cube or cube root of the other.
- The two numbers are squares of two other numbers which themselves are related. For example, the two numbers are squares of two consecutive integers or squares of two consecutive even integers or squares of two consecutive odd integers.
- The two numbers are such that they are obtained by subtracting a certain number from the squares or cubes of the two related numbers.
- The two numbers are such that they are obtained by adding a certain number to the squares or cubes of the two related numbers.
- The two numbers can be consecutive, even, odd or prime numbers.

There can be many more combinations that one can think of but the student has to note an important point in solving questions on Number Analogies. In Number Series related questions, since a series of numbers (more than two numbers) will be given, the relationship or pattern can be identified uniquely. In Number Analogies, since only two numbers are given, it may be possible to think of more than one relationship existing between the two numbers in the given pair. But, it should be kept in mind that generally, simple addition of one number or subtraction of one number is not what is given in Number Analogies. The questions try to test the insight that the student has got into the relationship between the numbers.

Let us take a few examples and understand the questions on Number Analogies.

Solved Examples

1. 25 is related to 36 in the same way as 49 is related to_____.
(A) 61 (B) 63
(C) 65 (D) 60

Sol: When the numbers in the question are considered the students tend to consider 25 and 36 as squares of two consecutive natural numbers. But the answer choices do not have any answer suitable to the above logic. Hence, it is important that the student keeps the answer choices in view in arriving at the logic.
25 + 11 = 36
Similarly, 49 + 11 = 60.

2. 27 is related to 51 in the same way as 83 is related to_____.
(A) 102 (B) 117
(C) 123 (D) 138

Sol: The given analogy can be written as:
$5^2 + 2 : 7^2 + 2 :: 9^2 + 2 :$_____.
5 and 7 are successive odd numbers.
Similarly, next odd number to 9 is 11 and $11^2 + 2 = 121 + 2 = 123$.

3. 11 is related to 25 in the same way as 17 is related to_____.
(A) 33 (B) 28
(C) 41 (D) 37

Sol: $11 \times 2 + 3 = 22 + 3 = 25$.
Similarly, $17 \times 2 + 3 = 34 + 3 = 37$.

Letter Analogies

The questions in this area are similar to Verbal Analogies. Here, the questions are based on the relationship between **two groups of letters** (instead of **two words** as in Verbal Analogies). Typically, three sets of letters are given followed by a question mark (where a fourth set of letters is supposed to be inserted). The student has to find the relation or order in which the letters have been grouped together in the first two sets of letters on the left hand side of the symbol ': :' and then find a set of letters to fit in place of the question mark so that the third and the fourth set of letters will also have the same relationship as the first and the second. The sequence or order in which the letters are grouped can be illustrated by the following examples.

Solved Examples

1. BDEG is related to DFGI in the same way as HKMO is related to_____.
(A) ILNP (B) JMOP
(C) JMOQ (D) JNOQ

Sol: Two letters are added to each letter to get the next letters in the analogy.
B D E G; Similarly, H K M O
+2 +2 +2 + 2 +2 +2 +2 +2
D F G I J M O Q

2. ACDF is related to CGJN in the same way as BEHI is related to_____.
(A) DJNQ (B) DINQ
(C) DINR (D) DHNQ

Sol: A C D F; Similarly, B E H I
+2 +4 +6 +8 +2 +4 +6 +8
C G J N D I N Q

3. SUWY is related to LPTX in the same way as PRTV is related to_____.

(A) INRU (B) INQU
(C) IMRU (D) IMQU

Sol: S U W Y; Similarly, P R T V
−7 −5 −3 −1 −7 −5 −3 −1
L P T X I M Q U

4. BCDE is related to DFHH in the same way as FGHI is related to_____.

(A) LJPL (B) LKPL
(C) JKPJ (D) IKPL

Sol: B C D E; Similarly, F G H I
x2 +3 x2 +3 x2 +3 x2 +3
D F H H L J P L

Verbal Analogies:

Here, the questions are based on relationship between two words. In these kind of questions three words are followed by a blank space, which the student has to fill up in such a way that the third and the fourth words have the same relationship between them as the first and the second words have. The following examples help in understanding the concepts.

Solved Examples

1. Gum is related to Stick in the same way as Needle is related to_____.
(A) Cloth (B) Prick
(C) Taylor (D) Stitch

Sol: Gum is used to Stick and Needle is used to Stitch.

2. Socks is related to Feet in the same way as Hands is related to_____.
(A) Arms (B) Shirt
(C) Gloves (D) Fingers

Sol: Socks are worn on Feet. Similarly, Gloves are worn on Hands.

3. Soft is related to Hard in the same way as Cold is related to_____.
(A) Hot (B) Ice
(C) Winter (D) Snow

Sol: Soft and Hard are antonyms. Similarly, the antonym of Cold is Hot.

Exercises

Directions for questions 1 to 25: Find the missing term.

1. 36 : 343 : : _____ : 1331
(A) 81 (B) 121
(C) 100 (D) 144

2. 24 : 576 : : 32 : _____
(A) 1024 (B) 992
(C) 1228 (D) 865

3. 13 : 2197 : : 16 : _____
(A) 256 (B) 2744
(C) 4096 (D) 3378

4. 81 : 729 : : 144 : _____
(A) 1728 (B) 1331
(C) 169 (D) 2197

5. 22 : 506 : : 27 : _____
(A) 675 (B) 756
(C) 702 (D) 783

6. 6 : 222 : : 9 : _____
(A) 738 (B) 767
(C) 729 (D) 744

7. 5 : 120 : : 8 : _____
(A) 520 (B) 504
(C) 448 (D) 512

8. 5 : 150 : : 8 : _____
(A) 520 (B) 516
(C) 512 (D) 576

9. 6 : 180 : : 9 : _____
(A) 729 (B) 738
(C) 632 (D) 648

10. 105 : 150 : : 39 : _____
(A) 68 (B) 64
(C) 60 (D) 72

11. 390 : 315 : : _____ : 564
(A) 663 (B) 689
(C) 653 (D) 674

12. 3864 : 5098 : : 4994 : _____
(A) 6228 (B) 6246
(C) 6194 (D) 6286

13. 1936 : 1360 : : _____ : 2142
(A) 2746 (B) 2718
(C) 2672 (D) 2466

14. 11 : 24 : : 37 : _____
(A) 68 (B) 92
(C) 74 (D) 78

15. 97 : 8 : : 43 : _____
(A) 4 (B) 2
(C) 3 (D) 7

16. PS : KH : : MT : _____
(A) NH (B) NG
(C) LG (D) LH

17. EOU : IUA : : AIU : _____
(A) EIO (B) IOE
(C) EOA (D) EAO

18. HRD : JSF : : XMP : _____
(A) ZNQ (B) ZOR
(C) YNR (E) YNQ

19. DATE : ECWI : : CHAIN : _____
(A) DJDMS (B) DJELR
(C) DIFMS (D) DIELS

20. MONTH : NMQPM : : PAPER : _____
(A) QYTBV (B) QXSBX
(C) QYTAV (D) QYSAW

21. 6P1 : 5Y2 : : 6J3 : _____
(A) 6L4 (B) 9K4
(C) 9W4 (D) 4L6

22. 3P2 : 2J0 : : 3R6 : _____
(A) 2M6 (B) 2N8
(C) 1H6 (D) 2L4

23. 12L : 24X : : 5E : _____
(A) 21U (B) 19S
(C) 10J (D) 20T

24. 2E3 : 4I5 : : 7O8 : _____
(A) 10U11 (B) 11W12
(C) 13A14 (D) 9U12

25. B6H : D10N : : K5P : _____
(A) M9V (B) T72
(C) R8J (D) B6D

Directions for questions 26 to 30: Select the correct alternative from the given choices.

26. Hand is related to Elbow in the same way as Leg is related to _____.

(A) Joint (B) Fingers
(C) Toes (D) Knee

27. Aeroplane is related to Pilot in the same way as Elephant is related to_____.
(A) Elephant Man (B) Saddle
(C) Mahout (D) Jockey

28. Bangladesh is related to Dhaka in the same way as Germany is related to_____.
(A) Paris (B) Berlin
(C) Baghdad (D) Rome

29. Spain is related to King in the same way as Brazil is related to_____.
(A) Chancellor (B) President
(C) Pope (D) Director

30. River is related to Bank in the same way as Sea is related to_____.
(A) Bank (B) Port
(C) Coast (D) Pebble

ANSWER KEYS

1. (C)	**6.** (A)	**11.** (A)	**16.** (B)	**21.** (C)	**26.** (D)
2. (A)	**7.** (B)	**12.** (A)	**17.** (C)	**22.** (D)	**27.** (C)
3. (C)	**8.** (D)	**13.** (B)	**18.** (D)	**23.** (C)	**28.** (B)
4. (A)	**9.** (D)	**14.** (D)	**19.** (A)	**24.** (A)	**29.** (B)
5. (B)	**10.** (A)	**15.** (B)	**20.** (D)	**25.** (A)	**30.** (C)

SOLUTIONS

Solutions for questions 1 to 25:

1. 36 : 343 : :_____: 1331
$(6)^2 : (7)^3 : : (10)^2 : (11)^3$
Hence, $10^2 = 100$ is the missing number.

2. 24 : 576 : : 32 : _____
The given analogy is of the form $n : n^2$.
$24 : (24)^2 : : 32 : (32)^2$
$(32)^2 = 1024$ is the next number.

3. 13 : 2197 : : 16 : _____
The given analogy is of the form $n : n^3$.
$13 : (13)^3 : : 16 : \underline{(16)3}$
$(16)^3 = 4096$ is the missing number.

4. 81 : 729 : : 144 : _____
$(9)^2 : (9)^3 : : (12)^2 : \underline{(12)3}$
$(12)^3 = 1728$ is the next number.

5. 22 : 506 : : 27 : _____
$22 : (22)^2 + 22 : : 27 : \underline{(27)2 + 27}$
This is of the form $n : n^2 + n$.
$(27)^2 + 27 = 756$ is the next number.

6. 6 : 222 : 9 : _____
$6 : (6)^3 + 6 : : 9 : \underline{(9)3 + 9}$
$(9)^3 + 9 = 738$ is the next number.

7. 5 : 120: : 8 : _____
$5 : (5)^3 - 5 : : 8 : \underline{(8)3 - 8}$
$(8)^3 - 8 = 504$ is the next number.

8. 5 : 150 : : 8 : _____
$5 : 5^3 + 5^2 : : 8 : \underline{83 + 82}$
This is of the form $n : n^3 + n^2$
$8^3 + 8^2 = 576$ is the next number.

9. 6 : 180 : : 9 : _____
$6 : 6^3 - 6^2 : : 9 : \underline{93 - 92}$
This is of the form $n : n^3 - n^2$.
$9^3 - 9^2 = 648$.

10. 105 : 150 : : 39: _____

$$(10)^2 + \frac{10}{2} : (12)^2 + \frac{12}{2} : : (6)^2 + \frac{6}{2} : (8)^2 + \frac{8}{2}$$

$+2$ $+2$

This is of the form $n^2 + \frac{n}{2}$.

$(8)^2 + \frac{8}{2} = 68$ is the next number.

11. 390 : 315 : :_____: 564

$(20)^2 - \frac{20}{2} : (18)^2 - \frac{18}{2} :: (26)^2 - \frac{26}{2} : (24)^2 - \frac{24}{2}$

+2 +2

This is of the form $n^2 - \frac{n}{2}$.

Hence, $(26)^2 - \frac{26}{2}$ = 663 is the missing number.

12. $3864^{+1234} : 5068 :: 4994^{+1234} :$ _____

4994 + 1234 = 6228.

13. $1936^{-576} : 1360 ::$ _____ : 2142

2142 + 576 = 2718.

14. $11^{+13} : 24 :: 37 :$ _____

Next prime number to 11 is 13. 11 + 13 = 24.
Next prime to 37 is 41 and 37 + 41 = 78.

15. $97^{-89} : 8 :: 43 :$ _____

Previous prime number to 97 is 89 and 97 – 89 =8.
Similarly, the previous prime to 43 is 41 and 43 – 41 = 2.

16. PS : KH :: MT : _____

For P the opposite letter is K and for S the opposite letter is H.
Similarly, for M and T, the opposite letters are N and G, respectively.

17. EOU : IUA :: AIU : _____

For each of the vowels, its next vowel is given.
Similarly, for AIU the next vowels are EOA.

18. HRD : JSF :: XMP : _____

For each of these consonants its next consonant is given.
Similarly, for XMP their next constants are YNQ.

19. DATE : ECWI :: CHAIN : _____

D	A	T	E		C	H	A	I	N
+1	+2	+3	+4	Similarly	+1	+2	+3	+4	+5
E	C	W	I		D	J	D	M	S

20. MONTH : NMQPM :: PAPER : _____

M	O	N	T	H		P	A	P	E	R
+1	+2	+3	+4	+5	Similarly	+1	+2	+3	+4	+5
N	M	Q	P	M		Q	Y	S	A	W

21. 6P1 : 5Y2 :: 6J3 : _____

P is the 16th letter and 16 is $(Y)^2$.
The value is written in the reverse order.
Next number to 4 is 5 and $(5)^2$ = 25 Y.
The digits 25 are written in reverse order.
Similarly, 6^2 = 36 ⇒ 6J3and 9W4 is the next term.

22. 3P2 → P is the 16th letter and 16 × 2 = 32.
The digits in 32 are written on either side of P.
P^{-6} is J. J is the 10th letter and 10 × 2 = 20. ⇒ 2J0.
R is the 18th letter and 18 × 2 = 36 ⇒ 3 R6
R^{-6} is L. L is the 12th letter and 12 × 2 = 24 ⇒ 2L4.

23. 12L : 24 X :: 5E : _____

L is the 12th letter and 12 × 2 = 24
The 24th letter is X.
Similarly, E is the 5th letter and 5 × 2 = 10
The 10th letter is J.

24. 2E3 : 4I5 :: 7O8 : _____

The letters are consecutive vowels and the sum of the numbers on either side of the letter is equal to the place value of the letter and the number are consecutive. Hence, 10U11 is the required term.

25. B6H : D8N :: K5P : _____

In each group, the difference and the place values of the letters is equal to the number written between then.

B		H
+2		+6
D		N

Similarly,

K		P
+2		+6
M		V

M is 13 and V is 22 and 22 – 13 = 9. Hence, M9V is the required group.

Solutions for questions 26 to 30:

26. Elbow is the joint of the Hand and Knee is the joint of the Leg.

27. Pilot, one who controls an Aeroplane and Mahout, one who controls an Elephant.

28. The capital of Bangladesh is Dhaka and the capital of Germany is Berlin.

29. The head of Spain is King and the head of Brazil is the President.

30. The land near the River is Bank. Similarly, land near the Ocean is Coast.

3 Odd Man Out

Chapter

Learning Objectives

In this chapter, you will:

- Learn how to pick the odd one out from the given items
- Learn about different ways of classifying elements like:
  - Number classification
  - Alphabet classification
  - Word classification

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Odd Man

Finding the odd man out from the given alternatives is a very common type of questions that one comes across in different competitive examinations. In the questions on odd man out, all the items, except one follow a certain pattern (in their formation) or belong to a group. The item that does not follow the pattern or does not belong to the group has to be marked as the answer choice.

The problems of this variety often fall under the category of 'Classification'. When a given set of elements is classified under a single head, one of the items will not fall into that group to which the rest belong, i.e., it will not have the common property, which the others will have. Hence, it becomes the odd man out.

Questions on classification can be asked in any form. Some of the commonly asked ones are given below.

Number Classification

In this case, we need to choose the odd number from the given alternatives. The numbers may belong to a particular set, i.e., they may be odd, even, prime, rational, squares, cubes, etc., and only one of the choices will not follow the rule which others do and that is our answer. A few illustrations are given below.

1. Find the odd one among the following.

(a) (A) 17 (B) 27
(C) 37 (D) 47

(b) (A) 441 (B) 289
(C) 361 (D) 343

Sol: (a) All the given numbers except 27 are prime numbers whereas 27 is a composite number.
(b) The given numbers can be written as $(21)^2$, $(17)^2$, $(19)^2$, $(7)^3$, $(25)^2$. All except 343 are the squares whereas 343 is a cube.

Alphabet Classification

In this type, a group of jumbled letters typically consisting of three letters (but can be four or two or just a single letter) are put together. The pattern or order in which they are grouped is to be studied and we need to find out which groups have the same pattern or relationship between the letters. There will be one choice, which will have a pattern that is different from the rest and that is our answer.

2. Find the odd one among the following.
(A) ZW (B) TQ
(C) SP (D) NL

Sol: $Z^{-3}W$, $T^{-3}Q$, $S^{-3}P$, $N^{-2}L$, $P^{-3}M$
Hence, NL is the odd one.

3. Find the odd one among the following.
(A) CFD (B) GJH
(C) KNM (D) JMK

Sol: $C^{+3}F^{-2}D$, $G^{+3}J^{-2}H$, $K^{+3}N^{-1}M$, $J^{+3}M^{-2}K$, $V^{+3}Y^{-2}W$
Hence, KNM is the odd one.

Word Classification

Here, different items are classified based on common properties, like names, places, professions, parts of speech, etc. A few examples are illustrated below.

4. Find the odd one among the following.
(A) Mercury (B) Moon
(C) Jupiter (D) Saturn

Sol: All others except Moon are planets where as Moon is a satellite.

5. Find the odd one among the following.
(A) SORE (B) SOTLU
(C) NORGAE (D) MEJNIAS

Sol: The words are jumbled. The actual words are ROSE, LOTUS, ORANGE, JASMINE and LILLY. All, except ORANGE are flowers whereas ORANGE is a fruit.

EXERCISES

Directions for questions 1 to 30: Three of the following four are alike in a particular pattern and hence, form a group. Find the one which does not belong to that group.

1. (A) 16 (B) 9 (C) 49 (D) 121

2. (A) 248 (B) 224 (C) 236 (D) 268

3. (A) 1296 (B) 2304 (C) 2704 (D) 1764

4. (A) $\frac{312}{468}$ (B) $\frac{318}{477}$ (C) $\frac{230}{345}$ (D) $\frac{354}{472}$

5. (A) 2 (B) 5 (C) 10 (D) 54

6. (A) 144 (B) 169 (C) 225 (D) 196

7. (A) 543 (B) 435 (C) 345 (D) 354

8. (A) 39 (B) 636 (C) 24 (D) 37

9. (A) 346 (B) 469 (C) 742 (D) 427

10. (A) 4774 (B) 4174 (C) 363 (D) 666

11. (A) 744 (B) 852 (C) 654 (D) 473

12. (A) 5840 (B) 6530 (C) 7321 (D) 6422

13. (A) 18 (B) 32 (C) 72 (D) 88

14. (A) 29 (B) 341 (C) 129 (D) 67

15. (A) 43 (B) 59 (C) 13 (D) 21

16. (A) QDW (B) UHS (C) BOL (D) SGT

17. (A) 2D (B) 3I (C) 4P (D) 6A

18. (A) IED (B) OCL (C) IDE (D) OHK

19. (A) PQUM (B) HIOE (C) NOSK (D) RSWO

20. (A) MNPL (B) SUWR (C) FHJE (D) JLNI

21. (A) ABB (B) KBV (C) BCE (D) EDT

22. (A) EHFC (B) ILJG (C) PSQN (D) ROSU

23. (A) AZ (B) CZYX (C) DZYXW (D) EZYXW

24. (A) $\frac{A}{BB}$ (B) $\frac{CCC}{DDDD}$ (C) $\frac{BB}{CCC}$ (D) $\frac{DDDDD}{CCC}$

25. (A) 2W3 (B) 1Q7 (C) 1L2 (D) 2Z5

26. (A) Late (B) Mate (C) Rate (D) Bite

27. (A) Spider (B) Housefly (C) Mosquito (D) Bee

28. (A) Pistchios (B) Pecans (C) Walnuts (D) Apple

29. (A) November (B) September (C) June (D) February

30. (A) November (B) March (C) August (D) December

ANSWER KEYS

1. (A)	6. (B)	11. (D)	16. (D)	21. (C)	26. (D)
2. (D)	7. (D)	12. (D)	17. (D)	22. (D)	27. (A)
3. (C)	8. (D)	13. (D)	18. (D)	23. (D)	28. (D)
4. (D)	9. (A)	14. (B)	19. (B)	24. (D)	29. (D)
5. (D)	10. (B)	15. (?)	20. (A)	25. (D)	30. (A)

SOLUTIONS

1. Except 16, all are odd numbers.

2. Except 268, in all the numbers, the last digit is the product of first two digits.

3. Except 2704, all the numbers are divisible by '6'.

4. Except $\frac{354}{472}$, all fractions become $\frac{2}{3}$ when simplified.

5. Except 54, all the numbers can be expressed in the form $n^2 + 1$.

6. Except 169, all the numbers are squares of composite numbers.

7. Except 354, all the numbers are odd numbers.

8. 6 $\underline{62}$ = 636, 2 $\underline{22}$ = 24, 8 $\underline{82}$ = 864, 33^2 = 39.

The above pattern is not followed in $\underline{37}$.

9. Except 346, all the numbers are divisible by 7.

10. Except 4174, all the numbers are palindromes.

11. Except 473, in all the numbers the sum of all the digits is 15.

12. Except in '6422', in all the numbers, the last two digits are product of the first digits.

13. $18 = 2 \times 3^2$, $32 = 2 \times 4^2$, $72 = 2 \times 6^2$, $98 = 2 \times 7^2$
Except 88, all the numbers follow similar pattern.

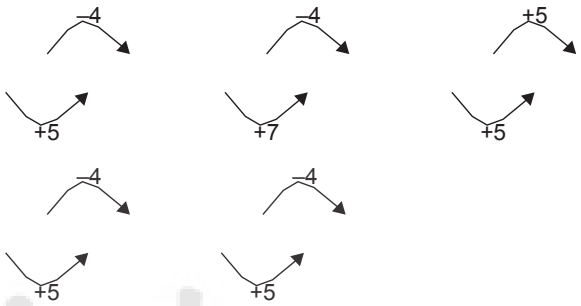
14. $29 = 3^3 + 2$, $129 = 5^3 + 4$, $67 = 4^3 + 3$, $221 = 6^3 + 5$,
Except 341, all the numbers follow similar pattern.

16. In all the groups, the first and last letters are corresponding and opposite letters of the 2nd letter, respectively except SGT.

17. In each of the group 2D, 3I, 4P, 5Y the number is the square root of the position value of the letter. This pattern is not followed by 6A.

18. In all the groups, the difference of the first letter and the last letter's place value is the place value of the second letter, except in 'OHK'.

19.



Except HIOE, all the other groups follow the similar pattern.

20. $M^{+1}N^{+2}P^{-4}L$, $S^{+2}U^{+2}W^{-5}R$, $F^{+2}H^{+2}J^{-5}E$, $J^{+2}L^{+2}N^{-5}I$, $C^{+2}E^{+2}G^{-5}B$. Except MNPL, all other groups follow the similar pattern.

21. In all the groups the product of place values of first two letters is the place value of last letter. Except in BCE.

22. $I^{+3}\,L^{-2}\,J^{-3}\,G$, $P^{+3}\,S^{-2}\,Q^{-3}\,N$, $M^{+3}\,P^{-2}\,N^{-3}\,K$,$R^{-3}\,O^{+4}\,S^{+2}\,U$, $E^{+3}\,H^{-2}\,F^{-3}\,C$
Except ROSU, all follow the similar pattern.

23. In all the groups the number of letters of the place value of the first letter is taken from the back side, in reverse order, except in EZYXW.

24. In all the groups, the number of letters in the numerator are less than the number of letters in denominator.
Except in $\frac{\text{DDDDD}}{\text{CCC}}$.

25. The digits on either side of the letter in each of the groups 2W3, 1Q7, 1L2, 1R8 indicate the place value of the letter in the alphabet. Except in 2Z5.

26. Except 'Bite', all the words are rhyming words.

27. Except 'Spider', all are flying insects.

28. Except 'Apple', all are types of nuts.

29. Except 'February', all the given months have 30 days.

30. Except 'November', all the given months have 31 days.

4 Coding and Decoding

Chapter

Learning Objectives

In this chapter, you will:

- Learn about coding (encrypting a message, according to a pattern or set of rules so that no one can understand the message without knowing the rule)
- Learn about decoding (decrypting a message and writing the original message so that anyone can understand it)
- Be exposed to various types of coding/decoding like:
  - Arranging in ascending/descending order
  - Adding/subtracting from each element to generate new elements
  - Coding letters as numbers and vice-versa

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Coding and Decoding

Before looking at the different types of questions and some of the codes that can be used with the help of examples, let us first understand what we mean by coding and decoding. When we say **coding**, a particular code or pattern is used to express a word in English language as a different word or in a different form. The coded word itself does not make any sense unless we know the pattern or code that has been followed.

Decoding refers to the process of arriving at the equivalent English word from the given code word.

In the questions, a particular code is given and on the basis of this given code, we have to find out how another word (in English language) can be coded. The correct code for the given word has to be selected from the answer choices on the basis of the code given in the question.

Solved Examples

1. In a certain code language, if the word 'PARTNER' is coded as OZQSMDQ, then what is the code for the word 'SEGMENT' in that language?

(A) TFHNFOU (B) RDFLDMS
(C) RDELDMS (D) RDFEDNS

Sol: Word: P A R T N E R
Logic: -1 -1 -1 -1 -1 -1 -1
Code: O Z Q S M D Q
Similarly, the code for SEGMENT is
Word: S E G M E N T
Logic: -1 -1 -1 -1 -1 -1 -1
Code: R D F L D M S

2. In a certain code language, if the word 'RECTANGLE' is coded as TGEVCPING, then how is the word 'RHOMBUS' coded in that language?
(A) TJOQDWV (B) TJQNDWU
(C) TJQODWU (D) TJQOEWU

Sol: Word: R E C T A N G L E
Logic: +2 +2 +2 +2 +2 +2 +2 +2 +2
Code: T G E V C P I N G
Similarly, the code for RHOMBUS is
Word: R H O M B U S
Logic: +2 +2 +2 +2 +2 +2 +2
Code: T J Q O D W U

3. In a certain code language, if the word 'SPHERE' is coded as EREHPS, then how is the word 'EXHIBITION' coded in that language?
(A) NOTITBIHXE (B) NOITIDIHXE
(C) NOITIBIHWE (D) NOITIBIHXE

Sol: Word: S P H E R E
Logic: The letters in the given word are reversed.
Code: E R E H P S
Similarly, the code for EXHIBITION is
Word: E X H I B I T I O N
Logic: The letters in the given word are reversed.
Code: N O I T I B I H X E

4. In a certain code language, if the word 'REJECTION' is coded as SGMIHZPWW, then how is the word 'MECHANIC' coded in that language?
(A) NGFLFTPK (B) NGPLFTPK
(C) NGFKFTPK (D) NGPTPKIL

Sol: Word: R E J E C T I O N
Logic: +1 +2 +3 +4 +5 +6 +7 +8 +9
Code: S G M I H Z P W W
Similarly, the code for MECHANIC is
Word: M E C H A N I C
Logic: +1 +2 +3 +4 +5 +6 +7 +8
Code: N G F L F T P K

5. In a certain code language, if the word 'PLAYER' is coded as AELPRY, then how is the word 'MANAGER' coded in that language?
(A) AEAGMNR (B) AAGEMNR
(C) AAEGMNR (D) AAEGNMR

Sol: Word: P L A Y E R
Logic: The letters in the word are arranged in the increasing order of their value as in the alphabet.
Code: A E L P R Y
Similarly, the code for MANAGER is AAEGMNR.

6. In a certain code language, if the number 1 is assigned to all the letters in odd numbered places in the alphabet and the remaining letters are assigned the number 2, then what is the code for the word 'INDIAN'?
(A) 121212 (B) 111222
(C) 112212 (D) 122112

Sol: The code for the word INDIAN is 122112.

7. In a certain code language, if CRICKET is coded as 3923564, ROCKET is coded as 913564 and KETTLE is coded as 564406, then how is LITTLE coded in that language?
(A) 244060 (B) 024406
(C) 020446 (D) 200446

Sol: As we observe that the letters and their corresponding codes are given in order, i.e., the code for C is 3, R is 9, I is 2 and so on. Hence, the code for LITTLE is 024406.

Directions for questions 8 to 11: In a certain code language, the codes for some words are as follows.

WORDS		CODES
NATION	-	agvnab
REMOTE	-	rzgrbe
STAIR	-	efgnv
FORMAL	-	bensyz
COMMON	-	zabzpb
FOR	-	ebs

Based on the above coding pattern answer the following questions.

8. What is the code for 'SCREEN'?
(A) fepcra (B) fpersa
(C) fpreba (D) fperra

9. What is the code for 'RATION'?
(A) ensvba (B) engvba
(C) engrba (D) engvca

10. What is the code for 'CREATOR'?
(A) prengbc (B) persbgc
(C) perngbe (D) pebrycn

11. What is the code for 'AMERICAN'?
(A) nzrevpna (B) nzrespna
(C) nzlespna (D) nzreqpna

Solutions for questions 8 to 11: The given words and their codes are as follows.

	WORDS		CODES
(1)	NATION	-	agvnab
(2)	REMOTE	-	rzgrbi
(3)	STAIR	-	efgnv
(4)	FORMAL	-	bensyz
(5)	COMMON	-	zabzpb
(6)	FOR	-	ebs

In the 1st word, the letter N is repeated and the code 'a' is repeated. Hence, for N, the code is 'a'. Similarly, from the 2nd word, the code for E is 'r'. In the 1st and 6th words, the letter O is common and so is the code b. Hence, the code for O is b. In the 5th word, the letter M is repeated and so is the code z. Hence, the code for M is Z. Similarly, the codes for the remaining letters can be determined.

The letters and their respective codes are as follows.

Letter	A	C	E	F	I	L	M	N	O	R	S	T
Code letter	n	p	R	s	v	y	z	a	b	e	f	G

8. The code for 'SCREEN' is fperra.

9. The code for 'RATION' is engvba.

10. The code for 'CREATOR' is perngbe.

11. The code for 'AMERICAN' is nzrevpna.

12. In a certain code if white is called as black, black as yellow, yellow as blue, blue as red, red as green, green as purple, then what is the colour of blood in that language?
(A) Red (B) Green
(C) Yellow (D) Purple

Sol: The colour of blood is Red and in this code, Red is called Green. Hence, blood is green in colour in that language.

Exercises

Directions for questions 1 to 20: Select the correct alternative from the given choices.

1. In a certain code language, if the word CLIMATE is coded as IAECLMT, then how is the word CALCULATE coded in that language?
(A) AUEACLCLT (B) AUACELCLT
(C) AUAECLCLT (D) AUAECLCCT

2. In a certain code language, if the word SOLUTIONS is coded as SNOITULOS, then how is the word ANSWER coded in that language?
(A) RENSWA (B) RENSAW
(C) REASWN (D) REWSNA

3. In a certain code language, if the word BASKET is coded as UFLTBC, then how is the word SIMPLE coded in that language?
(A) FMQNJG (B) FMQGNJ
(C) FMQNJT (D) MFNQTJ

4. In a certain code language, if the word SINGER is coded as XNSLJW, then how is the word DANCER coded in that language?
(A) IFSHJW (B) ISFHJW
(C) ISFJHW (D) IJWFSH

5. In a certain code language, if the word PLEASE is coded as GNRGUC, then how is the word CODING coded in that language?
(A) FQIPEK (B) FPKQEI
(C) FQKPIE (D) FQEIPK

6. In a certain code language, if the word KITE is coded as 4567 and the word RATE is coded as 8967, then how is the word TAKE coded in that language?
(A) 6974 (B) 6794
(C) 6947 (D) 6479

7. In a certain code language, if SP is coded as UR and LO is coded as NQ then TV is coded as_____.
(A) VW (B) WV
(C) VN (D) VX

8. In a certain code language, if the word ASIA is coded as 1431, the word AFRICA is coded as 125361 and the word FRANCE is coded as 251768, then how is the word ARIES coded in that language?
(A) 15348 (B) 15438
(C) 13584 (D) 15384

9. In a certain code language, if the word LOCAL is coded as MPDBM, then which word is coded as DBMMFS?
(A) CARROT (B) CODING
(C) CALLER (D) CARING

10. In a certain code language, if the word CREATE is coded as $\$\Omega\theta\#4\theta$ and the word INDIA is coded as 8768#, then how is the word ACCIDENT coded in that language?
(A) $\$\#\$86\theta74$ (B) $86\theta74\#\$\$$
(C) $\theta\#\#86\$74$ (D) $\#\$\$86\theta74$

11. In a certain code language, if the word PROGRAM is coded as RTQHTCO, then how is the word PLAYING coded in that language?
(A) RKPICZN (B) RCKPIZN
(C) RPICKZN (D) None of these

12. In a certain code language, if the word DOUBLE is coded as ODBUEL, then how is the word SINGLE coded in that language?
(A) ISNGEL (B) ISGNLE
(C) SINGEL (D) ISGNEL

13. In a certain code language, if the word SUMMER is coded as $\Omega\theta\#\#17$, and the word MOTION is coded as #$%2$6, then how can the word 'SECTOR' be coded in that language?
(A) Ω$©21% (B) Ω21#θ$
(C) θ$Ω861 (D) Ω1©%$7

14. In a certain code language, if ADC is coded as 143 and BED is coded as 254 then how is DFG coded in that language?
(A) 456 (B) 465
(C) 467 (D) 645

15. In a certain code language, if sun means moon, moon means earth, earth means sky, sky mean sea, then on which of the following do we live according to that language?
(A) Sun (B) Moon
(C) Earth (D) Sea

16. In a certain code language, if the word STOP is coded as PWLS, then how is the word EXIT coded in that language?
(A) ABFW (B) BWFA
(C) WBFA (D) BAFW

17. In a certain code language, if the word LANGUAGE is coded as LNGGAUAE then how is the word FINANCE coded in that language?
(A) FNCNIAE (B) FNCNIEA
(C) FNNCIAE (D) FNNCAIE

18. In a certain code, if the word SOME is coded as MSEO and the word NAME is coded as MNEA, then what is the code for WARM in that language?
(A) RAMW (B) RMAW
(C) RWMA (D) RAWM

19. In a certain code language, if the word LETTER is coded as MUFFUS, then how is the word DECIDE coded in that language?
(A) EDFEEJ (B) EEFFJD
(C) FFEEDJ (D) EDEFJF

20. In a certain code language, if the word CORRECT is coded as ORCCRET, then what is the code for the word KINGDOM?
(A) IGOKNDM (B) HFNMJCL
(C) HFJNMCL (D) HFNCLMJ

Directions for questions 21 to 25: In a certain code language, the codes for the sentences in Column I are given in Column II. Each word has a unique code. Answer the questions based on these codes.

	Column I	Column II
1.	kite night right might	sap tap map cap
2.	might weight sight eight	zap cap wap yap
3.	night eight boat right	yup tap sap zap
4.	boat not weight night	wap sap yup lap

21. What is the code for the word 'not'?
(A) lap (B) map
(C) nap (D) zap

22. Which word is coded as 'cap'?
(A) weight (B) might
(C) night (D) not

23. What is the code for the word 'right'?
(A) yup (B) sap
(C) map (D) tap

24. What can be the code for 'might right boat correct'?
(A) cap fap tap yup (B) tap yap sap map
(C) wap yup lap cap (D) cap zap tap sap

25. What can be coded as 'sap tap map pop'?
(A) might right boat eight
(B) boat sight might weight
(C) right night site kite
(D) might not boat kite

Directions for questions 26 to 30: Given below are the codes for the digits/symbols. Study the conditions given below and answer the questions that follow.

Digit/ Symbol	5	2	©	#	4	@	8	Ω	7	$	3	9	®	*	1
Letter code	C	G	R	L	B	T	H	M	D	X	W	O	P	K	N

Conditions:
(i) If both the first and the last elements are odd digits, then code both of them as 'A'.
(ii) If both the first and the last elements are even digits, then code both of them as 'E'.
(iii) If the first element is an even digit and the last element is a symbol, then the codes for the first and the last elements get interchanged.
(iv) If both the first and the last elements are symbols, then reverse the code for the entire group.

What will be the codes for the following group of elements?

26. 25$391@4
(A) GCXWONTE (B) ECXWONTE
(C) ECWVOTNE (D) GWXCONTE

27. 1$Ω4925
(A) AXKPMGA (B) BPKXMGB
(C) BXKPMBA (D) None of these

28. $4@Ω2*5
(A) XTBMGKC (B) XBTMGKC
(C) XBTGMCK (D) CBTMGKX

29. *87$Ω2$
(A) KHDXMGX (B) HKXDGMO
(C) DXGKDHM (D) XGMXDHK

30. 872Ω@9®
(A) HDGMTOP (B) HGDMOTP
(C) PDGMTOH (D) PGMDOTH

ANSWER KEYS

1. (C)	6. (C)	11. (D)	16. (D)	21. (A)	26. (B)
2. (D)	7. (D)	12. (D)	17. (C)	22. (B)	27. (D)
3. (C)	8. (D)	13. (D)	18. (C)	23. (D)	28. (B)
4. (A)	9. (C)	14. (C)	19. (D)	24. (A)	29. (D)
5. (D)	10. (D)	15. (B)	20. (A)	25. (C)	30. (C)

SOLUTIONS

Solutions for questions 1 to 20:

1. Word: CLIMATE
Logic: Letters in the word are arranged as all vowels come together first and then consonants.
Code: IAECLMT
Similarly, the code for CALCULATE is AUAECLCLT.

2. Word: SOLUTIONS
Logic: The letters in the given word are reversed.
Code: SNOITULOS
Similarly, the code for ANSWER is REWSNA.

3.

Word:	B	A	S	K	E	T
Logic:	+1	+1	+1	+1	+1	+1
Code:	C	B	T	L	F	U

and then the code is reversed, i.e., UFLTBC.
Similarly,

Word:	S	I	M	P	L	E
Logic:	+1	+1	+1	+1	+1	+1
Code:	T	J	N	Q	M	F

and then the code is reversed, i.e., FMQNJT.

4.

Word:	S	I	N	G	E	R
Logic:	+5	+5	+5	+5	+5	+5
Code:	X	N	S	L	J	W

Similarly,

Word:	D	A	N	C	E	R
Logic:	+5	+5	+5	+5	+5	+5
Code:	I	F	S	H	J	W

∴ IFSHJW is the code for DANCER.

5.

Word:	P	L	E	A	S	E
Logic1:	+2	+2	+2	+2	+2	+2
Logic2:	R	N	G	C	U	G

Half coded and then reversed.
Code: GNRGUC.
Similarly,

Word:	C	O	D	I	N	G
Logic1:	+2	+2	+2	+2	+2	+2
Logic2:	E	Q	F	K	P	I

Half coded and then reversed.
Code: FQEIPK.
∴ FQEIPK is the code for CODING.

6.

WORD	CODE					
KITE	4567	→(I)				
RATE	8967	→(II)				

By comparing the positions of the letters T and E, in both the words with respective codes it can be identified that the code for each letter is in the corresponding position in the code.
Hence, the code for the word TAKE is 6947.

7.

Word1:	S	P	Word2:	L	O	
Logic:	+2	+2	Logic:	+2	+2	
Code:	U	R	Code:	N	Q	

Similarly,

Word:	T	V				
Logic:	+2	+2				
Code:	V	X				

∴ VX is the code for TV.

8. As we observe that the letters and their corresponding codes are given in order, i.e., the code for A is 1, S is 4 and so on. Hence, the code for ARIES is 15384.

9.

Word:	L	O	C	A	L	
Logic:	+1	+1	+1	+1	+1	
Code:	M	P	D	B	M	

Similarly,

Word:	C	A	L	L	E	R
Logic:	+1	+1	+1	+1	+1	+1
Code:	D	B	M	M	F	S

∴ CALLER is coded as DBMMFS.

10. As we observe that the letters and their corresponding codes are given in order, i.e., the code for C is $, R is Ω and so on.
Hence, the code for ACCIDENT is '#$$86θ74'.

11.

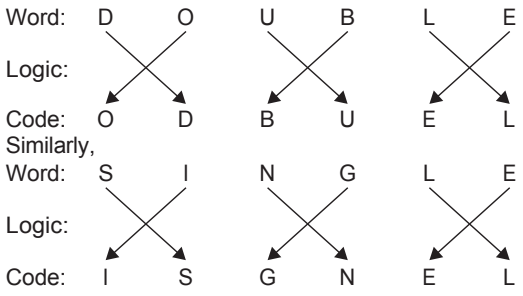
Word:	P	R	O	G	R	A
M						
Logic:	+2	+2	+2	+1	+2	+2
+2						
Code:	R	T	Q	H	T	C
O						

Similarly,

Word:	P	L	A	Y	I	N
G						
Logic:	+2	+2	+2	+1	+2	+2
+2						
Code:	R	N	C	Z	K	P
I						

∴ RNCZKPI is the code for PLAYING.

12.



∴ ISGNEL is the code for SINGLE.

13. As we observe that the letters and their corresponding codes are given in the following order, i.e., the code for S is Ω, U is θ and so on. Hence, the code for SECTOR is 'Ω1©%$7'.

14. As we observe that the alphabets are coded with their place values according to the alphabetical order, i.e., the code for A is 1, B is 2 and so on. Hence, the code for DFG is 467.

15. We live on the earth and earth is called moon in the given code language.

16.

Word:	S	T	O	P		
Logic:	−3	+3	−3	+3		
Code:	P	W	L	S		

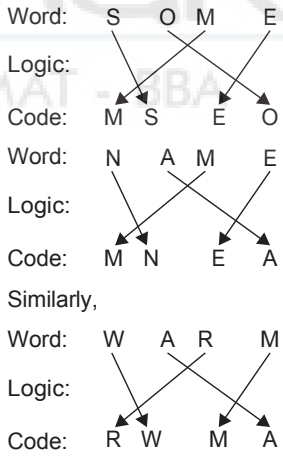
Similarly,

Word:	E	X	I	T		
Logic:	−3	+3	−3	+3		
Code:	B	A	F	W		

∴ BAFW is the code for EXIT.

17. As we observe that consonants come first, followed by vowels in the corresponding code. Hence, the code for the word FINANCE is FNNCIAE.

18.



∴ RWMA is coded for WARM.

19. First write the odd-positioned letters of the word and then even-positioned ones one after the other.

Word:	L	E	T	T	E	R
Logic:	L	T	E	E	T	R
+1	+1	+1	+1	+1	+1	
Code:	M	U	F	F	U	S

Similarly,

Word:	D	E	C	I	D	E
Logic:	D	C	D	E	I	E
+1	+1	+1	+1	+1	+1	
Code:	E	D	E	F	J	F

∴ EDEFJF is code for DECIDE.

20. Write the even-positioned letters of the word first and then the odd-positioned ones one after the other.

Word:	C	O	R	R	E	C
T						
Code:	O	R	C	C	R	E
T						

Similarly,

Word:	K	I	N	G	D	O
M						
Code:	I	G	O	K	N	D
M						

∴ IGOKNDM is the code for KINGDOM.

Solutions for questions 21 to 25:

From (1) and (2), the code for 'might' is 'cap'.
From (2) and (3), the code for 'eight' is 'zap'.
From (1) and (4), the code for 'night' is 'sap'.
From (3) and (4), the code for 'boat' is 'yup'.
From (3), the code for 'right' is 'tap' and from (1), the code for 'kite' is 'map'.
From (2) and (4), the code for 'weight' is 'wap' and from (2), the code for 'sight' is 'yap' and from (4), the code for 'not' is lap.
Hence, the codes are as follows:

Word	kite	night	right	might	weight	sight	Eight	boat	not
Code	map	sap	tap	cap	wap	yap	Zap	yup	lap

21. The code for 'not' is 'lap'.

22. 'might' is coded as 'cap'.

23. The code for 'right' is 'tap'.

24. The code for 'might right boat correct' can be 'cap tap yup fap'.

25. 'right night site kite' can be coded as 'sap tap map pop'.

Solutions for questions 26 to 30:

26. The given group of elements is 25$391@4.
This group follows condition (ii).
Hence, the code is ECXWONTE.

27. The given group of elements is 1$Ω4925.
This group follows condition (i).
Hence, the code is AXMBOGA.

28. The given group of elements is $4@Ω2*5.
This group does not follow any condition.
Hence, the code is XBTMGKC.

29. The given group of elements is *87$Ω2$.
This group follows condition (iv).
Hence, the code is XGMXDHK.

30. The given group of elements is 872Ω@9®.
This group follows condition (iii).
Hence, the code is PDGMTOH.

5 Symbols and Notations

Chapter

Learning Objectives

In this chapter, you will:
- Learn about symbols and notations as an extension of coding-decoding
- Learn how to draw conclusions, find the values or compare two or more quantities after understanding the notations/relations given

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Symbols And Notations

The basic approach for the questions of this chapter is more or less similar to that of coding and decoding. As in the questions of coding and decoding, a basic word is coded in a particular way and the candidate is asked to code another word using the same logic.

Similarly, in 'Symbols and Notations', one has to study the symbols and their meanings carefully which are given against them. Then, the meanings given are to be used in place of those symbols in answering the questions. The word 'Notation' basically stands for the meaning which each symbol will be assigned.

Solved Examples

Directions for questions 1 to 5: These questions are based on the following information.

$a + b$ means a is greater than b.
$a - b$ means a is less than or equal to b.
$a \times b$ means a is greater than or equal to b.
$a \div b$ means a is less than b.
$a \# b$ means a is equal to b.

Each of the following questions consists of some statements followed by two conclusions.

Give your answer as:

(A) If only conclusion (I) follows.
(B) If only conclusion (II) follows.
(C) If both conclusions (I) and (II) follow.
(D) If neither (I) nor (II) follows.

1. Statements: m – n, n ÷ o, o # q.
Conclusions: I: q × m
II. q + m

Sol: The given statements are (i) m ≤ n, n < o and o = q, i.e, m ≤ n < o = q.
Conclusion I: q × m ⇒ q ≥ m does not follow.
Hence, conclusion I does not follow.
Conclusion II: q + m ⇒ q > m follows.
Hence, only conclusion II follows.

2. Statements: l ÷ m, o # q, m + o
Conclusions: I: m + q
II: l × o

Sol: The given statements are I < m, o = q and m > o, i.e., m > l, m > o = q.
Conclusion I: m +q ⇒ m > q follows.
Conclusion II: l × o ⇒ l ≥ o does not follow.
∴ Only conclusion I follows

3. Statements: $x \div y, y - z, z \div a$
Conclusions: I. $x - a$
II. $z - x$

Sol: By combining the statements, we get $x < y \le z < a$.
Conclusion I: $x - a \Rightarrow x \le a$ does not follow.
Conclusion I does not follow.
Conclusion II: $z - x \Rightarrow z \le x$ does not follow.
Conclusion II does not follow
∴ Neither I nor II follows.

4. Statements: e # f, f + g, g ÷ h
Conclusions: I. e + g
II. g + f

Sol: By combining all the statements, we get:
e = f > g; g < h
Conclusion I: e + g ⇒ e > g follows.
Conclusion I follows.
Conclusion II: g + f ⇒ g > f does not follow.
Conclusion II does not follow.
∴ Only I follows.

5. Statements: $a + b, c - d, d \div b$
Conclusions: *I.* $a + c$
II. $c \div b$

Sol: By combining all the statements, we get:
$a > b, c \le b, d < b$
$\Rightarrow a > b > d \ge c$
Conclusion I: $a + c \Rightarrow a > c$ follows.
Conclusion I follows.
Conclusion II: $c \div b \Rightarrow c < b$ follows.
Conclusions II follows.
∴ Both I and II follow.

6. If 'Δ' means 'is less than', '$' means 'is greater than' and '£' means 'is equal to' and given that $a \Delta b$, c £ d and $c \$ b$, then which of the following is true?
(A) $d \Delta a$ (B) $b \$ d$
(C) a £ c (D) $a \Delta b \Delta c$

Sol: $a \Delta b \Rightarrow a < b$
$c \$ b \Rightarrow c > b \Rightarrow b < c$
c £ $d \Rightarrow c = d$
$\therefore a < b < c = d$
(A) d Δ a ⇒ $d < a$ → does not follow
(B) $b \$ d \Rightarrow b > d$ → does not follow
(C) a £ $c \Rightarrow a = c$ → does not follow
(D) $a \Delta b \Delta c \Rightarrow a < b < c$ → follows

Exercises

Directions for questions 1 to 5: In a certain code language, '+' means '×', '×' means '–', '–' means '÷' and '÷' means '+'.

Simplify the following expressions using the above directions, in which the mathematical operators are written according to the code language.

1. 9 + 4 – 6 × 6 ÷ 8
(A) 8.5 (B) 8
(C) 5.25 (D) 0

2. 10 + 10 × 10 – 10 ÷ 10
(A) 109 (B) 10
(C) 19 (D) 11

3. 16 × 4 ÷ 4 + 14 – 2
(A) 56 (B) 28
(C) 40 (D) 112

4. 16 – 2 + 4 ÷ 16 – 8 × 2
(A) –15 (B) 2
(C) 4 (D) 32

5. 2 ÷ 4 + 8 – 16 × 32 ÷ 64 × 128 ÷ 256
(A) 4·5 (B) 164
(C) 4 (D) 163

Directions for questions 6 to 10: These questions are based on the following information.

In the following questions certain symbols are used to represent relations as given below.

A ϕ B means A is greater than B.
A δ B means A is greater than or equal to B.
A Ω B means A is equal to B.
A ⌠ B means A is not greater than B.
A λ B means is neither greater nor equal to B.

In each of the following questions four statements followed by four conclusions marked I, II, III, IV are given. Assuming that the statements to be true, find which of the four conclusions follows the given statements.

6. Statements: P Ω R, Q ⌠ S, R δ S, P λ T.
Conclusions:
I. P ϕ S,
II. P Ω Q
III. P Ω S
IV. Q λ P
(A) Either I or III follows.
(B) Either II or IV follows.
(C) Either I or III and either II or IV follow.
(D) All follow

7. Statements: J ϕ H, J λ G, I δ K, G ⌠ K.
Conclusions:
I. I ϕ G
II. J ϕ I
III. G Ω I
IV. H λ K
(A) Only IV follows. (B) Either I or III follows.
(C) Only II follows. (D) Both (A) and (B).

8. Statements: W Ω Z, Z δ X, W ⌠ V, Y ϕ
Conclusions: V.
I. V δ X
II. Y ⌠ X
III. Y ϕ Z
(A) Only I follows. (B) Only III follows.
(C) Only II follows. (D) Both (A) and (B).

9. Statements: P ϕ F, U λ W, R ⌠ F, R δ
Conclusions: U.
I. P δ W
II. W Ω F
III. W λ F
(A) Only I and III follow.
(B) Only II and IV follow.
(C) Either III or IV follows.
(D) None follows

10. Statements: A λ B, B ⌠ C, C δ E, E ϕ
Conclusions: D.
I. A λ C
II. B ϕ E
III. C ϕ D
(A) Only I follows.
(B) Only III follows.
(C) Only II and III follows.
(D) Only I and III follows.

Directions for questions 11 to 15: Select the correct alternative from the given choices.

11. Which of the following symbols should replace the question marks in that order in the given expression, in order to make the expression 'A > J' definitely true?
A? X? E? U? J? S
(A) =, ≥, =, =. > (B) >, ≥, =, <, >
(C) =, >, =, >, ≥ (D) <, =, ≤, <, >

12. Which of the following elements should replace the question marks in that order in the given expression, in order to make the expression 'L > P' definitely true?
? > ? =? >? =? <?
(A) L, O, N, M, Q, P (B) L, M, N, O, P, Q
(C) P, O, N, Q, M, L (D) L, M, O, N, Q, P

13. Which of the following expressions is true if the given expressions 'B > K' as well as 'T < D' are true?
(A) T < B ≤ G < D = K (B) B < T = G ≤ D > K
(C) D < K > G = T ≥ B (D) B > D = G ≥ K > T

14. Which of the following expressions is not true if the given expression 'L < F' as well as 'H ≥ Q' are definitely true?
(A) L < M ≤ H = F ≥ Q (B) L < M ≤ Q = F ≤ H
(C) L < Q = M ≥ H ≤ F (D) H ≥ F = M ≥ Q > L

15. Which of the following symbols should replace the question mark in the given expression in order to make the expressions 'C < V' and 'Y < Q' definitely true?
C < J ≤ Q ? V ≥ W > Y
(A) = (B) <
(C) ≤ (D) >

Directions for questions 16 to 20: Study the following sequence carefully and answer the questions given below.
R K 5 9 # B 2 % * E ? A 8 L $ I 4 S V 7 ! C 6 N @ H 1 3 & D

16. Four of the following are alike. Find the odd one.
(A) RKB (B) ALI
(C) SVC (D) BLI

17. How many consonants are there, which are immediately followed by a digit but not immediately preceded by a consonant?
(A) 3 (B) 2
(C) 1 (D) 0

18. Find the next term in the following series.
5#2, *?8, $4V, ____
(A) LIS (B) !6@
(C) I4S (D) 13$

19. Which is the 9th element to the right of the 19th element from the left end?
(A) 7 (B) 3
(C) V (D) H

20. How many letters are there, each of which are immediately followed and immediately preceded by a symbol?
(A) One (B) Three
(C) Two (D) More than three

Directions for questions 21 to 25: Select the correct alternative from the given choices.

21. If $a \Delta b = a + b + ab$ and $a \$ b = a^2 + b^2$, then $(3 \Delta 4) \$ 5$ =
(A) 386 (B) 1625
(C) 336 (D) 436

22. If $p > q = p^2 + q^3$ and $p < q = p^3 - q^2$ then $(1 > 2) < 3$ =
(A) 503 (B) 720
(C) 648 (D) 960

23. If $x > y = x^3 + y^3$ and $x @ y = x^3 - y^3$ then $3 > (2 @ 1)$ =
(A) 756 (B) 702
(C) 440 (D) 370

24. If $E \downarrow F = (E + F)^2 + (E - F)^2$ and $E \uparrow F = (E + F)^2 - (E - F)^2$, then $(2 \downarrow 5) \uparrow (4 \downarrow 3)$ =
(A) 7808 (B) 15616
(C) 11600 (D) 23200

25. If $m \neq n = m^2 - mn + n^2$ and $m ? n = (m + n)^2 - mn$, then $(2 ? 3) \neq (5 \neq 3)$ =
(A) 900 (B) 361
(C) 642 (D) 729

Directions for questions 26 to 30: In a certain instruction system the different computation processes are written as follows.
(a) 'A % B ! C' means 'A is added to the product of B and C'.
(b) 'A © B * C' means 'the product of B and C is subtracted from A'.
(c) 'A # B @ C' means 'the product of A and B is divided by C'.
(d) 'A • B $ C' means 'C is multiplied by the sum of A and B'.
You have to find out what will come in the place of question mark (?) in each question following the computation processes.

26. 100 © 20 * 3 = *a*
a % 40 ! 5 = ?
(A) 140 (B) 240
(C) 340 (D) 360

27. 16 • 14 $ 4 = t
t # 10 @ 12 = ?
(A) 700 (B) 300
(C) 400 (D) 100

28. 100 © 5 * 16 = q
q % 4! 12 = ?
(A) 140 (B) 68
(C) 98 (D) 102

29. 50 # 40 @ 200 = p
16 % 12 ! p = ?
(A) 112 (B) 136
(C) 126 (D) 226

30. 12 • 13 $ 5 = r
10 © 4 * r = ?
(A) 120 (B) –430
(C) –490 (D) 720

ANSWER KEYS

1. (B)	6. (C)	11. (C)	16. (D)	21. (A)	26. (B)
2. (A)	7. (D)	12. (B)	17. (A)	22. (B)	27. (D)
3. (C)	8. (D)	13. (D)	18. (B)	23. (D)	28. (B)
4. (D)	9. (D)	14. (C)	19. (B)	24. (C)	29. (B)
5. (B)	10. (D)	15. (A)	20. (A)	25. (B)	30. (C)

SOLUTIONS

Solutions for questions 1 to 5:

1. '+' means '×', '×' means '−', '−' means '÷' and '÷' means '+'
The given expression is 9 + 4 − 6 × 6 ÷ 8.
On converting this expression as per the directions, we get the expression 9 × 4 ÷ 6 − 6 + 8.
Let us simplify this expression using BODMAS rule, where
'B' stands for 'Brackets',
'O' stands for 'of',
'D' stands for 'Division',
'M' stands for 'Multiplication',
'A' stands for 'Addition' and
'S' stands for 'subtraction'.
∴ 9 × 4 ÷ 6 − 6 + 8 = 36 ÷ 6 − 6 + 8 = 6 − 6 + 8 = 8

2. The given expression is 10 + 10 × 10 − 10 ÷ 10.
As per the directions, it becomes 10 × 10 − 10 ÷ 10 + 10.
Using BODMAS rule, we get:
10 × 10 − 10 ÷ 10 + 10 = 100 − 1 + 10 = 109.

3. The given expression 16 × 4 ÷ 4 + 14 − 2 becomes 16 − 4 + 4 × 14 ÷ 2 as per the given directions.
Using BODMAS rule, we get:
16 − 4 + 4 × 14 ÷ 2 = 12 + 56 ÷ 2 = 12 + 28 = 40.

4. As per the given directions, the given expression 16 − 2 + 4 ÷ 16 − 8 × 2 becomes
16 ÷ 2 × 4 + 16 ÷ 8 − 2.
Using BODMAS rule, we get:
16 ÷ 2 × 4 + 16 ÷ 8 − 2 = 8 × 4 + 2 − 2 = 32 + 0 = 32.

5. 2 ÷ 4 + 8 − 16 × 32 ÷ 64 × 128 ÷ 256 becomes
2 + 4 × 8 ÷ 16 − 32 + 64 − 128 + 256.
Using BODMAS rule, we get:
2 + 4 × 8 ÷ 16 − 32 + 64 − 128 + 256
= 2 + 32 ÷ 16 + 32 + 128
= 2 + 2 + 160 = 164

Solutions for questions 6 to 10:

A ϕ B means A is greater than B ⇒ A > B.
A δ B means A is greater than or equal to B ⇒ A ≥ B.
A Ω B means A is equal to B ⇒ A = B.
A ⌠ B means A is not greater than B ⇒ A ≤ B.
A λ B means A is neither greater nor equal to B ⇒ A < B.

6. Given statements are:
P Ω R ⇒ P = R
Q ⌠ S ⇒ Q ≤ S
R δ S ⇒ R ≥ S
P λ T ⇒ P < T
By combining all the statements, we get:
T > P = R ≥ S ≥ Q

Conclusion I: P ϕ S ⇒ P > S does not follow.
Conclusion II: P Ω Q ⇒ P = Q does not follow.
Conclusion III: P Ω S ⇒ P = S, does not follow.
Conclusion IV: Q λ p ⇒ Q < P does not follow.
But either I or III and either II or IV follows.

7. Given statements are:
J ϕ H ⇒ J > H
J λ G ⇒ J < G
I δ K ⇒ I ≥ K
G ⌠ K ⇒ G ≤ K
By combining all the statements, we get:
H < J < G ≤ K ≤ I
Conclusion I: I ϕ G ⇒ I > G does not follow.
Conclusion II: J ϕ I ⇒ J > I does not follow.
Conclusion III: G Ω I ⇒ G I does not follow.
Conclusion IV: H λ K ⇒ H < K follows.
∴ Only IV and either I or III follow.

8. Given statements are:
W Ω Z ⇒ W = Z; Z δ X ⇒ Z ≥ X
W ⌠ V ⇒ W ≤ V; Y ϕ V ⇒ Y > V
By combining all the statements, we get:
Y > V ≥ W = Z ≥ X
Conclusion I: V δ X ⇒ V ≥ X follows.
Conclusion II: Y ⌠ X ⇒ Y ≤ X does not follow.
Conclusion III: Y ϕ Z ⇒ Y > Z follows.
Conclusion IV: V λ X ⇒ V < X does not follow.
∴ Only I and III follow.

9. Given statements are:
P ϕ F ⇒ P > F; U λ W ⇒ U < W
R ⌠ F ⇒ R ≤ F; R δ U ⇒ R ≥ U
By combining all the statements, we get:
P > F ≥ R ≥ U < W

Conclusion I: P δ W ⇒ P ≥ W does not follow.
Conclusion II: W Ω F ⇒ W = F does not follow.
Conclusion III: W λ F ⇒ W < F does not follow.
Conclusion IV: P λ W ⇒ P < W does not follow.
∴ None follows.

Given statements are:

10. A λ B ⇒ A < B
B ⌠ C ⇒ B ≤ C; C δ E ⇒ C ≥ E; E ϕ D ⇒ E > D
By combining all the statements, we get:
A < B ≤ C ≥ E > D

Conclusion I: A λ C ⇒ A < C follows.
Conclusion II: B ϕ E ⇒ B > E, does not follow.
Conclusion III: C ϕ D ⇒ C > D, follows.
Conclusion IV: E Ω A ⇒ E = A does not follow.
∴ Only I and III follow.

Solutions for questions 11 to 15:

11. In order to make the given expression 'A > J' true, the symbols which are to be placed in the place of question mark are =, >, =, >, ≥. Then the expression becomes A = X > E = U > J ≥ S.

12. In order to make the given expression 'L > P' true, the elements which are to be placed in the place of question mark are L, M, N, O, P and Q. Then the expression becomes L > M = N > O = P < Q.

13. In the expression B > D = G ≥ K > T, the given expression 'B > K' as well as 'T < D' are true.

14. In all the other expressions except in L < Q = M ≥ H < F the expressions 'L < F' and 'H ≥ Q' are definitely true.

15. In the given expression the question mark should be replaced with '=' in order to make the expressions 'C < V' and 'Y < Q' definitely true. Then the expression becomes C < J ≤ Q = V ≥ W > Y.

Solutions for questions 16 to 20:

16. The given sequence is:
R K 5 9 # B 2 % * E ? A 8 L $ I 4 S V 7 ! C 6 N @ H 1 3 & D
Except BLI, in all others, the three letters are consecutive alphabets in the given sequence.

17. B, C and H are the three letters which are followed by a digit but not immediately preceded by a consonant.

18. The sequence is:
5 # 2, *?8, $4V ____
The logic is as follows:
5^{+2} $\#^{+2}$ 2^{+2}, $*^{+2}$ $?^{+2}$ 8^{+2}, $\$^{+2}4^{+2}$ V^{+2}, $!^{+2}$ $6^{+2}@$

19. The 9th element to the right of the 19th element form the left end is (9 + 19)th = 28th from the left end, that is 3.

20. There is only one letter, i.e., E, which is immediately followed and immediately preceded by symbol.

Solutions for questions 21 to 25:

21. 3 Δ 4 = 3 + 4 + 3 × 4 = 7 + 12 = 19
(3 Δ 4) $ 5 = 19 $ 5 = $19^2 + 5^2$
= 361 + 25 = 386

22. 1 > 2 = $1^2 + 2^3$ = 1 + 8 = 9
(1 > 2) < 3 = 9 < 3 = $9^3 - 3^2$
= 729 – 9 = 720

23. 2 @ 1 ⇒ $2^3 - 1^3$ = 8 – 1 = 7
3 > (2 @ 1) = 3 > 7 = $3^3 + 7^3$
⇒ 27 + 343 = 370

24. E ↓ F = $(E + F)^2 + (E - F)^2 = 2(E^2 + F^2)$
E ↑ F = $(E + F)^2 - (E - F)^2$ = 4 E F
2 ↓ 5 = 2 $(2^2 + 5^2)$ = 2 (4 + 25) = 58
4 ↓ 3 = 2 $(4^2 + 3^2)$ = 2 (16 + 9) = 50
∴ (2 ↓ 5) ↑ (4 ↓ 3) = 58 ↑ 50
= 58 ↑ 50
⇒ 4 × 58 × 50 = 11600

25. 2 ? 3 = $(2 + 3)^2 - 2 \times 3$ = 25 – 6 = 19
5 ≠ 3 = $5^2 - 5 \times 3 + 3^2$ = 25 – 15 + 9 = 19
(2 ? 3) ≠ (5 ≠ 3) = 19 ≠ 19
= $19^2 - 19 \times 19 + 19^2 = 19^2$ = 361

Solutions for questions 26 to 30:

(a) 'A % B ! C' means 'A is added to the product of B and C'.
(b) 'A © B * C' means 'the product of B and C is subtracted from A'.
(c) 'A # B @ C' means 'the product of A and B is divided by C'.
(d) A • B $ C' means 'C is multiplied by the sum of A and B'.

26. Given, 100 © 20 * 3 = a
The value a = 100 – (20 × 3) = 40
Then 40% 40 ! 5 = 40 + 40 × 5 = 240.

27. Given, 16 • 14 $ 4 = q
The value of q = (16 + 14) × 4 = 120
Then 120 # 10 @ 12
$= \frac{120 \times 10}{12} = 10 \times 10 = 100.$

28. Given, 100 © 5 * 16 = t
∴ t = 100 – (5 × 16) = 20
Then 20 % 4 ! 12 = 20 + 4 × 12 = 20 + 48 = 68.

29. Given, 50 # 40 @ 200 = p
$\Rightarrow p = \frac{50 \times 40}{200} = 10$
Then 16% 12! 10 = 16 + 12 × 10 = 16 + 120 = 136.

30. Given, 12 • 13 $ 5 = r
⇒ r = (12 + 13) × 5 = 125
10 © 4 * 125 = 10 – (4 × 125) = – 490.

6 Blood Relations

Chapter

Learning Objectives

In this chapter, you will:

- Learn about different types of blood relations
- Learn how to draw a family tree
- Learn to differentiate between different stages/levels of the family tree
- Learn how to represent the gender of each person and the relationship between two persons

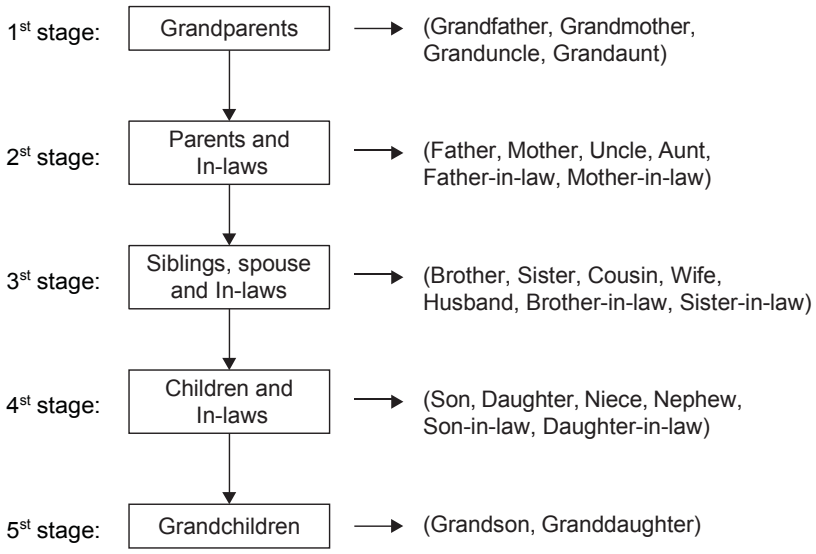
The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Blood Relations

There are two types of questions based on blood relations that are given in different competitive examinations. For the sake of convenience, we will refer to the two types of questions as Type I and Type II. (Please note that the questions on blood relationships are not categorized as above in the actual exam papers. It is being done purely from the point of better understanding).

In the exams, the success of a candidate in the questions on blood relations depends upon his knowledge about various blood relations. Some of the relationships given below help in solving the problems.

The easiest and non-confusing way to solve these types of problems would be to draw a family tree diagram and increase the levels in the hierarchy as shown in the next page:



Mother's or Father's son	:	Brother
Mother's or Father's daughter	:	Sister
Mother's or Father's brother	:	Uncle
Mother's or Father's sister	:	Aunt
Mother's or Father's mother	:	Grandmother
Mother's or Father's father	:	Grandfather
Grandmother's brother	:	Granduncle
Grandmother's sister	:	Grandaunt
Grandfather's brother	:	Granduncle
Grandfather's sister	:	Grandaunt
Sister's or Brother's son	:	Nephew
Sister's or Brother's daughter	:	Niece
Uncle or Aunt's (Son or Daughter)	:	Cousin
Son's wife	:	Daughter-in-law
Daughter's husband	:	Son-in-law
Husband's or Wife's sister	:	Sister-in-law
Husband's or Wife's brother	:	Brother-in-law
Sister's husband	:	Brother-in-law
Brother's wife	:	Sister-in-law
Children of same parents	:	Siblings (could be all brothers, all sisters or some brothers and some sisters)
Children	:	Son, Daughter
Children's Children	:	Grandchildren (Grandson, Granddaughter)

In addition, remember the word spouse which means either husband or wife.

Grandfather and grandmother will come in the first stage; mother, father, uncle and aunt will come in the second stage; sister, brother and cousin will come at the third stage; son, daughter, niece and nephew will come in the fourth stage and finally, granddaughters and grandsons will come. The above stages are made from the point of view of an individual.

In **Type – I questions**, the relationship between two people is given through a roundabout way of relating them through other people. We have to go through the series of relationships and finally determine the relationship between the two people given in the question. The relationship can be given as a simple statement or as a statement made by a person. In the first example given below, a person is involved in making a statement whereas in the **Type – II question**, there is no person involved in making a statement.

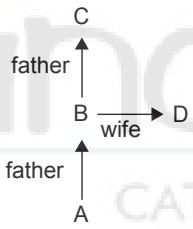
Solved Examples

1. A's father's mother-in-law's only daughter's son is B. How is A related to B?
(A) Brother
(B) Sister
(C) Nephew
(D) Cannot be determined

Sol: A's father's mother-in-law's only daughter is A's mother. A's mother's son is A's brother.
But A can be either brother or sister to B.

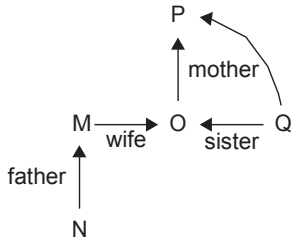
2. If A's father is B, C is the father of B and D is A's mother, then how is C related to D?
(A) Father
(B) Grandfather
(C) Father-in-law
(D) Uncle

Sol: A's father is B and mother is D. Therefore, D is B's wife and C is the father of B. Hence, C is D's father-in-law.



3. A + B means A is the son of B.
A – B means A is the daughter of B.
A × B means A is the father of B.
A ÷ B means A is the mother of B.
If M × N + O – P ÷ Q, then how is M related to Q?
(A) Husband
(B) Cousin
(C) Brother-in-law
(D) Uncle

Sol: M × N + O – P ÷ Q means M is the father of N, N is the son of O, O is the daughter of P, P is the mother of Q.
M is the father of N and N is the son of O means M is the husband of O.
O is the daughter of P and P is the mother of Q means O is the sister of Q.
M is the husband of O and O is the sister of Q means M is the brother-in-law of Q.



4. A + B means A is the son of B.
A – B means A is the daughter of B.
A × B means A is the father of B.
A ÷ B means A is the mother of B.
Which of the following means S is the son-in-law of P?
(A) P + Q ÷ R × S – T (B) P × Q ÷ R – S + T
(C) P + Q × R – S ÷ T (D) P × Q – R ÷ S × T

Sol: P + Q ÷ R × S – T means P is the son of Q. Q is the mother of R, R is the father of S and S is the daughter of T. Hence, S is the nephew of P.
P × Q ÷ R – S + T means P is the father of Q, Q is the mother of R, R is the daughter of S and S is the son of T. Hence, S is the son-in-law of P.
R + Q × R – S ÷ T means P is the son of Q, Q is the father of R, R is the daughter of S and S is the mother of T. Hence, S is the mother of P.
P × Q – R ÷ S × T means P is the father of Q, Q is the daughter of R, R is the mother of S and S is the father of T. Hence, S is the son of P.

5. Pointing to a person, Raju said, 'He is the only brother of my father's mother's daughter'. How is the person related to Raju?
(A) Brother (B) Father
(C) Uncle (D) Nephew

Sol: Raju's father's mother's daughter is Raju's father's sister. Raju's father's sister's only brother is Raju's father. Hence, the person is Raju's father.

6. A's mother's father is the husband of B's mother. How is A related to B, if A and B are males?
(A) Uncle (B) Father
(C) Nephew (D) Son

Sol: A's mother's father is the husband of B's mother.
ThatmeansA'smotheristhesisterofB.Hence,Ais

Exercises

Directions for questions 1 to 15: Select the correct alternate from the given choices.

1. How is my mother's daughter's only sister-in-law related to me if my father has only one child?
(A) Cousin (B) Sister
(C) Sister-in-law (D) Niece

2. A person who is my wife's mother's only son is my _____.
(A) Brother-in-law (B) Sister-in-law
(C) Cousin (D) Mother-in-law

3. How is my father's daughter's mother's only daughter-in-law related to my wife's son?
(A) Mother (B) Father
(C) Brother (D) Sister

4. How is my brother's son's sister related to my mother's husband?
(A) Son (B) Daughter
(C) Grandson (D) Granddaughter

5. A is the sister of B's wife's brother-in-law's father. If B's father-in-law has only one child, B is A's_____.
(A) Nephew (B) Niece
(C) Aunt (D) Daughter

6. Mr Rakesh's father-in-law's only child's sister-in-law's father is Rakesh's_____.
(A) Uncle (B) Father
(C) Brother (D) Grandfather

7. How is my mother's sister's only sibling's father related to me?
(A) Father (B) Uncle
(C) Father-in-law (D) Grandfather

8. How is my father's wife's son's daughter's brother related to me?
(A) Son (B) Nephew
(C) Niece (D) Cannot be determined

9. How is my son's daughter's sibling's mother related to my wife's only son?
(A) Sister (B) Sister-in-law
(C) Wife (D) Aunt

10. How is Mr Harry's son's paternal grandmother related to Harry's father-in-law's only daughter?
(A) Mother-in-law (B) Aunt
(C) Mother (D) Wife

11. How is my father's son's sister's mother related to me?
(A) Grandmother (B) Aunt
(C) Sister (D) Mother

12. C is the brother of D. A is the husband of B. B is the mother of C. E is the wife of D. How is B related to E?
(A) Mother (B) Father
(C) Mother-in-law (D) Father-in-law

13. How is my father's brother's wife's daughter related to me?
(A) Brother (B) Cousin
(C) Sister (D) Aunt

14. Ms Ritu's only brother's son's maternal grandmother is Sita. How is Sita's husband related to Ritu's brother's sister-in-law?
(A) Father (B) Uncle
(C) Grandfather (D) Brother

15. Ms Sneha introduced a person to Deepti and said, 'He is your sister's paternal grandfather and also my only brother's father'. How is Sneha related to Deepti?
(A) Mother (B) Sister
(C) Grandmother (D) Aunt

Directions for questions 16 to 20: Use the relationship given below and answer the following questions.
P @ Q means P is the father of Q.
P ⇒ Q means P is the mother of Q.
P * Q means P is the son of Q.
P # Q means P is the daughter of Q.
P $ Q means P is the brother of Q.
P % Q means P is the sister of Q.

16. Which of the following means A is the grandson of B?
(A) A ⇒ R * S * B (B) A $ R # S @ B
(C) A $ R # S *B (D) A $ R ⇒ S * B

17. Which of the following means W is the mother of Z?
(A) W * X * Y @ Z (B) W ⇒ X # Y @ Z
(C) W ⇒ X * Y @ Z (D) Both (B) and (C)

18. Which of the following means E is the nephew of G?
(A) E # F $ G (B) E * F $ G
(C) E * F % G (D) Both (B) and (C)

19. Which of the following means H is the father of L?
(A) H @ I % J # K ⇒ L (B) H ⇒ I % J # K @ L
(C) H @ I % J % K # L (D) H ⇒ I # J @ K $ L

20. Which of the following means M is the aunt of S?
(A) M $ N @ R $ S (B) M % N @ R $ S
(C) M % N ⇒ R @ S (D) M @ N ⇒ R % S

Directions for questions 21 to 25: These questions are based on the following information.

P, Q, R, S, T, U, V and W are eight members of a family. W is T's only brother. S's son is U and S is P's son. R is T's brother-in-law and his mother is Q. V is not Q's husband. R is not S's son. W has a niece.

21. Who is Q's daughter-in-law?
(A) S (B) T
(C) U (D) V

22. What is the ratio of males to females in the family?
(A) 1 : 1 (B) 3 : 5
(C) 5 : 3 (D) 3 : 1

23. How is R related to V?
(A) Brother (B) Father
(C) Daughter (D) Uncle

24. Which of the following statements is true?
(A) U is R's Son (B) V is W's daughter
(C) P is Q's brother (D) None of these

25. How is P's grandson related to T's brother?
(A) Nephew (B) Niece
(C) Son (D) Daughter

Directions for questions 26 to 30: These questions are based on the following information.

In a family of three generations there are six members A, B, C, D, E and F. All of them are from different professions. E is the son of a Teacher. The Architect is married to the Manager. C is an Engineer and his daughter is a Doctor. D is the wife of an Engineer. A is not C's father and C's mother is B. A's grandfather is a Manager. One of them is a Student, who is not F.

26. Which of the following pair represents a couple?
(A) FD (B) AB
(C) CD (D) AE

27. Who is a Student?
(A) A (B) B
(C) C (D) E

28. What is the profession of D's daughter?
(A) Doctor (B) Student
(C) Engineer (D) Manager

29. How is the Engineer related to the Student?
(A) Son (B) Daughter
(C) Father (D) Brother

30. Who is Teacher's father-in-law?
(A) A (B) B
(C) C (D) None of these

ANSWER KEYS

1. (C)	6. (B)	11. (D)	16. (C)	21. (B)	26. (C)
2. (A)	7. (D)	12. (C)	17. (D)	22. (C)	27. (D)
3. (A)	8. (D)	13. (B)	18. (D)	23. (D)	28. (A)
4. (D)	9. (C)	14. (A)	19. (A)	24. (D)	29. (C)
5. (A)	10. (A)	15. (D)	20. (B)	25. (A)	30. (D)

SOLUTIONS

Solutions for questions 1 to 15:

1. Note: For all the diagram, ▢ represent males and ○ represent females.
My mother's daughter is myself. As my father has only one child, my only sister-in-law is my sister-in-law.

2. My wife's mother's only son is my wife's brother. Hence, he is my brother-in-law.

3. My father's daughter's mother is my mother. My mother's only daughter-in-law is my wife. My wife is the mother of her son.

4. My brother's son's sister is my brother's daughter. My mother's husband is my father. therefore, he is my brother's father. My brother's daughter is my father's granddaughter.

5. B's wife's brother-in-law is B's brother as B's father-in-law has only one child. B's brother's father's sister is B's aunt. Thus, B is A's nephew.

6. Mr Rakesh's father-in-law's only child is Rakesh's wife. Rakesh's wife's sister-in-law is Rakesh's sister, whose father is Rakesh's father.

7. My mother's sister's only sibling is my mother. My mother's father is my grandfather.

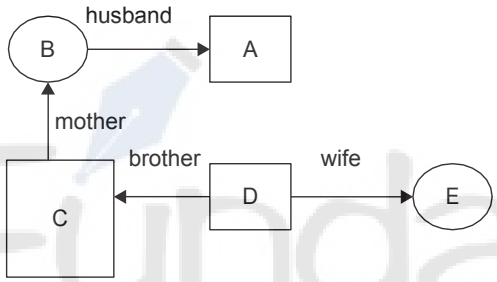
8. My father's wife's son can be me or my brother. Thus, the person here can be my son or my nephew. Hence, it cannot be determined.

9. My son's daughter's sibling's mother is my daughter-in-law. My wife's only son is my son. My daughter-in-law is my son's wife.

10. Harry's son's paternal grandmother is Harry's mother. Harry's father-in-law's only daughter is Harry's Wife. Harry's mother is Harry's wife's mother-in-law.

11. My father's son's sister's mother is my mother.

12. As A is the husband of B, B is the mother of C and C is the brother of D, we can say that C and D are children of A and B. Now, E is the wife of D. Thus, B is the mother-in-law of E.



13. My father's brother's wife's daughter is my cousin.

14. Ms. Ritu's only brother's son's maternal grandmother is Ritu's brother's mother-in-law, i.e., Sita.
Ritu's brother's sister-in-law is Sita's daughter. Sita's husband is the father of Sita's daughter.

15. He is your sister's paternal grandfather means he is Deepti's paternal grandfather. He is my only brother's father means he is Sneha's father. Thus, Sneha is the aunt of Deepti.

Solutions for questions 16 to 20:

16. Choice (A):
A ⇒ R * S * B means A is the mother of R, R is the son of S, S is the son of B. Hence, A is the daughter-in-law of B.
Choice (B):
A $ R # S @ B means A is the brother of R, R is the daughter of S, S is the father of B.
∴ A is the brother of B.
Choice (C):
A $ R # S * B means A is the brother of R, R is the daughter of S, S is the son of B.
∴ A is the grandson of B.

17. From (A), W is a male. Hence, he cannot be a mother.
Choice (B):
W ⇒ X # Y @ Z means W is the mother of X, X is the daughter of Y and Y is the father of Z. Hence, W is the mother of Z.
Choice (C):
W ⇒ X * Y @ Z means W is the mother of X, X is the son of Y and Y is the father of Z. Thus, W is the mother of Z.
Hence, (B) and (C) are correct.

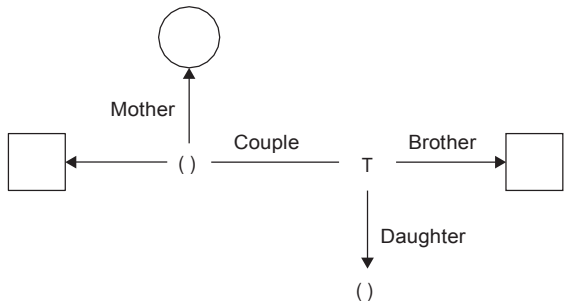
18. Choice (A):
E # F means, E is the daughter of F. Thus, E is a female and hence, she cannot be a nephew.
Choice (B):
E * F means, E is the son of F. F $ G means F is the brother of G. Hence, E is the nephew of G.
Choice (C):
E * F means, E is the son of F. F % G means F is the sister of G. Hence, E is the nephew of G.
∴ Both (B) and (C) are correct.

19. Choice (A):
H @ I means H is the father of I. I % J means I is the sister of J. J # K means J is the daughter of K and K ⇒ L means K is the mother of L. Hence, H is the father of L.

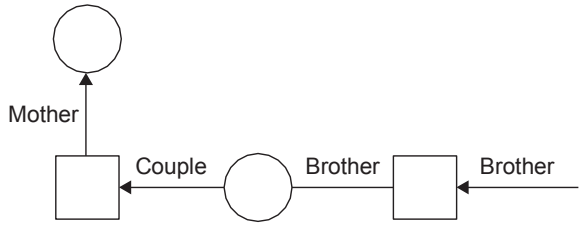
20. Choice (A):
M $ N means M is the brother of N. Thus, M is a male. Hence, he cannot be the aunt.
Choice (B):
M % N means M is the sister of N, N @ R means N is the father of R. R $ S means R is the brother of S. Thus, M is the aunt of S.

Solutions for questions 21 to 25: From the information, W is T's brother, R is T's brother-in-law and R's mother is Q and W has a niece. We get the following relationship diagram.

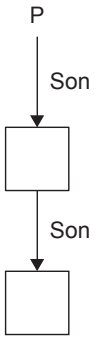
(i)



(ii)



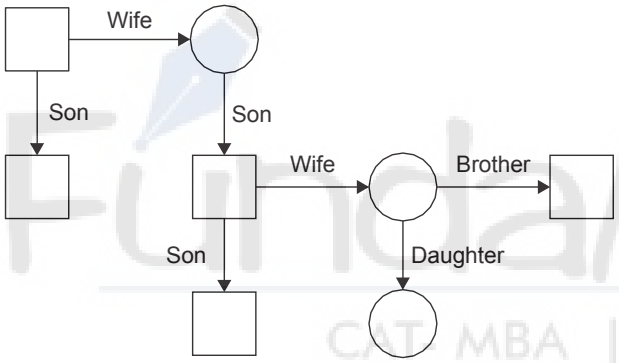
Now, S is P's son and U is S's son.



Now, Q's husband is not V (given) and not S (R is not S's son).

Thus, Q's husband is either P or U. But U can be Q's husband because then there is no way to find out R's sibling and T's daughter.

Thus, P is Q's husband and V is T's daughter. Case (ii) is not possible as S is a male. Thus, we get following relationship diagram.



21. Q's daughter-in-law is T.

22. P, R, S, W and U are males and Q, T and V are females. Hence, the ratio is 5 : 3.

23. R is V's uncle.

24. None of the statements is true.

25. P's grandson is U. T's brother is W. U is W's nephew.

Solutions for questions 26 to 30: It is given that C is an Engineer. Also, D is the wife of an Engineer, i.e., D is C's wife. Also, C's mother is B and C has a daughter. And from the information that F is not C's father. Thus, we get the following relationship diagram.

Now, we have got at least one person from each of the three generations of the family.

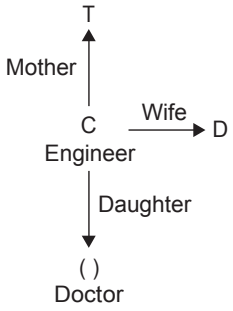
Now, E is the son of a Teacher and A's grandfather is a Manager. Also, Manager is married to an Architect.

Now, comparing the above three figures, there is only one way to combine them. C's father is a Manager. C's mother is an Architect. D is a Teacher. So, A and E are C's children. Now, as E is a male, E cannot be the Doctor.

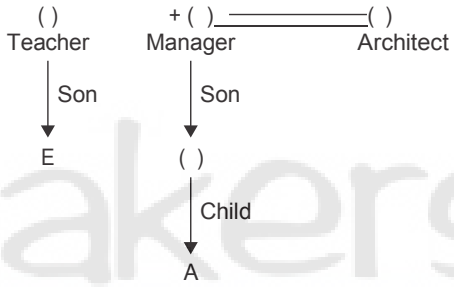
Hence, E is a Student. Thus, A is the Doctor. Finally, F is the Manager and is C's father.

∴ The family tree is represented as shown below.

It is give that C is an Engineer. Also D is the wife of an Engineer I.e., D is C's wife. Also, C's mother is B and C has a daughter. And from the information that F is not C's Father. Thus, we get the following relationship.



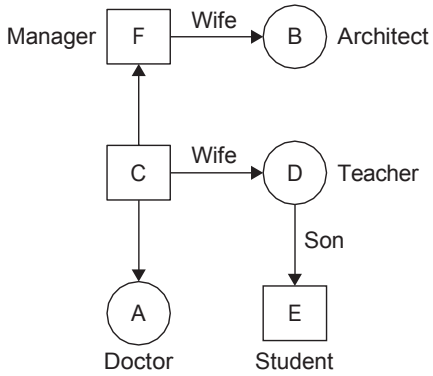
Now, we have got at least one person from each of the three generations of the family. Now E is the son of an Teacher. And, A's grandfather is a Manager. Also, Manager is married to an Architect.



Now, comparing the above three figures, there is only one way to combine them. C's father is a manager. C's Mother is an Architect. D is a Teacher. So, A and E are c's children. Now, as E is a Male, E cannot be the Doctor.

Hence, E is a Student. Thus, A is the Doctor. Finally, F is the Manager and is C's father.

∴ The family tree is represented as shown below.



26. CD represents a couple.

27. E is a Student.

28. D's daughter is A. A is a Doctor.

29. C is the Engineer and E is the Student, C is E's father.

30. D is the Teacher. D's father-in-law is F.

7 Direction Sense

Chapter

Learning Objectives

In this chapter, you will:

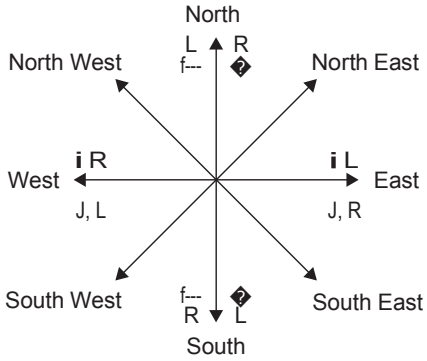
- Revisit the cardinal directions (North, South, East and West) and the intermediate directions (northeast, southeast, northwest and southwest)
- Become familiar with spatial visualization, and draw figures tracing the journey of a person/moving body
- Learn to apply Pythagoras theorem to find the distance between two points in a plane

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Direction Sense

The questions on direction sense typically involve a person moving certain distances in specified directions. Then, the student is asked to find out the distance between the initial and the final points. The easiest way of solving these problems is to draw a diagram as you read the information given in the problem and ensure that the diagram reflects all the information given in the problem.

To solve these types of problems, the student should be aware of the directions. The student should also recognize the left and right of a person walking in a particular direction. The following diagram shows all the directions and left (L) and right (R) of a person walking in that direction and the student should memorize the diagram.



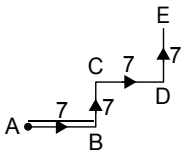
NOTE

The distance from a particular point after travelling a distance of x metres in the horizontal direction and a distance of y metres in the vertical direction is equal to $\sqrt{x^2 + y^2}$. (Please note that in common usage, North-South direction is referred to as 'vertical' direction and the East-West direction is referred to as the 'horizontal' direction).

Solved Examples

1. A person travels a distance of 7 km towards east from his house, then travels 7 km towards north and then a distance of 7 km towards east and finally 7 km towards north. What is the vertical distance travelled by him?

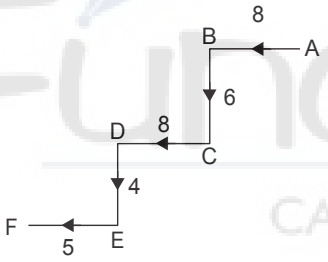
Sol:



Let A and E be the initial and the final positions. The vertical distance travelled = BC + ED = (7 + 7) km = 14 km.

2. A person starts from his house and travels 8 m towards west; then he travels 6 m towards his left, then 8 m towards west and then 4 m towards south. Finally, he turns right and travels 5 m. What is the horizontal distance travelled by him?

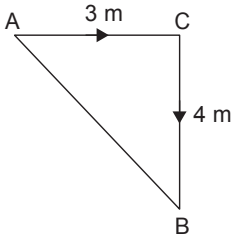
Sol:



Let A and F be the initial and the final positions.
∴ Horizontal distance travelled = FE + DC + BA
= 5 + 8 + 8 = 21 m.

3. Surya travels 3 m towards east and then turns right and travels 4 m. What is the distance between the initial and the final positions of Surya?

Sol:

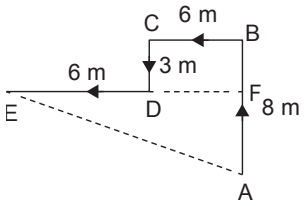


Let A and B be the initial and the final positions of Surya.

$AB = \sqrt{AC^2 + BC^2} = \sqrt{3^2 + 4^2} = 5$ m.

4. Starting from his house, Sachin walks a distance of 8 m towards north, then he turns left and walks 6 m, then he walks 3 m towards south and finally travels 6 m towards west to reach his office. What is the distance between his house and office and also find in which direction is his office situated with respect to his house?

Sol:



Let A be Sachin's house and E his office.
The distance between A and E

$= \sqrt{(EF)^2 + (AF)^2} = \sqrt{(ED + CB)^2 + (AB - FB)^2}$

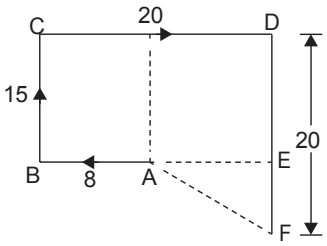
$= \sqrt{(ED + CB)^2 + (AB - FB)^2} = \sqrt{12^2 + 5^2}$

= 13 m.

His office is towards north-west of his house.

5. Starting from her house, Nisha travelled 8 m towards west, then turned right and travelled 15 m. She then travelled 20 m towards east, followed by another 20 m towards south to reach a hostel. How far is her house from the hostel and in which direction?

Sol:



Let A and F be the initial and final positions.

Now AF = $\sqrt{AE^2 + EF^2}$

AE = CD – BA

= 20 – 8 = 12 m

EF = DF – DE = DF – CB

= 20 – 15 = 5m

∴ AF = $\sqrt{144 + 25}$

= $\sqrt{169}$ = 13 m

Her house is towards north-west from the hostel.

Exercises

Directions for questions 1 to 20: Select the correct alternative from the given choices.

1. A boy walks 7 km towards the north, then turns to his right to travel 13 km then he turns to his left and travels 11 km. What is the vertical distance between the starting point and end point (in km)?
(A) 11 (B) 18
(C) 21 (D) 13

2. Shyam travels 8 km towards the east, then turns right and travels 4 km, then turns right and travels 18 km and then turns left and travels 17 km. What is the vertical distance between his starting and end points?
(A) 21 km (B) 26 km
(C) 47 km (D) 20 km

3. Akash travels 8 km towards the east then turns right and travels 9 km. After he travels 6 km towards east, he turns left and travels 5 km, then he travels 13 km towards the east and stops. How far is he from the starting point, in horizontal direction (in km)?
(A) 41 (B) 14
(C) 26 (D) 27

4. Mahesh runs 20 m towards the west, turns left and runs 10 m, again turns left and runs 8 m. Then he runs 25 m towards the north, turns left and runs 17 m and stops. In which direction is he from the starting point?
(A) South-west (B) South-east
(C) North-west (D) North-east

5. A person travels 2 km towards the south, turns left and travels 10 km, again turns left and travels 14 km and then turns right and travels 5 km. In which direction is he from the starting point?
(A) South-west (B) South
(C) North-west (D) North-east

6. A person travels 8 km, turns right and travels 5 km. Then, he turns right again and travels 8 km. Finally, he turns left and travels 17 km towards south. In which direction is his starting point with respect to his end point?
(A) North (B) South
(C) North-east (D) South-west

7. Sonal went for a walk from her house to the park. She walked for 100 m then turned right to walk 200 m towards south. Then she turned right and walked 50 m, then turned left and walked 20 m. Finally, she turned left and walked 250 m to reach the park. In which direction is her home with respect to the park?
(A) East (B) West
(C) North (D) North-west

8. Harilal travels 4 km towards east, turns left and travels 2 km and then travels another 6 km towards the north. He then turns right and travels 2 km to reach a temple. How far is the temple from his starting point (in km)?
(A) 6 (B) 8
(C) 10 (D) 12

9. Pooja starts from her house and travels 7 km towards the north. Then she turns left, travels 3 km, then turns left again and travels 4 km and then travels 2 km towards the west. Finally, she turns right and travels 9 km. How far is she from the starting point (in km)?
(A) 10 (B) 12
(C) 0 (D) 13

10. Kapil travelled 7 km towards the north-east followed by 12 km towards the south, then 7 km towards the south-west followed by 5 km towards the west. How far is he from the starting point (in km)?
(A) 13 (B) 12
(C) 5 (D) 14

11. Sunil travelled 15 km towards the east, then he took a left turn and travelled 4 km, then he turned right and travelled 9 km followed by 11 km after taking a right turn. How far is he from the starting point (in km)?
(A) 24 (B) 25
(C) 20 (D) 5

12. Pramod went to visit his friend Malik's home. He travelled 10 km towards the north, then turned right and travelled 6 km. Then he took a left turn and travelled 4 km, then took right and travelled 9 km, then again, he took right and travelled 6 km to reach Malik's home. Malik told him that there is a shortcut road which is of the shortest possible distance between their homes. How many kilometers less Pramod can travel if he follows the shortcut for returning back to his home?
(A) 17 (B) 35
(C) 15 (D) 18

13. Lokesh travelled 7 km towards the east. Then he turned left and travelled 4 km then he travelled 3 km towards the west, then he turned right and travelled 5 km. How far is he from the starting point?
(A) $13\sqrt{2}$ (B) $\sqrt{97}$
(C) $2\sqrt{13}$ (D) 13

14. Ramesh and Suresh started their journey from a common point. Ramesh travelled 7 km towards the north, then turned left and travelled 23 km, then he turned left again and travelled 15 km and Suresh travelled 2 km towards the south, then he turned left and travelled 12 km,

then he turned left again and travelled 6 km stopped. How far they are from each other (in km)?
(A) 35 (B) 37
(C) 12 (D) 38

15. Pallavi and Jessica decided to meet at a theatre. Pallavi travelled 9 km from her house towards the west. Then she took a right turn and travelled 10 km, then 7 km towards her right to reach the theatre. Jessica travelled 5 km from her house, then 7 km towards her right then 5 km towards her left. Then she took a left turn and travelled 12 km towards south and reached the theatre. How far is Pallavi's home from Jesscia's home (in km)?
(A) 14 (B) 15
(C) 16 (D) 17

16. A person walks 4 km towards the east, then turns to his left to travel 7 km, then turns towards the west and travels 10 km, finally he travels 15 km towards the south. How far and in which direction is he from the starting point?
(A) 10 km, South-west
(B) 12 km, South-east
(C) 12 km, North-east
(D) 10 km, North-east

17. A person started travelling from place A towards the east. After travelling 9 km he took a right turn and travelled 5 km, then he took a right turn and travelled 4 km, then again right and travelled for 6 km, then he travelled 10 km towards the east, then took a left turn and travelled 7 km to reach place B. How far and in which direction is B with respect to A?
(A) 17 km, South-west
(B) 15 km, North-east
(C) 17 km, North-east
(D) 25 km, North-west

18. A defective compass points towards the north when it should point towards the south-west. If a person is holding that compass facing north-east, then in which direction that defective compass will indicate?
(A) South (B) East
(C) South-west (D) North-west

19. Sujay walked 9 m facing towards the west, then took a left turn and walked a distance of 6 m. He then took a right turn and walked a distance of 9 m. Approximately, how far is he from the starting point?
(A) 18 m (B) 20 m
(C) 19 m (D) 21 m

20. Anil started walking towards the east. After walking 8 km, he took a left turn and walked for 4 km then again took a left turn and walked for 2 km. Further, he took a right turn and walked for 6 km then again took a right turn and walked for 2 km then took a left turn before taking another left turn and walked for 2 km and 8 km, respectively and stopped. In which direction is he from the starting point?
(A) North-east (B) South
(C) North-west (D) North

Directions for questions 21 to 23: These questions are based on the following information.

A person starts from place A and goes upto place J through B, C, D, E, F, G, H and I in that order. From A he travels 7 km towards the north to reach B, then he takes a right turn and travels 6 km to reach C, from C he travels 11 km towards the south to reach D, then he turned left and travelled 12 km to reach E, then he again turned left and travelled for 5 km to reach F. From F he travelled 9 km towards west to reach G, then he took a left turn and travelled 15 km to reach H, then he took a left turn, travelled 15 km to reach I, then again turned left and travelled 7 km to reach J.

21. How far and in which direction is A with respect to J?
(A) 29 km, North-west
(B) 25 km, North-west
(C) 29 km, South-west
(D) 25 km, South-east

22. H is in which direction from F?
(A) South-west (B) South-east
(C) South (D) North-east

23. How far is F from D (in km)?
(A) 10 (B) 17
(C) 15 (D) 13

Directions for questions 24 to 26: These questions are based on the following information.

Point A is 8 m towards the south of point E. Point C is 4 m towards the north of point B, which is 5 m towards the west of point D. Point C is 7 m towards the east of point E. Point I is 6 m towards the east of point F, which is 9 m towards the north of point H. Point D is 11 m towards the south of point G, which is 8 m towards the east of point H.

24. In which direction is point I with respect to point A?
(A) South-west (B) North-east
(C) South-east (D) North-west

25. If point K is 2 m towards the east of point I, then what is the distance between the points D and K?
(A) 19 m (B) 21 m
(C) 22 m (D) 20 m

26. Approximately how far and in which direction is point E with respect to point G?
(A) 14 m, South-west (B) 15 m, North-west
(C) 13 m, South-west (D) 14 m, South

Directions for questions 27 and 28: These questions are based on the following information.

S, T, U, V, W, X, Y and Z are the eight class rooms in a college. Z is 10 km towards the south of X and is 2 km towards the east of U, which is 3 km towards the south of T. S is 5 km towards the west of T and is 6 km towards the south of V. W is 1 km towards the north of Y, which is 5 km towards the east of V.

27. How far and in which direction is X with respect to W?

(A) 2 km, West (B) 2 km, East
(C) 1 km, East (D) 2 km, North

28. If classroom R is constructed exactly between X and Z, then approximately how far is T with respect to R?

(A) 9 km (B) 8 km
(C) 3 km (D) 4 km

Directions for questions 29 and 30: These questions are based on the following information.

Eight cities T_1, T_2, T_3, T_4, T_5, T_6, T_7 and T_8 in a state are in different directions as given below.

T_6 is towards the south of T_4, which is towards the south-west of T_3. T_8 is towards the north of T_2 and is west of T_5. T_1 is towards the west of T_2. T_7 is towards the west of T_6 and is towards the south of T_5.

29. If the distance between the cities (T_8, T_2), (T_8, T_5) and (T_5, T_7) are equal, then in which direction is T_2 with respect to T_7?

(A) East (B) West
(C) North-east (D) South-west

30. In which direction is T_4 with respect to T_5?

(A) East (B) North-east
(C) South-east (D) North

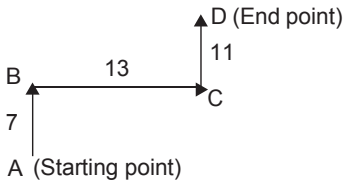
ANSWER KEYS

1. (B)	6. (A)	11. (B)	16. (A)	21. (B)	26. (A)
2. (A)	7. (D)	12. (D)	17. (C)	22. (A)	27. (B)
3. (D)	8. (C)	13. (B)	18. (A)	23. (D)	28. (C)
4. (C)	9. (D)	14. (B)	19. (C)	24. (B)	29. (B)
5. (D)	10. (A)	15. (D)	20. (D)	25. (D)	30. (A)

SOLUTIONS

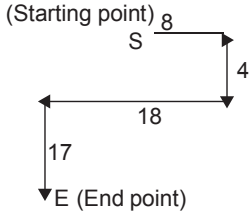
Solutions for questions 1 to 20:

1.



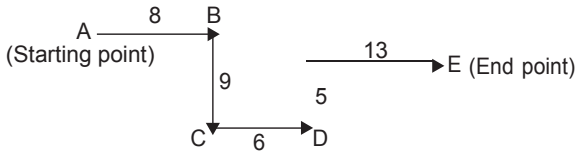
Vertical distance between A and D = 7 + 11 =18 km.

2.



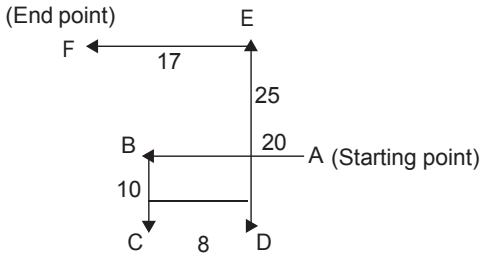
Vertical distance between S and E is 4 + 17 = 21 km.

3.



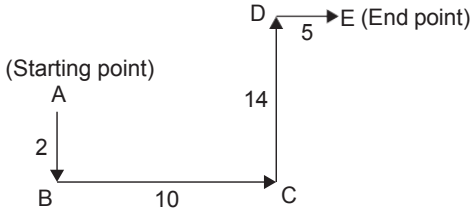
∴ Total distance in horizontal direction = AB + CD + DE = 8 + 6 + 13 = 27 km.

4.



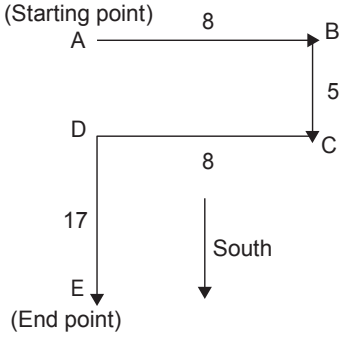
F is towards the north-west of A.

5.



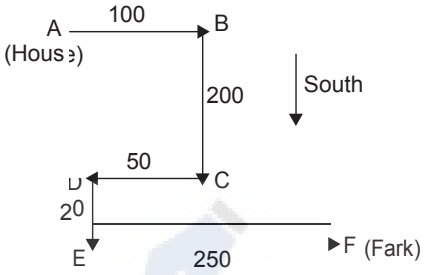
E is towards the north-east of A.

6. (Starting point)



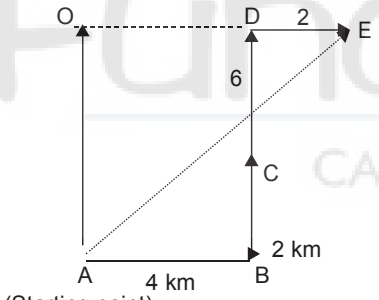
Hence, A (starting point) is towards the north of E (end point).

7.



Hence, her home (A) is towards the north-west of park (F).

8.



We have to find AE:

In ΔAOE, AE = $\sqrt{AO^2 + OE^2}$

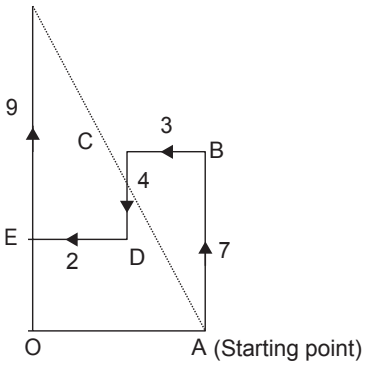
AO = BC + CD = 8 km

OE = AB + DE = 6 km

∴ AE = $\sqrt{8^2 + 6^2}$ = 10 km

F (End point)

9.



We have to find AF.

In ΔAOF,

AF² = $\sqrt{AO^2 + OF^2}$

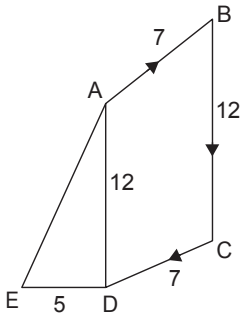
AO = BC + DE = 5 km.

OF = AB – CD + EF = 12 km.

AF = $\sqrt{25 + 144}$ = $\sqrt{169}$.

AF = 13 km

10.



We have to find AE.

In ΔADE,

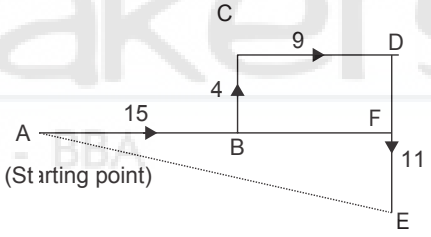
AE² = AD² + DE²

AD = BC = 12

∴ AD = $\sqrt{12^2 + 5^2}$ = 13 km

We have to find AE.

11.



In ΔAEF,

AE² = AF² + EF²

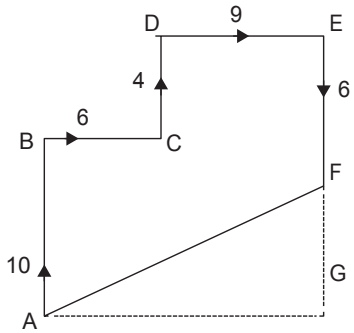
AF = 15 + 9 = 24

EF = 11 – 4 = 7

∴ AE = $\sqrt{24^2 + 7^2}$

= 25 km

12.

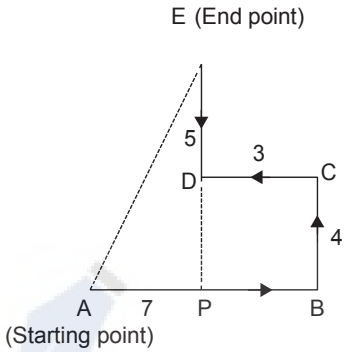


A is Pramod's home and F is Malik's home.

Total distance travelled by Pramod from A to F is
= 10 + 6 + 4 + 9 + 6 = 35 km
AF represents the shortcut road.
In ΔAGF,
$AF^2 = AG^2 + GF^2$
AG = BC + DE = 15.
GF = AB + CD – EF = 10 + 4 – 6 = –8

$\therefore AF^2 = 15^2 + 8^2 = 17$ km
Hence, Pramod can travel (35 – 17) km = 18 km less if he follows the shortcut for returning to his home.

13. We have to find AE.

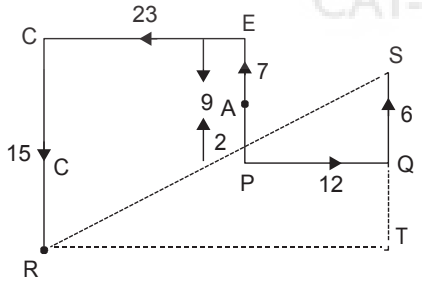


In ΔAPE,
$AE^2 = AP2 + EP^2$
AP = AB – CD = 4
EP = DE + BC = 9

$AE = \sqrt{4^2 + 9^2}$

$\Rightarrow AE \quad \sqrt{97}$ km

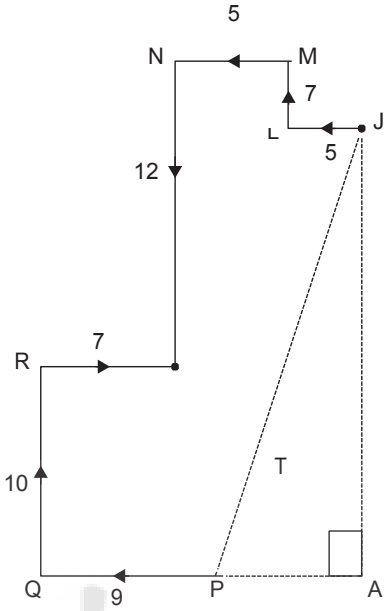
14.



Here, A is the common point from where Ramesh and Suresh start. R is the final position of Ramesh and S is the final position of Suresh. We have to find RS.
Now, RT = 23 + 12 = 35
QS = 6 + (15 – 9) = 12
∴ In ΔRTS,
$RS^2 = RT^2 + TS^2$
TS= QS + (RC – PE)

$\therefore RS = \sqrt{35^2 + 12^2}$
RS = 37 km

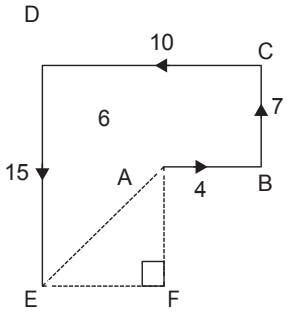
15. Let P represents Pallavi's home. J represents Jessica's home and T represents the theatre where they meet.



We have to find PJ.
In ΔPAJ,
$PJ^2 = PA^2 + JA^2$
PA = 7 + 5 + 5 – 9 = 8
JA = 10 + 12 – 7 = 15
$\therefore PJ = \sqrt{8^2 + 15^2}$
PJ = 17 km

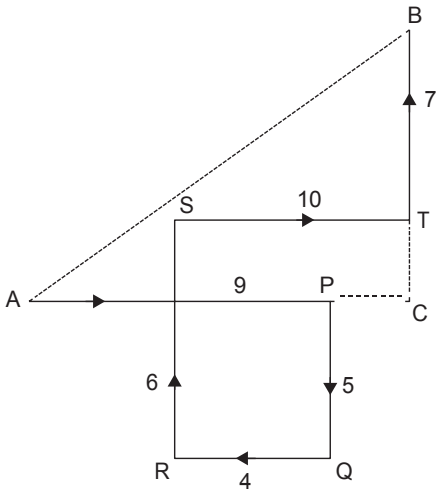
In ΔAEF, AF = 15 – 7 = 8.

16.



EF = 10 – 4 = 6
$\therefore AE = \sqrt{8^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100}$
AE = 10 km
E is towards the south-west of A.

17.

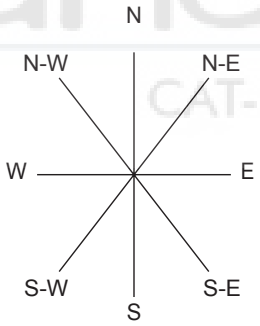


In ΔACB,
$AB^2 = BC^2 + AC^2$
BC = BT + RS – PQ
= 6 + 7– 5 = 8.
AC = AP + ST – RQ
= 9 + 10 – 4 = 15

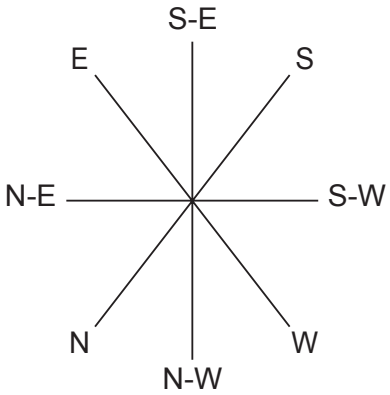
$\therefore AB = \sqrt{8^2 + 15^2}$

AB = 17 km.
B is towards the north-east of A.

18. Actual direction:

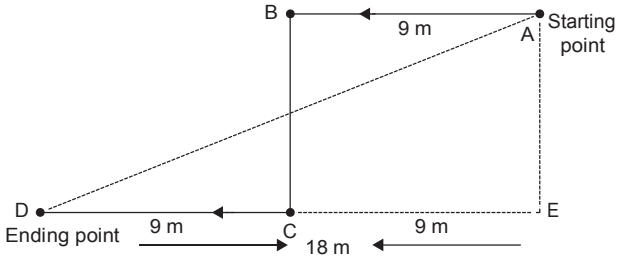


Damaged compass:



By comparing the two diagrams it is clear that, the pointer which was showing north-east is directed towards the south by damaged compass.

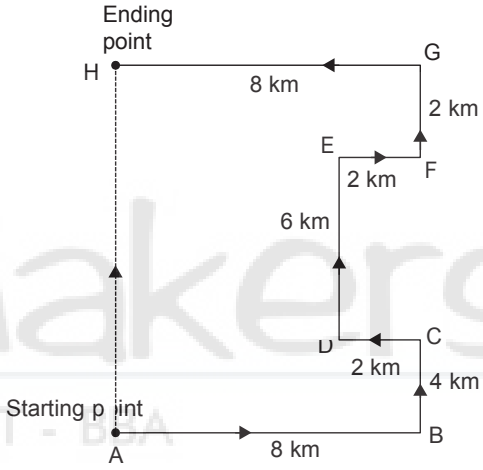
19. The path traced by Sujay is as shown below.



$AD^2 = DE^2 + AE^2$

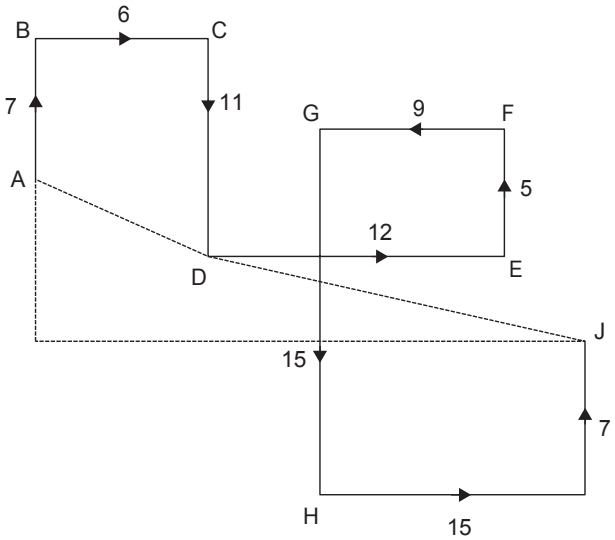
$AD = \sqrt{18^2 + 6^2} = 360 \approx 19\ m$

20. The path traced by Anil is as shown below.



$\therefore$ He is towards the north of the starting point.

Solutions for questions 21 to 23:



21. In ΔAPJ, $AJ^2 = AP^2 + PJ^2$

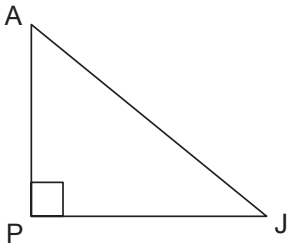
$AP = (CD - AB) + (GH - FE - JI)$

$= (11 - 7) + (15 - 5 - 7)$

$= 4 + 3 = 7$

$PJ = BC + HI + (DE - GF)$

$= 6 + 15 + 12 - 9 = 24$



$AJ = \sqrt{7^2 + 24^2} = \sqrt{625}$

$AJ = 25$

A is towards the north-west of J.

22. H is towards the south-west of F.

23.

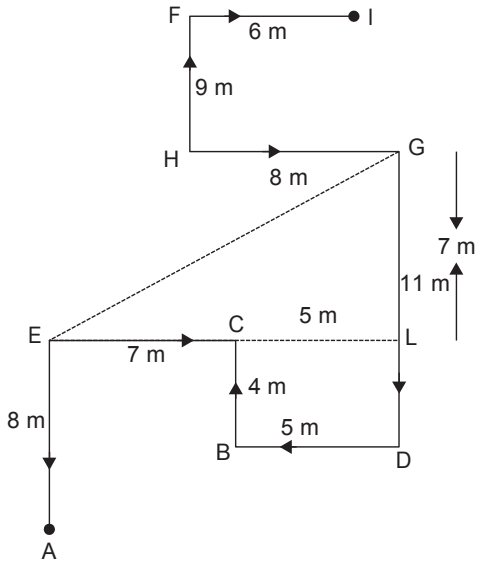
$FD^2 = EF^2 + DE^2$

$FD^2 = 5^2 + 12^2$

$FD = \sqrt{169} = 13$ km

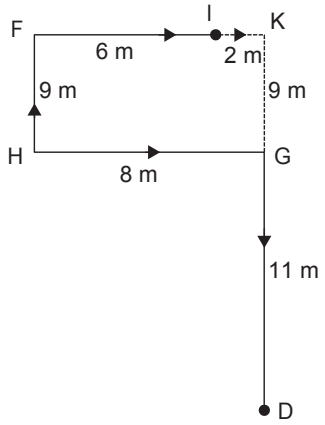
Solutions for questions 24 to 26:

24. The given data can be represented as shown below.



Point I is towards the north-east of point A.

25. If point K is 2 m towards the east of point I, then we shall draw the following route.



∴ The distance between D and K is
DK = DG + GK = 11 + 9 = 20 m.

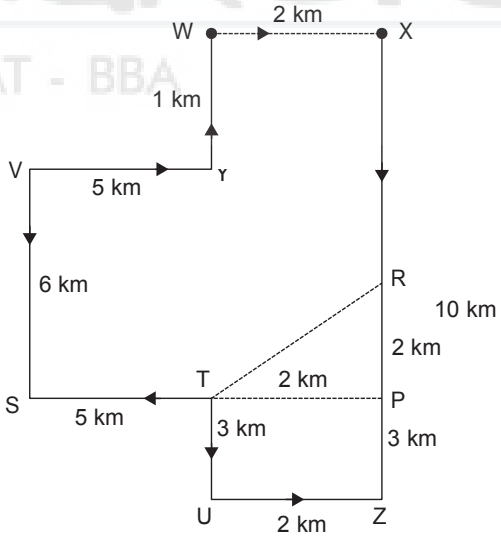
26. $GE = \sqrt{EL^2 + LG^2}$

$= \sqrt{(7+5)^2 + 7^2} = \sqrt{193} \approx 14m$

∴ Point E is 14 m towards the south-west of point G.

Solutions for questions 27 and 28:

27. The given data can be represented as shown below.

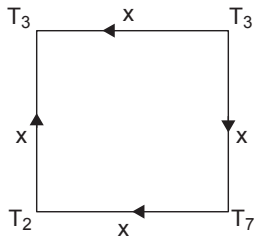


X is 2 km towards the east of W.

28. $TR = \sqrt{TP^2 + RP^2} = \sqrt{2^2 + 2^2} \approx 3\ km$

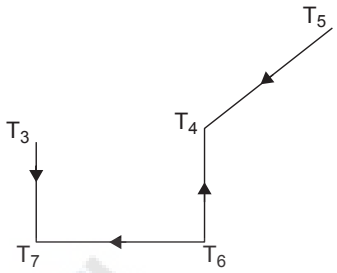
Solutions for questions 29 and 30:

29. From the given information, the path can be represented as shown below.

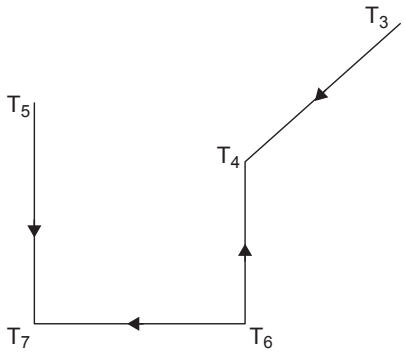


$\therefore$ T_2 is towards the west of T_7.

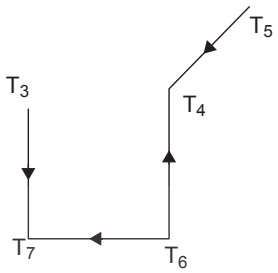
30. From the given information, we have the following possibilities.



Hence, T_4 is towards the north-east of T_5.



Hence, T_4 is towards the south-east of T_5.



Hence, T_4 is towards the east of T_5.

8 Clocks

Chapter

Learning Objectives

In this chapter, you will:

- Calculate the angular speed at which the minute hand and the hour hand of a clock move
- Learn to apply relative velocity concept to clocks
- Learn how many times in a day the hands of a clock coincide
- Learn how to find the angle between the hands of a clock at any time of the day

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Clocks

The hour hand and the minute hand of a clock move in relation to each other continuously and at any given point of time, they make an angle between 0° and 180° with each other.

If the time shown by the clock is known, then the angle between the hands can be calculated. Similarly, if the angle between two hands is known, then the time shown by the clock can be found out.

When we say angle between the hands, we normally refer to the acute/obtuse angles (upto 180°) between the two hands and not the reflex angle (>180°).

For solving the problems on clocks, the following points will be helpful.

1. Minute hand covers 360° in 1 hour, i.e., in 60 minutes. Hence, MINUTE HAND COVERS 6° PER MINUTE.
2. Hour hand covers 360° in 12 hours. Hence, hour hand covers 30° per hour. Hence, HOUR HAND COVERS 1/2° PER MINUTE.

The following additional points also should be remembered. In a period of 12 hours, the hands make an angle as follows.

1. 0° with each other (i.e., they coincide with each other), 11 times.
2. 180° with each other (i.e., they lie on the same straight line), 11 times.
3. 90° or any other angle with each other, 22 times.

NOTE

We can also solve the problems on clocks using the method of 'Relative Velocity'.

In 1 minute, minute hand covers 6° and hour hand covers 1/2°.

Therefore, relative velocity = 6 – 1/2 = 51/2° per minute. Alternately, in 1 hour, the minute hand covers 60 minute divisions whereas the hour hand covers 5 minute divisions.

∴ Relative speed = 60 − 5 = 55 minutes per hour.

However, adopting the approach of actual angles covered is by far the simplest and does not create any confusion.

Important points to remember

1. Any angle is made 22 times in a period of 12 hours.
2. In a period of 12 hours, there are 11 coincidences of the two hands, when the two hands are in a straight line facing opposite directions.
3. The time gap between any two coincidences is 12/11 hours or $65^5/_{11}$ minutes.
4. If the hands of a clock (which do not show the correct time) coincide every p minutes, then

If $p > 65^5/_{11}$, then the watch is going slow or losing time. If $p < 65^5/_{11}$, then the watch is going fast or gaining time.

To calculate the angle 'θ' between the hands of a clock, we use the following formula (where m = minutes and h = hours).

1. $\theta = \left|\frac{11}{2}m - 30h\right|$ when $\frac{11}{2}m > 30h$
2. $\theta = 30h - \frac{11}{2}m$ when $30h > \frac{11}{2}m$

Solved examples

1. What is the angle between the minute hand and the hour hand of a clock at 3 hours 40 minutes?
(A) 20° (B) 70°
(C) 90° (D) 130°

Sol: The angle between the hands can be calculated by $\theta = \left|\frac{11}{2}m - 30h\right|$, where m is minutes and h is hours. Here, m = 40 and h = 3.

$\therefore \theta = \left|\frac{11}{2} \times 40 - 30 \times 3\right| = |220 - 90| = 130°$

The angle between the two hands is 130°.

2. Find the time between 2 and 3 p.m. at which the minute hand and the hour hand
(i) make an angle of 60° with each other.
(ii) overlap
(iii) are perpendicular to each other.
(iv) are on the same straight line but are facing opposite directions.

Sol: (i) In the formula $\theta = \left|\frac{11}{2}m - 30h\right|$,

$\theta = 60°$ and $h = 2$

$\therefore 60 = \frac{11}{2}m - 30 \times 2$

$\frac{11}{2}m = 120$

$m = \frac{240}{11} = 21\frac{9}{11}$ minutes past 2

or

$60 = 30 \times 2 - \frac{11}{2}m$

$\therefore \frac{11}{2}m = 0$

$m = 0$

Therefore, the angle between the hour hand and the minute hand is 60° at 2 p.m. and at $21\frac{9}{11}$ minutes past 2 p.m..

(ii) When the two hands overlap, the angle between them is 0°.

$\theta = \left|\frac{11}{2}m - 30h\right|$

$\therefore \theta = 0°$ and $h = 2$

$\frac{11}{2}m = 30 \times 2$

$m = \frac{120}{11} = 10\frac{10}{11}$ minutes past 2.

(iii) When two hands are perpendicular: $\theta = 90°$ and $h = 2$

$\therefore \theta = \left|\frac{11}{2}m - 30h\right|$ or $30h - \frac{11}{2}m$

$90 = \frac{11}{2}m - 30 \times 2$

$\frac{11}{2}m = 150$

$m = \frac{300}{11} = 27\frac{3}{11}$ minutes past 2.

or

$90 = 30 \times 2 - \frac{11}{2}m$

$\frac{11}{2}m = -30$

As m cannot be negative, this case is not possible.
So, the hands are perpendicular to each other only once, i.e., at $27\frac{3}{11}$ minutes past 2 p.m.

(iv) When two hands are pointing opposite directions and are on a straight line the angle between them would be 180°, i.e., $\theta = 180°$ and $h = 2$.

$180° = \frac{11}{2}m - 30h$

$\frac{11}{2}m = 180 + 60 = 240$

$m = \frac{480}{11} = 43\frac{7}{11}$

So, at $43\frac{7}{11}$ minutes past 2 p.m. the hands will be at 180°.

exercises

Directions for questions 1 to 30: Select the correct alternative from the given choices.

1. What is the angle covered by the minute hand in 22 minutes?
(A) 66° (B) 110°
(C) 121° (D) 132°

2. By how many degrees does an hour hand move in one quarter of an hour?
(A) 5° (B) 7.5°
(C) 10° (D) 12.5°

3. By how many degrees will the minute hand move in the same time, in which the hour hand moves 6°?
(A) 54° (B) 84°
(C) 72° (D) 60°

4. What is the angle between the hands of the clock, when it shows 40 minutes past 6?
(A) 40° (B) 70°
(C) 80° (D) 90°

5. When the clock shows 3 hours 14 minutes, then what is the angle between the hands of the clock?
(A) 10° (B) 12°
(C) 13° (D) 14°

6. What is the angle between the two hands of a clock when the time is 25 minutes past 7 p.m.?
(A) $62^1/_2°$ (B) $66^1/_2°$
(C) $72^1/_2°$ (D) $69^1/_2°$

7. When the clock shows 20 minutes past 11 p.m., then what is the angle between the two hands of the clock?
(A) 110° (B) 120°
(C) 130° (D) 140°

8. At what time between 9 and 10 p.m., will both the two hands of the clock coincide?
(A) $43\ ^3/_{11}$ minutes past 9 p.m.
(B) $45\ ^6/_{11}$ minutes past 9 p.m.
(C) $49\ ^1/_{11}$ minutes past 9 p.m.
(D) $49\ ^6/_{11}$ minutes past 9 p.m.

9. At what time between 4 and 5 p.m. are the hands of a clock in the opposite directions?
(A) $52^3/_{11}$ minutes past 4 p.m.
(B) $54^6/_{11}$ minutes past 4 p.m.
(C) $51^7/_{11}$ minutes past 4 p.m.
(D) $53^9/_{11}$ minutes past 4 p.m.

10. The angle between the hands of a clock is 20° and the hour hand is in between 2 and 3. What is the time shown by the clock?
(A) 2 hours $7^3/_{11}$ minutes
(B) 2 hours $14^6/_{11}$ minutes
(C) 2 hours $15^5/_{11}$ minutes
(D) Both (A) and (B)

11. Which of the following can be the time shown by the clock, when the hour hand is in between 4 and 5 and the angle between the two hands of the clock is 60°?
(A) $16^4/_{11}$ min past 4 (B) $18^9/_{11}$ min past 4
(C) $32^8/_{11}$ min past 4 (D) $36^5/_{11}$ min past 4

12. Which of the following can be the time shown by the clock, when the hour hand is in between 2 and 3 and the angle between the two hands of the clock is 50°?
(A) 25 min past 2 (B) $11\frac{9}{11}$ min past 2
(C) $1\frac{9}{11}$ min past 2 (D) $2\frac{8}{11}$ min past 2

13. How many times the hands of a clock will be at 30° with each other in a day?
(A) 36 (B) 40
(C) 44 (D) 48

14. How many times the minute hand of a clock overlaps with the hour hand from 9 a.m. to 4 p.m. in a day?
(A) 5 (B) 6
(C) 7 (D) 8

15. A watch which gains uniformly was observed to be 1 minute slow at 8 a.m. on a day. At 6 p.m. on the same day it was 1 minute fast. At what time did the watch show the correct time?
(A) 12 p.m. (B) 1 p.m.
(C) 2 p.m. (D) 3 p.m.

16. A watch, which gains uniformly was observed to be 6 minutes slow at 9 a.m. on a Tuesday and 3 minutes fast at 12 p.m. on the subsequent Wednesday. When did the watch show the correct time?
(A) 9 p.m. on Tuesday
(B) 12 a.m. on Wednesday
(C) 3 a.m. on Wednesday
(D) 6 a.m. on Wednesday

17. A watch which gains uniformly was observed to be 3 minutes slow at 7 a.m. on a day. At 5 p.m. on the same day, it was 3 minutes fast. At what time did the watch show the correct time?

(A) 1 p.m. (B) 12 p.m.
(C) 11 a.m. (D) 2 p.m.

18. A watch showed 10 minutes past 6 a.m. on Thursday morning when the correct time was 6 a.m. It loses uniformly and was observed to be 15 minutes slow at 8 a.m. on Saturday morning. When did the watch show the correct time?
(A) 1 p.m. on Friday afternoon
(B) 12 p.m. noon on Friday
(C) 4 p.m. on Friday evening
(D) 2 a.m. on Friday morning

19. The minute hand of a clock overtakes the hour hand at intervals of 60 minutes of correct time. How much time does the clock gain or lose in one hour of correct time?
(A) Gains $5^5/_{11}$ minutes
(B) Loses $5^5/_{11}$ minutes
(C) Gains $^5/_{11}$ minutes
(D) Loses $^5/_{11}$ minutes

20. The minute hand of a clock overtakes the hour hand after every 70 minutes of correct time. How much time does the clock lose or gain in a day of normal time?
(A) $93^{39}/_{77}$ minutes
(B) $91^{31}/_{77}$ minutes
(C) $92^{24}/_{77}$ minutes
(D) $94^{56}/_{77}$ minutes

21. Two clocks are showing correct time at 4 p.m. One clock loses 3.5 minutes in an hour, while the other gains 2.5 minutes in one hour. At 10 p.m. on the same day, by how much time will the two clocks differ?
(A) 12 minutes (B) 36 minutes
(C) 24 minutes (D) 30 minutes

22. A watch which gains uniformly was observed to be three minutes slow at 8 a.m. on a particular day. At 8 p.m. on the same day it was three minutes fast. At what time did the watch show the correct time?
(A) 1 p.m. (B) 3 p.m.
(C) 2 p.m. (D) 6 p.m.

23. A watch which loses uniformly was observed to be two minutes fast at 6 p.m. on a Wednesday and four minutes slow at 3 p.m. on the next day, i.e., Thursday. When did the watch show the correct time?
(A) 2 a.m. on Thursday
(B) 12 p.m. on Thursday
(C) 1 a.m. on Wednesday
(D) 1 a.m. on Thursday

24. There are two clocks on a wall, both set to show the correct time at 5 p.m. The clocks lose 2 minutes and 3 minutes, respectively in an hour. If the clock which loses 2 minutes in one hour shows the time as 9.50 p.m. on the same day, then what time does the other clock show?
(A) 9.30 p.m. (B) 9.40 p.m.
(C) 9.45 p.m. (D) 10.15 p.m.

25. If the time in a clock is 10 hours 40 minutes, then what time does its mirror image show?
(A) 1 hour 25 minutes (B) 1 hour 15 minutes
(C) 1 hour 10 minutes (D) 1 hour 20 minutes

26. The reflection of a wall clock in a mirror shows the time as 3 hours 40 minutes. What is the actual time?
(A) 8 hours 20 minutes
(B) 8 hours 15 minutes
(C) 8 hours 45 minutes
(D) 8 hours 35 minutes

27. If the seconds hand moves by 240°, then by how many degrees does the minute hand move in the same time?
(A) 1° (B) 2°
(C) 3° (D) 4°

28. When the time is 10.30, if the minute hand points towards south, the hour hand will point towards
(A) North-east (B) North-west
(C) South-east (D) South-west

29. A clock strikes once at 1 p.m., twice at 2 p.m., three times at 3 p.m. and so on. If it takes 10 seconds to strike at 6 p.m., find the time taken by it to strike at 12 p.m.
(A) 18 seconds (B) 22 seconds
(C) 24 seconds (D) 26 seconds

30. At a particular point of time, the number of hours to 12 p.m. from that particular time is twice the number of hours to 12 p.m. after five hours from that particular time. Find the time.
(A) 2.30 p.m. (B) 4 p.m.
(C) 2 p.m. (D) None of these

ANSWER KEYS

1. (D)	6. (C)	11. (C)	16. (C)	21. (B)	26. (A)
2. (B)	7. (D)	12. (C)	17. (B)	22. (C)	27. (D)
3. (C)	8. (C)	13. (C)	18. (D)	23. (D)	28. (B)
4. (A)	9. (B)	14. (B)	19. (A)	24. (C)	29. (B)
5. (C)	10. (D)	15. (B)	20. (A)	25. (D)	30. (C)

SOLUTIONS

Solutions for questions 1 to 30:

1. The angle covered by the minute hand in 22 minutes is $22 \times 6 = 132°$.

2. The hour hand covers 360^0 in 12 hours.

$\therefore$ It covers $\frac{1^o}{2}$ in one minute. In quarter of an hour, i.e., in 15 minutes the hour hand will move $15 \times \frac{1^\circ}{2} = 7.5°$.

3. The hour hand will move by 6° in 12 minutes. So, minutes hand will move $12 \times 6° = 72°$ in 12 minutes, as the minute hand moves by 6° in one minute.

4. Angle will be $\theta = \left|\left(\frac{11}{2}m - 30h\right)\right|$

$\left|\left(\frac{11}{2} \times 20 - 30 \times 6\right)\right| = 40°$.

5. The angle between the hands will be:

$\theta = \left|\frac{11}{2}m - 30h\right|$

here, h = 3 and m = 14

$\theta = \frac{11}{2} \times 14 - 30 \times 3$

$\theta = |77 - 90| = 13°$.

6. Angle between two hands is given by:

$\theta = \left|\frac{11}{2}m - 30h\right|$

Here, h = 7 and m = 25

$\therefore \theta = \left|\frac{11}{2} \times 25 - 30 \times 7\right|$

$= \frac{275 - 210}{2} = \frac{145}{2} = 72\frac{1}{2}$

7. Angle between the two hands is given by:

$\theta = \left|\frac{11}{2}m - 30h\right|$, here m = 20 and h = 11

$\Rightarrow \theta = \left|\frac{11}{2} \times 20 - 30 \times 11\right| = 220$

As the angle is more than 180°, the angle must be $360° - 220° = 140°$.

8. When the hands coincide with each other the angle between them is 0. Therefore, the angle between two hands is given by:

$\theta = 30h - \frac{11}{2}m$ ($\because 30h > \frac{11}{2}m$)

Here, h = 9

$0 = 30 \times 9 - \frac{11}{2}m$

$270 \times \frac{2}{11} = m$

$\therefore m = 49\frac{1}{11}$ minutes

So, the hands coincide at $49\frac{1}{11}$ minutes past 9 hours.

9. When the hands of a clock are in opposite direction the angle between them is 180°.

Therefore, $\theta = \left|\frac{11}{2}m - 30h\right|$

Where $\theta = 180°$ and h = 4

$180 = \frac{11}{2}m\ 120$

$\frac{11}{2}m = 300$

$m = \frac{600}{11}$ $m = 54\frac{6}{11}$ minutes

So, at $54\frac{6}{11}$ minutes past 4 hours, the hands are in opposite direction.

10. Given $\theta = 20°$ and $h = 2$

$\theta = \frac{11}{2}m - 30h$ or $30h - \frac{11}{2}m$

$20 = \frac{11}{2}m - 30 \times 2$

$\frac{11}{2}m = 80$

$m = \frac{160}{11} = 14\frac{6}{11}$ minutes (or) $20 = 30 \times 2 - \frac{11}{2}m$

$\frac{11}{2}m = 40$

$m = \frac{80}{11} = 7\frac{3}{11}$ minutes

Therefore, the angle between the hands will be 20° at hours $14\frac{6}{11}$ minutes past 2 and $7\frac{3}{11}$ minutes past 2.

11. Given $\theta = 60°$ and $h = 4$

$\theta = \frac{11}{2}m - 30h$ or $\theta = 30h - \frac{11}{2}m$

$60 = \frac{11}{2}m - 30 \times 4$ or $60 = 120 - \frac{11}{2}m$

$\frac{11}{2}m = 180$ or

$\frac{11}{2}m = 60 \therefore m = \frac{2x\,60}{11} = 10\frac{10}{11}$ minutes

$m = \frac{360}{11} = 32\frac{8}{11}$ minutes

Hence, the angle between the hands will be 60° at $32\frac{8}{11}$ min past 4.

12. In the formula, $\theta = \left|\frac{11}{2}m - 30h\right|$

$\theta = 50°$, $h = 2$

$\therefore 50 = -\frac{11}{2}m - 30 \times 2$

$\frac{11}{2}m = 110$

$m = 20$ minutes past 2 p.m.

or

$50 = 30 \times 2 - \frac{11}{2}m \Rightarrow \frac{11}{2}m = 10$

$m = \frac{20}{11} = 1\frac{9}{11}$ minutes past 2 p.m.

13. In 12 hours the clock will be at 30° with each other for 22 times. So, they will be at 30° with each other for 44 times in a day.

14. The minute hand overlaps with the hour hand once between 9 and 10, 10 and 11, 1 and 2, 2 and 3, 3 and 4. But between 11 and 1, the overlap happens for only one time, i.e., a total of 6 times.

15. From 8 a.m. to 6 p.m., i.e., in 10 hours the clock gained 2 minutes.
So, it gains 1 minute in 5 hours.
So, it shows correct time at 1 p.m. on the same day.

16. The watch which was 6 minutes slow at 9 a.m. on a Tuesday and 3 minutes fast at 12 p.m. on Wednesday.
$\therefore$ The watch gained 9 minutes in 27 hours.

So, it gains 6 minutes in $\frac{6x\,27}{9} = 18$ hours.

$\therefore$ It shows correct time after 18 hours, i.e., at 3 a.m. on Wednesday.

17. The duration from 7 a.m. to 5 p.m. on a day is 10 hours. The total number of minutes gained by the clock in these 10 hours is given as 6 (3 + 3) minutes. If the clock gains 3 minutes, then it shows the correct time. The time taken by the clock to gain 3 minutes is $\frac{3}{6} \times 10 = 5$ hours. 5 hours after 7 a.m., i.e., 12 p.m. Therefore, the clock shows the correct time.

18. The watch lost 25 minutes in 50 hours, i.e., 6 a.m. on Thursday to 8 a.m. on Saturday. So, it will lose 10 minutes in 20 hours. So, it will show correct time at 2 a.m. on Friday morning.

19. The minute hand gains $65\frac{5}{11} - 60 = 5\frac{5}{11}$ minutes in one hour.

20. In a normal clock, the minute hand overtakes the hour hand 11 times in 12 hours (i.e., 720 minutes). Hence, it takes $\frac{720}{11} = 65\frac{5}{11}$ minutes to overtake once. But in the given clock the minute hand overtakes the hour hand in 70 minutes. Minute hand loses $70 - 65\frac{5}{11}$ *i.e.*, $4\frac{6}{11}$ in 70 minutes.

So, it loses $\frac{50}{11} \times \frac{24x\,60}{70}$ minutes in 24 hours,

i.e., $\frac{7200}{77} = 93\frac{39}{77}$ minutes.

21. After 1 hour, the two clocks differ by 3.5 + 2.5 = 6 minutes. So, after 6 hours the two clocks differ by 36 minutes.

22. The duration from 8 a.m. to 8 p.m. is 12 hours. Total number of minutes gained by the clock in these 12 hours is given as 6 (3 + 3) minutes. If the clock gains three minutes, then it shows the correct time, the time taken by the clock to gain three $\frac{3}{6} \times 12 = 6$ hours.

6 hours after 8 a.m., i.e., at 2 p.m. the clock shows the correct time.

23. The duration from 6 pm on Wednesday to 3 p.m. on Thursday is 21 hours. The total number of minutes by the clock in this 21 hours is 6 minutes.
The clock shows correct time when it covers the initial 2 minutes.
The time taken by the clock to lose 2 minutes is $\frac{2}{6} \times 21$ = 7 hours.
∴ After 7 hours, i.e., at 1 a.m. on Thursday, the clock shows the correct time.

24. After 5 hours, i.e., at 10 p.m. the clock, which loses 2 minutes will lose 10 minutes and shows 9.50 p.m. So, the other clock will lose 3 × 5 = 15 minutes and show 9.45 p.m.

25. Mirror time = 12 – Actual time = 12 – 10.40 = 1.20.

26. When the time is 3 hours 40 minutes the hour hand will be between 3 and 4 and the minutes hand will be at 8. So, in the reflection, the hour hand will be between 8 and 9 and the minute hand will be at 4. So, the time is 8 hours 20 minutes.
Mirror time = 12 – Actual time = 12 – 3:40 = 8:20.

27. When the seconds hand moves by 360° (i.e., 1 minute) the minute hand moves by 6°. So when the seconds hand moves by 240°, the minute hand moves by $\frac{240x\ 6}{360}$ = 4°.

28. At 10.30 the angle between minute hand and hour hand will be $\theta = \left|\frac{11}{2}\times 30 - 30\times 10\right|$
when the minute hand points towards south, the hour hand will be to the right of the minute hand which is north-west.

29. The clock strikes for 6 times at 6 p.m. Let the gap between two consecutive strikes be x.
Now, the total gap between 1st strike and 6th strike is $5x$.
Now $5x = 10 \Rightarrow x = 2$
Now, the gap between 1st strike and 12th strike at 12 p.m. is $11x$, i.e., 22 seconds.

30. Let the present time be x p.m.
$\therefore 2(12 - (x + 5)) = 12 - x$
$2(7 - x) = 12 - x$
$14 - 2x = 12 - x$
$x = 2$
∴ The present time is 2 p.m.

9 Calendars

Chapter

Learning Objectives

In this chapter, you will:

- Learn concepts of calendars like:
  - Leap and non-leap years
  - Odd days
- Learn how to calculate the number of odd days when two dates are given
- Learn how to find the day of the week when a date is given
- Learn how to find the day of the week when two reference dates are given

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❒ Calendars

Suppose you are asked to find the day of the week on 30 June 1974, it would be a tough job to find it if you do not know the method. The method of finding the day of the week lies in the number of 'odd days.

NOTE

Every 7th day will be the same day count wise, i.e., if today is Monday, then the 7th day counting from Tuesday onwards will once again be Monday. Odd day is the days remaining after completion of an exact number of weeks. Odd day is the reminder obtained on dividing the total number of days with seven.

Example: 52 days ÷ 7 = 3 odd days.

Leap and non-leap Year

A non-leap year has 365 days whereas a leap year has one extra day because of 29 days in the month of February. Every year which is divisible by 4 is called a leap year. Leap year consists of 366 days, (52 complete weeks + 2 days), the extra two days are the odd days. So, a leap year has two odd days.

A non-leap year consists of 365 days (52 complete weeks + 1 day). The extra one day is the odd day.

NOTE

For every century, the year which is a multiple of 400 is a leap year. A century year which is not divisible by 400 is a non-leap year.

Example: 400, 800, 1200, 1600 .... are leap years. 500, 700, 900, 1900 ... are non-leap years.

Counting the number of Odd days

100 years consist of 24 leap years + 76 ordinary years. (100 years when divided by 4, we get 25. But at the

100th year is not a leap year, hence, only 24 leap years).

= 2 × 24 odd days + 1 × 76 odd days

= 124 days

= 17 weeks + 5 days

The extra 5 days are the odd days.

So, 100 years contain 5 odd days.

Similarly, for 200 years we have 10 extra days (1 week + 3 days).

∴ 200 years contains 3 odd days.

Similarly, 300 years contain 1 odd day and 400 years contain 0 odd days.

Counting of number of Odd days, When Only One date is Given

Here, we take January 1st 1 AD as the earlier date and we assume that this day is a Monday. We take its previous day, i.e., Sunday as the reference day. After this the above-mentioned method is applied to count the number of odd days and find the day of the week for the given date.

Counting number of Odd days, When Two dates are Given

Any month which has 31 days has 3 odd days.

(∴ 31 ÷ 7 leaves 3 as remainder) and any month which has 30 days has 2 odd days (30 ÷ 7 leaves 2 as remainder).

Then, the total number of odd days are calculated by adding the odd days for each month. The value so obtained is again divided by 7 to get the final number of odd days. The day of the week of the second date is obtained by adding the odd days to the day of the week of the earlier date.

Solved Examples

1. If you were born on 14th April 1992, which was a Sunday, then on which day of the week does your birthday fall in 1993?

(A) Monday (B) Tuesday

(C) Wednesday (D) Friday

Sol: 14th April 1992 to 14th April 1993 is a complete year, which has 365 days. Hence, the number of odd days from 14th April 1992 to 14th April 1993 is 1. Hence, 14th April 1993 is one day after Sunday, i.e., Monday.

2. If 1st January 1992 is a Tuesday then on which day of the week will 1st January 1993 fall?

(A) Wednesday (B) Thursday

(C) Friday (D) Saturday

Sol: Since 1992 is a leap year there are 2 odd days. Hence, 1st January 1992 is two days after Tuesday, i.e., Thursday.

3. If 1st April 2003 was Monday, then which day of the week will 25th December of the same year be?

(A) Tuesday (B) Wednesday

(C) Thursday (D) Friday

Sol: The number of days from 1st April to 25th December

(29 + 31 + 30 + 31 + 31 + 30 + 31 + 30 + 25) days

= 268 days

$= \frac{268}{7}$ = 38 + 2 odd days .

Hence, 25th December is two days after Monday, i.e., Wednesday.

4. On which day of the week does 4th June 2001 fall?

(A) Monday (B) Tuesday

(C) Wednesday (D) Thursday

Sol: 4th June 2001 ⇒ (2000) years + 1st January to 4th June 2001.

We know that 2000 years have zero odd days.

The number of odd days from 1st January to 4th June 2001.

Month: Jan + Feb + Mar + Apr + May + June

Odd day: 3 + 0 + 3 + 2 + 3 + 4

$\frac{15}{7}$ = 1 odd day.

Hence, 4th June 2001 was a Monday.

5. Which year will have the same calendar as that of 2005?

(A) 2006 (B) 2007

(C) 2008 (D) 2011

Sol: Year: 2005+2006+2007+2008+2009+2010

Odd days: 1 + 1 + 1 + 2 + 1 + 1

Total number of odd days from 2005 to 2010 are 7 ≅ 0 odd days.
Hence, 2011 will have the same calendar as that of 2005.

6. What day of the week was 18th April 1901?
(A) Monday (B) Tuesday
(C) Wednesday (D) Thursday

Sol: 18th April 1901 ⇒ (1600 + 300) years + 1st January to 18th April 1901.

1600 years have – 0 odd days
300 years have – 1 odd day
The number of days from 1st January 1901 to 18th April 1901 is (31 + 28 + 31 + 18) days
108 days ≅ 3 odd days
∴ Total number of odd days = 3 + 1 = 4
Hence, 18th April 1901 is Thursday.

Exercises

Directions for questions 1 to 30: Select the correct alternative from the given choices.

1. If 8th February 1995 was a Wednesday, then 8th February 1994 was on which day?
(A) Wednesday (B) Thursday
(C) Tuesday (D) Monday

2. If 17th September 1993 was a Friday, then which day of the week was 30th June 1989?
(A) Wednesday (B) Thursday
(C) Friday (D) Saturday

3. If 11th August 1985 was a Sunday, then which day of the week was 13th August 1986?
(A) Tuesday (B) Monday
(C) Thursday (D) Wednesday

4. How many odd days are there in 352 days?
(A) One (B) Two
(C) Three (D) zero

5. Which among the following years is a leap year?
(A) 3000 (B) 3100
(C) 3200 (D) 3300

6. If 1st January 2012 is a Sunday, then which day of the week will the new year be celebrated in 2016?
(A) Friday (B) Sunday
(C) Wednesday (D) Saturday

7. If 1st April 1963 was a Monday, then which day of the week will be 1st August 1959?
(A) Saturday (B) Monday
(C) Tuesday (D) Thursday

8. On which dates of October 1994 did Monday fall?
(A) 4, 11, 18, 25 (B) 2, 9, 16, 23
(C) 1, 8, 15, 22 (D) 3, 10, 17, 24, 31

9. Which year will have same calendar as 2002?
(A) 2008 (B) 2011
(C) 2009 (D) 2013

10. The calendar for year 2005 is the same as that for which of the following years?
(A) 2010 (B) 2012
(C) 2011 (D) 2009

11. Which of the following years will have the same calendar as that of 2020?
(A) 2050 (B) 2048
(C) 2046 (D) 2052

12. What will be the next leap year after 2096?
(A) 2100 (B) 2101
(C) 2104 (D) 2108

13. If in a calendar year, there are 541 days and 10 days a week, then how many odd days will be there in that year?
(A) One (B) Two
(C) Three (D) Four

14. The last day of a century cannot be
(A) Friday (B) Wednesday
(C) Monday (D) Tuesday

15. Which day of the week was 25th December 1995?
(A) Sunday (B) Monday
(C) Tuesday (D) Wednesday

16. Which day of the week was 23rd July 1776?
(A) Sunday (B) Wednesday
(C) Thursday (D) Tuesday

17. If holidays are declared only on Sundays and in a particular year 12th March is a Sunday, is 23rd September in that year a holiday?

(A) Yes
(B) No
(C) Yes, if it is a leap year.
(D) No, if it is a leap year.

18. Which day of the week was 15th January1601?
(A) Monday (B) Tuesday
(C) Wednesday (D) Thursday

19. The first Republic day was celebrated on 26th January 1950 and it was on which day?
(A) Thursday (B) Friday
(C) Monday (D) Tuesday

20. If 23rd April 2006 is a Sunday, then 23rd April 2106 will be a
(A) Wednesday (B) Thursday
(C) Friday (D) Saturday

21. If the first day of the years 2012 and 2023 are Mondays, then which day of the week will be the last days of years respectively?
(A) Tuesday, Tuesday (B) Tuesday, Monday
(C) Monday, Tuesday (D) Sunday, Monday

22. If 14th November 2006 is a Sunday, then 14th November 2706 is a
(A) Sunday (B) Friday
(C) Tuesday (D) Monday

23. In a year, if 23rd November is a Friday then 14th March in that year is on which day of the week?
(A) Monday
(B) Wednesday
(C) Sunday
(D) Tuesday

24. In a leap year, which month will have the same calendar as that of January in that year?
(A) April (B) July
(C) October (D) March

25. What is the next leap year after 2396?
(A) 2398 (B) 2408
(C) 2404 (D) 2400

26. Which day of the week is 21st April 2006?
(A) Tuesday (B) Wednesday
(C) Thursday (D) Friday

27. What was the day of the week on 5th May 1938?
(A) Friday (B) Sunday
(C) Thursday (D) Saturday

28. What day of the week was the Indian Independence Day in 2001?
(A) Monday (B) Wednesday
(C) Tuesday (D) Thursday

29. If a year starts on Saturday but does not end on Saturday, then what is the day of the week on 13th June in that year?
(A) Monday (B) Tuesday
(C) Sunday (D) Saturday

30. If a year starts on a Friday, then what is the maximum possible number of Tuesdays in that year?
(A) 58 (B) 52
(C) 51 (D) 49

ANSWER KEYS

1. (C)	6. (A)	11. (B)	16. (D)	21. (B)	26. (D)
2. (C)	7. (A)	12. (C)	17. (B)	22. (D)	27. (C)
3. (D)	8. (D)	13. (A)	18. (A)	23. (B)	28. (B)
4. (B)	9. (D)	14. (D)	19. (A)	24. (B)	29. (B)
5. (C)	10. (C)	15. (B)	20. (C)	25. (D)	30. (B)

SOLUTIONS

Solutions for questions 1 to 30:

1. 1994 is not a leap year.
∴ It has only 1 odd day.
8th February 1995 is one day before Wednesday.
Hence, 8th February 1994 is a Tuesday.

2. The number of odd days from 17th September 1993 to 30th June 1993 is as follows.
Month: Sep + Aug + Jul + Jun
Odd days: 2 + 3 + 3 + 1 = 2 odd days.
Hence, 30th June 1993 was two days back to Friday, i.e., Wednesday.
The number of years from 1993 to 1989 is 4 years out of which there is one leap year and 3 non-leap years.
∴ The number of odd days = 2 × 1 + 3 = 5 odd days.
Therefore, it is the same day, i.e., Friday.

3. It is given that 11th August 1985 was Sunday then 13th August 1985 is Tuesday.
1985 is not a leap year, hence, it has only one odd day.
So, 13th August 1986 is one day to Tuesday, i.e., Wednesday.

4. The number of odd days in 352 days

$= \frac{352}{7} = 50 + 2$ odd days

Hence, the total number of odd days is 2.

5. Century years which are divisible by 400 are leap years.
As 3000, 3100 and 3300 are not divisible by 400, they are not leap years. But, 3200 is a leap year.

6. The total number of years from 2012 to 2016 is four out of which 2013, 2014 and 2015 are non-leap years. Hence, there is 1 odd day in each of these years, 2012 is a leap year, therefore, it has 2 odd days.
∴ The total number of odd days in these four years is 5.
Here, 1st Jan 2016 is five days to Sunday, i.e., Friday.

7. The total number of years from 1963 to 1959 is 4 years out of which 1959, 1961 and 1962 are ordinary years. Hence, they have 3 odd days and 1960 is leap year which has 2 odd days.
The total number of odd days in these 4 years is 5. Hence, 1st April 1959 is 5 days back to Monday, i.e., Wednesday.
Now, the number of odd days from 1st April to 1st August in 1959 is as follows.
Month: Apr + May + Jun + Jul + Aug
Odd days: 1 + 3 + 2 + 3 + 1
The total number of odd days is 3.
Hence, 1st August 1959 is 3 days to Wednesday, i.e., Saturday.

8. 1600 years contain zero odd days.
300 years contain 1 odd day.
93 years = (23 leap + 70 non-leap years)
Total number of odd days in 93 years = (23 × 2 + 70 × 1)
= 116 odd days ⇒ 4 odd days.
Number of odd days from 1st January to 1st October in 1994
Month: J + F + M + A + M + J + J + A + S + O
Odd days: 3 + 0 + 3 + 2 + 3 + 2 + 3 + 3 + 2 + 1
= 22 odd days ⇒ 1 odd day.
The total number of odd days = 1 + 4 + 1 = 6 odd days
∴ 1st October 1994 is Saturday.
Therefore, first Monday is on 3rd October.
So, 3, 10, 17, 24 and 31 are Mondays in October.

9. The number of odd days should be zero to have same calendar.

Years		Odd day
2002	–	1
2003	–	1
2004	–	2
2005	–	1
2006	–	1
2007	–	1
2008	–	2
2009	–	1
2010	–	1
2011	–	1
2012	–	2
2013	–	1

After the completion of 2013 we get 14 odd days.
Hence, the number of odd days is zero. So, 2013 will have the same calendar as that of 2002.

10. Year: 2005 2006 2007 2008 2009 2010
Odd days: 1 + 1 + 1 + 2 + 1 + 1
As the number of odd days from 2005 to 2010 is 7 ⇒ $\frac{7}{7}$ = 0 odd days.
Hence, 2011 had the same calendar as did 2005.

11. 2020 is a leap year. In the next 28 years we have 21 non-leap years and 7 leap years, which result in 35 odd days, i.e., effectively zero odd days.
Hence, 2020 + 28 = 2048 will have the same calendar as will 2020.

12. For a century year to be a leap year, it should be divisible by 400. As 2100 is not divided by 400 it is not a leap year. The next leap year is 2104.

13. To find the number of odd days, we have to find the remainder of 541/10. The remainder is one.
Hence, there is one odd day.

14. 100 years contain 5 odd days.
∴ The last day of the first century is Friday.
200 years contain 10 odd days, i.e., 3 odd days.
∴ The last day of the second century is Wednesday.
300 years contain 15 odd days, i.e., 1 odd day.
∴ The last day the third century is Monday.
400 years contain 20 odd days and the 400th year itself is a leap year. Hence, there is no odd day.
∴ The last day is Sunday. The last day of a century cannot be Tuesday, Thursday or Saturday.

15. The total number of odd days up to 25th December, 1995 is obtained as follows.
For 1600 years – zero odd days
For 300 years – 1 odd day
In 94 years there are 23 leap years and 71 non-leap years.
The total number of odd days in these 94 years is (23 × 2 + 71 × 1) = (46 + 71) = 117.
⇒ 5 odd days
The number of odd days from 1st January to 25th December 1995 is as follows.
Month: J + F + M + A + M + J + J + A + S + O + N + D
Odd days: 3 + 0 + 3 + 2 + 3 + 2 + 3 + 3 + 2 + 3 + 2 + 4
= 2 odd days.
The total number of odd days = 1 + 5 + 2 = 1, i.e., Monday.
Hence, 25th December 1995 is Monday.

16. 1600 years – 0 odd days
100 years – 5 odd days
75 years = (18L + 57 NL)
= 36 + 57 = 93 odd days ⇒ 2 odd days
Now 1st January – 24th July 1776
= 205 days ⇒ 2 odd days
Total number of odd days = 2
∴ 23rd July 1776 was Tuesday.

17. The total number of odd days from 12th March to 23rd September is as follows.
Month: M + A + M + J + J + A + S
Odd days: 5 + 2 + 3 + 2 + 3 + 3 + 2 = 20 days.
$\frac{20}{7}$ = 6 odd days.
Hence, 23rd September is 6 days to Sunday, i.e., Saturday.
So, 23rd September is not a holiday.

18. The number of odd days upto 15th January 1601 is as follows.
1600 + (1st January to 15th January 1601)
1600 years have zero odd days and there is one odd day in 15 days.
Hence, 15th January 1601 is a Monday.

19. The number of odd days upto 26th January 1950.
1600 years = odd days
300 years = 1 odd day
In 49 years these are 12 leap years and 37 non-leap years.
Number of odd days in these 49 years is 61.
= 61 odd days ⇒ 5 odd days.
26th January = 26 days = 5 odd days
Total odd days 11 odd days = 4 odd days
Therefore, the answer is Thursday.

20. Number of years from 2006 to 2106 is 100 years.
We know that 100 years have 5 odd days. Hence, 23rd April 2106 will be 5 days after Sunday, i.e., Friday.

21. 2012 is leap year, so it will have two odd days.
Hence, 1st January 2013 is two days after Monday, i.e., Wednesday.
So, 31st December 2012 is a Tuesday. 2023 is a non-leap year and have 1 odd day.
So, 1st January 2024 is Tuesday. Hence, 31st December 2023 is Monday.

22. Number of years from 2006 to 2706 is 700 years.
700 year (400 + 300) have 1 odd day.
Hence, 14th November 2706 is one day after Sunday, i.e., Monday.

23. The number of odd days from 23rd November to 14th March in that year.
Month: N + O + S + A + J + J + M + A + M
Odd days: 2 + 3 + 2 + 3 + 3 + 2 + 3 + 2 + 3
23 odd days ⇒ $\frac{23}{7}$ = 2 odd days.
Hence, it is two days before Friday, i.e., Wednesday.

24. In order to have the same calendar between these two months the number of odd days should be zero.
Month: Jan + Feb + Mar + Apr + May + Jun + Jul
Odd days: 3 + 1 + 3 + 2 + 3 + 2
At the completion of June, the number of odd days is zero. Hence, January and July will have the same calendar.

25. A century year which is divisible by 400 is a leap year and a leap year comes for every 4 years.
Hence, 2396 + 4 = 2400 is a leap year.

26. The number of odd days upto 21st April 2006 is as follows.
(200) years + 5 years + (1st January 2006 to 21st April 2006)
2000 years have 0 odd days.
In these 5 years there is a leap year and 4 non-leap years.
Odd days = 1 × 2 + 4 × 1 = 6 odd days.
The number of odd days from 1st January 2006 to 21st April 2006.
Month: Jan + Feb + Mar + Apr
Odd days: 3 + 0 + 3 + 0 = 6 days
The total, number of odd days = 6 + 6 = 12
⇒ 5 odd days
Hence, 21st April 2006 is Friday.

27. 5th May 1938 = 1600 + 300 + 37 + (1st January 1937 to 5th May 1937)
1600 years have o odd days.
300 years have 1 odd day.

37 years contain 9 leap years + 28 non-leap year.
One leap year contains 2 odd days.
One non-leap year contains 1 odd day.
In 37 years number of odd days = 9 × 2 + 28 = 46 odd days.
Number of odd days from 1st January 1938 to 5th May 1938 is as follows.

Month	Jan	Feb	March	Apr	May	Total
Odd day	3	0	3	2	5	13

∴ The total number of odd days = 0 + 1 + 46 + 13 = 60 odd days.
4 odd days means thus = 4 odd days (60 ÷ 4)
∴ 5th May 1938 is Thursday.

28. 15th August 2001 = 2000 + (1st January 2001 to 15th August 2001)
Century year contains 'o' odd days.
The number of odd days from 1st January to 15th August is as follows.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Odd day	3	0	3	2	3	2	3	1

∴ The total number of odd days = $\frac{17}{7}$ = 3 odd days.
3 odd days means = Wednesday
∴ 15th August 2001 is Wednesday.

29. As the year is starting and ending on two different days, it is a leap year.
It is given that 1st January is Saturday.
The number of odd days from 1st of January to 13th June is
= 2 (Excluding 1st January) + 1 + 3 + 2 + 3 + 6
= 17 = 3 odd days.
∴ The 3rd day after Saturday is Tuesday.

30. If the year is a leap year, it will have 53 Fridays as well as 53 Saturdays. Each of the remaining days of week occurs only 52 times. Similarly, if it is a non-leap year, it will have 53 Fridays and all the other days of the week occur only 52 times.
∴ The number of Tuesday is 52.

10 Decision Making

Chapter

Learning Objectives

In this chapter, you will:

- Practice how to take decisions subject to the given constraints
- Learn to sift through conditions and data to arrive at an actionable conclusion
- Learn to identify sufficiency or inadequacy of data to take a decision

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as, XAT, IIFT, MH-CET, MAT, etc.

❒ Introduction

In Decision Making, a situation/ circumstance or a caselet is provided, based on it students are generally asked two types of questions, such as:

What would be the best course of action to take in such circumstances? And, What lead to such a conclusion/situation?

These kinds of questions require a logical approach and a clear understanding of the case. It often requires careful reading of complete paragraphs and then logically inferring the information presented.

Exercises

Directions for questions 1 to 5: These questions are based on the following information.

A device classifies numbers according to the following criteria. The number must have

(1) Seven digits
(2) At least two prime digits.
(3) Perfect squares as the first and the last digits.
(4) An even digit as the middle digit.
If the number satisfies criteria (1), (2), (3) and (4), then the number is classified as a superior number.
(5) If the number is a superior number and the digits are in increasing order from left to right according to the value, then the number is classified as an impressive number.
(6) If the number satisfies criteria (1), (2) and (4) but not (3), but the first and last digits are even, then the number is classified as a mutual number.
(7) If the number satisfies criteria (1) (2) and (3) but not (4) but all the digits are odd, then the number is classified as a classic number.

(8) If the number does not fall under any of the above-mentioned classification, then the number is classified as a garbage number.

Based on the above criteria, decide which number should be classified in which of the above-mentioned classification. Mark your answer choice as follows.

(A) If the number is classified as superior number.
(B) If the number is classified as impressive number.
(C) If the number is classified as mutual number.
(D) If the number is classified as classic number (or) garbage number.

Classify the following number as mentioned above.

1. 1778459

2. 4276891

3. 1367574

4. 9632578

5. 4556666

Directions for questions 6 to 11: Study the following information carefully and answer the questions given below.

Following are the criteria required to be fulfilled, to gain admission into any intermediate college in Andhra Pradesh (AP):

(a) The candidate should have scored at least 80% marks in SSC or 70% marks in CBSE.
(b) The candidate should have scored at least 60% marks in the entrance exam.
(c) The candidate should be a male and must be at least 16 years old, as on 1st June 2000.
(d) The candidate should be a resident of Andhra Pradesh (AP), i.e., should have been born and brought up in AP.
In case a condition given above is not satisfied, an alternate condition for the same is given as below:
(e) If condition (d) is violated, but at least one relative of the candidate is presently staying in Andhra Pradesh, for the last 5 years, then the candidate can be admitted.
(f) If condition (b) or (c) is violated, but not both and the student has a good sports record, then he/she should be advised to approach the principal.
(g) If both conditions (a) and (b) are violated, but the candidate is ready to donate `1,00,000 to the college, then he is advised to approach the Secretary.

Now mark your answer as

(A) If admission can be granted.
(B) If admission cannot be granted.
(C) If the Principal (or) the Secretary of the school is to be approached.
(D) If data is inadequate.

The following cases are given to you as on 1st June 2000.

6. Jahangir has applied for a college in AP. He was born and brought up in Kerala. He was born in 1980 and has an excellent percentage of 95 in his SSC. He has done pretty well in the entrance test scoring 65%, and has a close relative working in AP for the past 10 years.

7. Rita was born in 1981 and has a very good academic record with 90% in her CBSE. She has done her entrance test well by scoring 80% and she is a resident of AP, where the college is also situated. She is a very good sports person and has represented the state for basketball.

8. Prakash is 17 years old and is a resident of AP where the college is located. He has scored 90% in the entrance test and 69% in SSC.

9. Ranga, a resident of state of AP is a gold medallist in swimming at National games in the junior's category. He has applied with a percentage of 75% in the SSC and a score of 55% in the entrance exam. The college is in the same locality as his residence is. He was born on 16th July 1981. He is ready to give a donation of `1,00,000.

10. Ram was born in 1980 and is a resident of AP. He is the present TT Champion of India. He was presented a gold medal by the President of India in the National Games. He scored below 40% of marks in both SSC and the entrance exam. He is ready to give a donation upto `2 lakhs.

11. Rahim, applying for a college in the same state as he is in has a bad academic record of 40% and 35% in CBSE and entrance exam, respectively. He is able to pay a donation of `1,00,000 to the college.

Directions for questions 12 to 17: Study the following information carefully. Answer the questions given below:

Following conditions are to be fulfilled in order to become the hero of a film:

(a) The person should have a good track record, i.e., the rate of success of that particular person as a hero should be at least 70%.
(b) The person should have been in the industry for at least 5 years.
(c) The person should ask for a remuneration of less than `10,00,000 per film.
(d) The person should be able to give dates continuously for at least one week.
In case a condition given above is not satisfied, the following alternate condition should be applied:
(e) If condition (a) is violated and the hero has a success rate of greater than 50% in films and recognized as a hit pair with the heroine he is going to work with in the film, then take the suggestion of the heroine; (OR)
If condition (a) is violated and the hero has acted in more than six films with that producer, then take the advice of the Producer.

(f) If condition (c) is violated, but the hero demands a remuneration of less than `50 lakhs, then he can be selected.

(g) If condition (d) is violated, but the hero can work for at least 15 days in a month, may not be continuous then the hero can be selected.

Now mark your answers as

(A) If the person is to be selected as a hero.

(B) If the person is not to be selected as a hero.

(C) If the heroine or the producer is to be consulted regarding the decision.

(D) If the data is insufficient.

12. Romeo has been in the film industry for the past 7 years and asks for a remuneration of `7,00,000. He is ready to give dates continuously for 10 days. As a hero he has 30 hits out of the 40 films that he has acted in for the last 7 years.

13. Chris has a very good reputation as an actor and has 80% hits in his career. He is famous for the kind of films the producer of this film is presently making and is considered as an ideal combination with the heroine of the film. However, he charges `40,00,000 per film.

14. Ritesh is a hero, who has 65% hits in his career and charges `8,00,000 per film. He has been in the film industry for the past 7 years and has acted in nine films with the producer of that movie. He is ready to give dates continuously for ten days.

15. Rajesh is a hero in the film industry for the past 10 years, having 85% hits and demands a remuneration of `9,00,000. He acted in 10 for the kind of films of that producer. He can give dates for 18 days in a month, but continuously for only 6 days at a stretch.

16. Hasmukh has been in the industry for the past 6 years and has 68% hits in his career. He demands a remuneration of `8,00,000 and is ready to give dates continuously for at least one week. The heroine and he are considered to be the hit pair of the industry.

17. Roopesh is a successful hero for the last 8 years in action films, delivering around 85% in that line. But the trend has changed for the past 5 years. Therefore, Roopesh had to act in romantic films, where he was a misfit. Because of his failure as a romantic hero, he reduced his remuneration to `5,00,000. The producer now wants to make an action movie.

Directions for questions 18 to 23: Study the following information carefully and answer the questions which follow:

The following are the conditions/criteria for a group of college students to watch a movie at a theatre.

(a) Every student in the group should have attended all their lectures, i.e., no student should miss any lecture for watching the movie.

(b) No student in the group should have watched the movie earlier.

(c) The movie should be screened at a theatre, which is not more than 3 kms away from their college.

(d) Every student of the group should agree to watch the same movie.

In case a condition given above is not satisfied, an alternate condition for the same is given below:

(e) If condition (a) alone is violated and less than half of the total number of students have to miss their lectures, then these students attend their lectures and others can proceed to watch the movie.

(f) If condition (b) alone is violated but the movie is a hit and more than half of the total number of students of the group have not watched the movie before, then all of them go to watch the movie.

(g) If condition (c) alone is violated but at least two seniors are accompanying them to watch the movie, then all of them go to watch the movie.

(h) If condition (d) alone is violated and more than one-fourth of the total number of students in the group are not willing to watch the movie, then all the members of the group should meet and take a decision.

Based on the above criteria and the information given in each of the following questions, you have to take decision with regard to each case. You should not assume anything beyond what is given in the question.

Now mark your answer as:

(A) , If the group decides to watch the movie.

(B) If the decision is not to watch the movie.

(C) If the data is inadequate.

(D) If a meeting is to be held to take a decision. (or) If only a few attends the classes and remaining go to watch the movie.

18. A group of students, having attended all of their lectures plan to watch a particular movie. The movie has been released for the first time in the city and is being screened in a theatre, which is 2 kms away from their college. None of them has watched the movie earlier. All of them agree to watch the movie.

19. A group of 10 students plans to watch a particular movie in a theatre, which is 3 kms away from their college. None of them has watched the movie earlier. Everybody agrees to watch this movie. Only 3 students out of the group have not attended their classes.

20. A group of students has plans to watch a particular movie, along with three senior students. The movie is being screened in a theatre, which is 5 kms away from their college. None of them has seen this movie earlier. Everyone in the group has attended all their lectures. All of them agree to watch this movie.

21. A group of students has planned to watch a particular movie. They attended all the lectures but only 8 out of 10 students in the group have not watched this movie earlier. The movie is being screened in a theatre, which is just 1 km away from their college. The movie is a hit. All of them agree to watch this movie.

22. A group of students plans to watch a particular movie, which has been watched before by less than half of the group. The movie is a hit. The movie is running in a theatre, which is 2 kms away from their college. All of the students in the group have attended all their lectures. All of them agree to watch this movie.

23. A group of students having attended all of their lectures, plan to watch a particular movie. The theatre in which the movie is being screened is just 2.5 km away from their college. Less than 20% of students of the group have already watched the movie and every one in the group wants to see the movie as it was a big hit.

Directions for questions 24 to 30: Study the following information and answer the questions that follow:

The following are the conditions for constructing a house.

(a) The cost of land should be less than `20,00,000.
(b) The estimated cost of construction should be less than `30,00,000.
(c) The land/house to be bought should be in a posh locality.
(d) A loan worth at least `20,00,000 should be available at an interest rate of not more than 18% per annum. If a condition given above is not satisfied, then an alternate condition for the same is given below.
(e) If condition (d) is violated, but the interest rate is less than 12% per annum, and the amount of loan that can be availed is at least `10,00,000, then the matter should be discussed with the family members.
(f) If condition (b) is violated, then a decision is made to buy a flat on the ground floor in that location, subject to availability.
(g) If condition (c) is violated, but all the basic amenities are available in the vicinity nearby, then the matter should be discussed with the family members.

Now mark your answer as:

(A) If the decision is to buy a flat (or) to construct a house.
(B) If the data is inadequate.
(C) If a discussion is to be held with the family members.
(D) If the house cannot be constructed.

24. The cost of a piece of land is `12,00,000 and the cost of construction is `38,00,000. The land is located in a posh locality. A loan of `30,00,000 can be availed at an interest rate of 15% per annum. There are flats available in that locality on the ground floor.

25. The cost of a piece of land would be around `15,00,000 and the cost of construction of a house would be around `20,00,000. Loan can be availed at a rate of 15% per annum. The land is located in a posh locality where every facility is available.

26. Land is available for `30,00,000 and the cost of construction is `20,00,000. Land is available in a very posh locality and a loan worth `20,00,000 can be availed at an interest rate of 16% per annum.

27. Land is available in a posh locality at `20,00,000 and the cost of construction is around `25,00,000. A loan worth `15,00,000 can be availed at an interest rate of 10% per annum.

28. Cost of a land in a locality is `10,00,000 and the cost of construction is `20,00,000. A loan can be availed at an interest rate of 20%.

29. Land is available in a posh locality of the city at `19,00,000 and the cost of construction is around `28,00,000. A loan of `15,00,000 can be availed at the rate of 10% per annum.

30. Mr Ravi has seen a piece of land costing `14,00,000 and the cost of construction of house is `28,00,000. A loan of `20,00,000 can be availed at the annual interest rate of a maximum of 18% per annum. The land is not located in a posh locality but has all basic amenities available in the vicinity.

Directions for questions 31 to 36: Read the following passage and answer the questions that follow it.

In May 1993, the Swedish automobile major, Volvo AB (Volvo) announced the closure of its car manufacturing facility at Uddevalla, Sweden, barely five years since its launch in 1989. A year later, the company had to shutdown yet another world-famous facility, the car assembly plant at Kalmar, which is also in Sweden.

Reacting to the two closures within a year's gap, analysts said Volvo's human centric approach towards automobile manufacturing was no longer feasible in the fiercely competitive scenario of the 1990's with most companies striving hard to improve production efficiency. Volvo was well recognized in the industry for its employee-friendly policies ever since its inception.

Guided by the 'Volvo Way,' the company had made conscious efforts to implement job enrichment concepts such as job rotation, job enlargement and employee work groups in its manufacturing facilities. In the late 1960s and early 1970s, when the company faced the problem of increasing employee turnover and absenteeism, it introduced these concepts and obtained positive results.

Volvo was inspired to build a new facility keeping this work design as a basis. This reiterated the company's belief that the industry needed to adapt itself to the people's requirements and not vice versa. This concept was imple-

mented successfully in other plants of the company too in the 1970s. The best practices in Human Relations (HR) tried and tested in these plants were passed on to new plants established in the 1980s. While investing heavily in developing new plants like Kalmar and Uddevalla, where new work design concepts were implemented, Volvo was conscious of the risks involved and the possible effect on the company's financial performance if the experiments failed.

Acknowledging this, Gyllenhammar, in Harvard Business Review wrote, 'Volvo's Kalmar plant, for example, is designed for a specific purpose: car assembly in working groups of about 20 people. If it didn't work, it would be a costly and visible failure, in both financial and social terms. We would lose credibility with our people and those who are watching from outside'.

Gyllenhammar's apprehensions proved correct when Volvo closed down the Kalmar plant in 1994. However, Volvo's efforts in bringing changes in work design offered valuable lessons to both the academic and corporate community.

Analysts appreciated Volvo for its constant emphasis on learning from experiences and implementing the lessons so learnt in its new initiatives. This contributed significantly to the development of human centric production systems. These systems brought to life several theories and concepts, which had earlier only been enunciated in textbooks but rarely practised with the kind of seriousness with which Volvo did.

31. Which of the following best captures Volvo's philosophy of work?
(A) Employees should update their skills according to the changing needs of the company.
(B) Industry needs to adapt itself to the employee's requirements.
(C) In order to maximize profits more emphasis should be laid on employee welfare.
(D) A company can gain recognition only through its pro-employee policies.
(E) Lavish financial incentives given to employees go a long way in keeping afloat employee morale.

32. Which of the following is perceived to be the main reason for the closure of Volvo's manufacturing facility?
(A) The so-called employee friendly policies which did more harm than good to the employees.
(B) The aggressively competitive scenario of the 90s.
(C) The incongruity between Volvo's human-centric work philosophy and the aggressively competitive atmosphere of the 90s.
(D) The mismatch between the number of workers and the work involved.
(E) Increasing absenteeism among the employees.

33. Which of the following can be inferred from the failure of the policies implemented by Volvo at Uddevalla and Kalmar?
(A) Policies should be designed according to the needs of the time.
(B) The policies which had positive results in the past need not necessarily have positive results in the present also.
(C) 'Employee-friendly' policies seldom improve production efficiency.
(D) Failure of policies implemented by the company will have a bearing on the company's financial performance.
(E) Policies introduced on an experimental basis will most often end in a fiasco.
(A) A + B + C (B) B + C + D
(C) C + D + E (D) A + B + D
(E) D + E

34. Which of the following is a positive outcome of Volvo's fiasco?
(A) It offered an opportunity to learn from experience.
(B) The lessons learnt from the mistakes were implemented in new ventures.
(C) It led to the development of human-centric production systems.
(D) The human-centric production system helped to put into practice theories and concepts which were enunciated only in text books.
(E) All of these

35. The closure of Volvo's new manufacturing facilities does not detract from the value of the example that was set in the area of
(A) Business strategy
(B) Cost-benefit analysis
(C) Business growth
(D) Human resource optimization
(E) Brand building

36. According to Gyllenhammar if the new concepts failed it would be a 'costly failure' because
(A) The credibility of the company was at stake.
(B) It would mean huge financial losses for the company.
(C) It may impact on company's image.
(D) It would be demoralizing for the employees.
(E) All of these

Direction for questions 37 to 40: Read the following situation and choose the best possible alternative.

37. A Programme Manager in a software outfit learned a valuable lesson firsthand. He had asked his team for some feedback on his leadership. While most of what he received was positive and supportive, he got some strong advice too, from his team, about how he could be more effective in helping a shared vision. 'We would benefit, as a team, when we walk with you while you create the goals and vision, so that we all get to the end vision together'.

What effect will the suggestion have on the team or the team leader?

(A) Team spirit will be fostered among the team members.
(B) It would help in fostering team spirit in the team leader.
(C) The team leader's morale may be adversely affected.
(D) The team would benefit because the leader would be able to take into account the abilities and hopes of people.
(E) The ego of the team leader may be hurt.

38. Who can help a junior executive at work? Who knows what's going on? Who gets around road blocks? Who are the critical links in the information chain? The boss can be a big help by identifying and introducing people, setting up meetings and so on. Others who can help are the office administrator (who always knows who's on the way up), those in the legal department (who have an idea of the major problems the organization is facing), those in liaison (who have an idea of impending changes, whether in the market or in government regulations).

What does this suggest about the working of an organization?

(A) Hierarchies are an inevitable part of every organization.
(B) Every individual has an important role to play in the smooth functioning of an organization.
(C) Networking is a skill every potential manager should develop.
(D) Networking is a binding force which is needed to ensure camaraderie among employees.
(E) Networking goes a long way in developing individual talent.

39. Many firms that have a system in place for employee suggestions are taking steps to improve the quality of ideas before they are submitted for review. They are encouraging employees to first discuss ideas with their colleagues to gain insights into their technical and market feasibility or how they fit with the company's objectives. Such steps are invaluable because

(A) They would either enhance the value of the ideas or lead to their early and appropriate demise.
(B) They would deter people from being forthcoming with their advice.
(C) There are too many suggestions being offered by employees.
(D) They would help in enhancing a sense of participation among employees.
(E) They would make the employees feel valued and important if their suggestions are taken into consideration.

40. Customers who are loyal to your competitors represent market share you don't have and will likely not get. Customers who are loyal to you represent market share you already have. Protecting your most loyal customers is an obvious priority in a downturn. However, if they are spending 25% less than in better times, most of that will come directly out of what they spend in your stores. As a smart retail manager, you would, in times of downturn

(A) Put in place ways of identifying customers who have needs but no established loyalties.
(B) Resort to aggressive marketing in order to attract more customers.
(C) Relax and rest on your laurels, i.e., rely on your brand name.
(D) Introduce attractive offers to all customers thus retaining old customers and attracting new ones.
(E) Offer your regular customers attractive deals to prompt them to spend more in your stores.

Directions for questions 41 to 43: Read the passages carefully and answer the questions that follow.

Udaan, with its headquarters in Delhi, India, began as an air taxi operator in 1991 and started its commercial operations a year later in 1992. It operated with just 24 flights across 10 destinations initially but showed exceptional growth and had more than 300 daily flights to about 60 domestic and international destinations in 2007. It was first listed in the National Stock Exchange (NSE) in the year 2004.

In January 2008, the Air Transport Association had predicted that, globally, the airline industry would lose about US $5.2 billion by the end of 2008 based on an average price of US $140 per barrel of oil as the rise in fuel prices would push the fuel bills of the industry for that year to US $186 billion. The case is about the retrenchment drama that unfolded in Udaan Limited in late 2008. After showing the door to more than 1000 employees in a bid to streamline its operations and reduce its losses, Udaan was faced with immense criticism and opposition by various organizations and political parties. Udaan chairman Brijesh Goswami reinstated the employees a day later saying that he was not aware of these sackings which were done by the senior business manager. The sudden decision not only took the employees by surprise but also caused alarm in the sector. Amidst great furore and opposition by various organizations and political parities, Brijesh Goswami Chairman of Udaan reinstated the employees a day later amidst great emotional drama. Mr Brijesh Goswami was quoted as saying he had been appalled by the retrenchments of his employees, which he claimed, he had come to know only through media reports. He added that he would 'not be able to live as long as he lives' with the tough decision his management had taken and clarified that he was taking back the employees as they were 'family to him and as the head of the family he would take care of them'.

41. Which of the following can be concluded from the passage?

(A) Brijesh Goswami had capitulated under pressure from external parties.

(B) All is not well with the organizational communication mechanisms at Udaan.

(C) The company had planned to retrench more employees had there been no protests.

(D) There were many loopholes in Udaan's organizational communication network.

(E) None of these

42. What is the flaw in the decision taken by the senior business manager from the business point of view?

(A) The company decided to layoff the employees without any prior notice.

(B) Such sudden lay offs make future recruitment difficult.

(C) If oil prices remain high for long time the company will have no other option but to close down.

(D) Such decision does not gain support from the industry.

(E) None of these

43. What can be a better way to cope with the losses?

(A) The company should have sold off a few of its airplanes.

(B) Instead of sacking the employees the management could have proposed a salary reduction and explained the circumstances behind it to all its employees.

(C) The company should reduce its fares below that of its competitors so as to increase the load factor.

(D) The company should sack all the experienced employees and start hiring new employees for lower salaries.

(E) All the above

Directions for question 44 and 15: Select the correct alternative from the given choices.

44. Shaheshah Law the Uttar Pradesh (UP) based law firm was founded in 1982. It has a number of in-house advocates operating in all the higher courts including the Supreme Court, High Court, Labour Courts and various Tribunals. It was also accredited by the law society for training purposes. They conduct training sessions for fresh law graduates, throughout the day starting from 5 a.m. to 8 p.m. They take up various legal cases on behalf of corporate companies and individuals. On 16 July 2007 the court gave a ruling that expanded the scope of law on disability discrimination to include those who were associated with or responsible for a disabled person. The case discusses in detail the events that led to this ruling which was considered a landmark and was expected to have huge implications on businesses. It all began when Sarla Damitri, a former legal secretary with Shaheshah Law, sued her former employer (and a partner in the firm) in August 2004 for constructive dismissal. Sarla, who had a disabled son, alleged that the firm had discriminated against her at the work place due to her association with a disabled person. She alleged that she was treated differently, subjected to criticism and insults, denied flexible working arrangements that would help her to take care of her badly disabled child and ultimately forced into accepting voluntary retirement. She claimed that other employees were allowed flexible working arrangements.

Which among the following weakens Sarla Damitri's argument that she was discriminated against because other employees were allowed flexible working arrangements while she was not.

(A) This is the first time there is such a request at Shaheshah Law.

(B) Sarla left her previous job for the same reason.

(C) Sarla Damitri has relatives at home to take care of her child.

(D) The firm had two legal secretaries and so her presence at all times was not critical.

(E) Only the trainees were allowed flexible working hours at the time.

45. Sumit Patil, a management trainee in the sales and marketing department of one of the largest hardware firms of the city, Sheeta Electronics, was greeted by Ganesh Singh, the zonal sales manager of that firm on the very first day of his joining. In addition to his normal responsibilities, Ganesh was entrusted with the job of training the sales executives of that city and the nearby areas on the outskirts of that city. The firm sold electronic instruments to industries, schools, colleges, banks, cinemas and other industries.

Ganesh gave Sumit the catalogues and pamphlets describing in detail the types of electronic equipment sold by the company and the company background and showed him to his assigned desk. Thereafter, Ganesh excused himself and did not return. He did not even respond to the calls made and the messages sent by Sumit to seek clarifications though he is free. Sumit spent the whole day scanning the material and late in the evening he picked up his things and went home.

Which of the following best describes Ganesh's training methodology?

(A) The trainees were expected to be fully prepared for the job before they join.

(B) The trainees were trained by letting them work on their own without the help of senior officers.

(C) Ganesh's training programme is not suited for the firm.
(D) Training aims at providing circumstantial pressure on the trainee.
(E) All the above

Directions for questions 46 and 47: Answer the questions based on the information given below.

Ambuja solutions, the logistics firm was growing steadily. The huge growth of the organization brought to the fore the need to recruit employees. The HR manager found that it is not difficult to recruit unskilled employees but recruiting people at the middle and top management level is going to be an uphill task. The HR team has formed a team to attract people who are already employed, busy in their jobs and are passive job seekers. The team has come up with their report indicating the reasons for looking for a change of job, their attachment to the present organization, the quantum of job satisfaction they are deriving now, their views regarding a conducive work atmosphere, etc. The team has found that these passive job seekers become active when a new employer approaches them through common friends.

46. Which of the following is a possible reason behind the HR manager's attempt to attract employees of other organizations?
(A) Fresh candidates lack experience.
(B) To weaken the other organizations.
(C) Amount spent on training new employees can be reduced.
(D) Experienced personnel are required for middle and top management.
(E) To infuse fresh competition among the middle and top managers.

47. Based on the findings of the report which of the following steps would help the organization to attract passive job seekers?
(A) Advertise the openings in the organization.
(B) Talk negative about other organizations.
(C) Encourage their employees to bring in potential candidates among friends and acquaintances.
(D) Increase the salary paid to the existing employees in the middle and top management
(E) Find out what keeps an employee loyal to an organization.

Directions for questions 48 to 50: Answer the questions based on the information given below.

Ravi's father is working as an agent for an insurance company. Ravi has developed interest in the field of insurance. He used to go through all insurance related laws and regulations. He appeared for several competitive exams conducted to recruit people into insurance companies. Finally, the day of joining his dream job had come. He was called for an interview for the post of sales manager in a major multinational insurance company. He prepared meticulously for the interview. He had gone through the fundamentals of his areas of interest and study. His father conducted several mock interviews.

Ravi arrived at the venue of the interview 15 minutes before time, but the interview started one hour late. During this time, he tried to complete the pre-interview formalities. The receptionist appeared to be ill-trained and lethargic. Ravi did not feel confident that the receptionist had gone through the formalities properly. The interview rooms were more intimidating. None of the six members on the panel retuned the pleasantries nor did they ask Ravi to sit. After standing for several minutes (which appeared to be several years for Ravi) one of the panel members asked Ravi to sit, but not in a pleasing manner. The chair offered to Ravi was quite uncomfortable. The attitude of the panel seemed like 'you need us, but we do not need you'. Most of the questions asked were not directly related to insurance, moreover several of them appeared sarcastic. Ravi kept his cool and answered most of the question carefully. At the end, when the panel asked him if Ravi had any questions, the exhausted Ravi, though he had prepared a list of questions, said no and left the room in disgust after thanking the panel.

48. Which among the following qualities is the interview panel trying to test in Ravi?
(i) Resistance to change
(ii) Aggressiveness
(iii) Patience
(iv) Behaviour while under pressure
(v) Persistence
(A) Only (i), (ii) and (iii)
(B) Only (iii) and (iv)
(C) Only (i), (iii) and (iv)
(D) Only (ii) and (v)
(E) Only (ii) and (iii)

49. Which of the following is a possible reason, why Ravi did not ask any question, even though he was given a chance to do so?
(A) Ravi had succumbed to the preemptive tactics played by the panel.
(B) Ravi thought that the panel was probably not interested in him.
(C) Ravi made an assessment of the work environment that he may have to face.
(D) Ravi had decided that insurance was not his cup of tea.
(E) None of the above

50. Which of the following denotes both the positive and negative traits of Ravi that were displayed during the interview?

(A) Punctuality; Resistance
(B) Enthusiasm; Pessimism
(C) Temperament; Hardworking nature
(D) Enthusiasm; Resistance
(E) Patience; Pessimism

Directions for questions 51 to 60: There is a passage given followed by certain directions. Read the directions given under the passage carefully before answering the questions that follow.

M/s. Anant Printers is a small printing press. It has three treadle machines, one modern offset machine and DTP equipment. It has nine workers for all the jobs in the press. The whole unit is just like a family and the proprietor has excellent relations with the workers. The press has a large number of orders. There is good demand and it can increase its operations, if the proprietor wishes to do so.

The proprietor has come across four offset machines in a medium-size press at Mumbai, which has been closed due to the death of its owner. If the proprietor purchases these machines, the total number of workers would increase to twenty. The trade union would come forward and build a union of the workers in M/s. Anant Printers. It is difficult to anticipate whether the wage rates could be maintained at the same level after union is formed.

One alternative is to import fully automatic machine from Germany, then the number of workers could be limited, but the capital cost is very high, besides skilled technicians will have to be appointed to run the modern automatic machines. The cost of production is expected to be very heavy.

Directions: The questions that follow relate to the preceding passage. Evaluate, in terms of the passage, each of the item given. Then select your answer from one of the following classifications.

(A) A Major Objective in making the decision: One of the goals sought by the decision.
(B) A Major Factor in making the decision: An aspect of the problem, specifically mentioned in the passage, that fundamentally affects and/or determines the decision.
(C) A Minor Factor in making the decision: A less important element bearing on/or affecting a major factor, rather than a major objective directly.
(D) A Major Assumption in making the decision: A projection or supposition arrived at by the decision maker before considering the factors and alternatives.
(E) An Unimportant issue in making the decision: An item lacking significant impact on, or relationship to, the decision.

Questions:

51. Funds are available for purchasing either of the machines.

52. Union may be formed and wage rate may not be at the present level.

53. Import of machinery would involve heavy capital cost, leading to rise in cost of the production.

54. Harmonious relations exist between the present set of workers and management.

55. Operations can be expanded.

56. Union may not accept the level of wages being paid now.

57. The owner of the offset printing press in Mumbai is dead.

58. If production capacity is not increased, then potential business could be lost to rivals.

59. Buying old machines may not keep the company in the forefront of technology.

60. New imported machinery will lead to better quality resulting in more business.

ANSWER KEYS

1. (C)	11. (B)	21. (B)	31. (B)	41. (A)	51. (C)
2. (C)	12. (C)	22. (D)	32. (B)	42. (A)	52. (B)
3. (D)	13. (A)	23. (B)	33. (D)	43. (B)	53. (B)
4. (B)	14. (D)	24. (B)	34. (E)	44. (E)	54. (B)
5. (C)	15. (B)	25. (D)	35. (C)	45. (B)	55. (D)
6. (A)	16. (D)	26. (D)	36. (E)	46. (D)	56. (D)
7. (A)	17. (B)	27. (C)	37. (B)	47. (C)	57. (E)
8. (D)	18. (A)	28. (B)	38. (C)	48. (B)	58. (C)
9. (D)	19. (A)	29. (B)	39. (A)	49. (B)	59. (E)
10. (C)	20. (C)	30. (B)	40. (D)	50. (E)	60. (C)

SOLUTIONS

Solutions for questions 1 to 5:

Q.No.	Number	(1) Seven digits	(2) At least 2 prime digits	(3) First and last digits are perfect squares. [6] First and last digits are even	(4) Middle digit even [7]. All digits are odd.	(5) Digits are in increasing order from left to right.
1	1778459	✓	✓	✓	✓	×
2	4276891	✓	✓	✓	✓	×
3	1367574	✓	✓	✓	× [×]	×
4	9632578	✓	✓	× [×]		×
5	4556662	✓	✓	× [×]	✓	×
6	4368579	✓	✓	[✓]	✓	×
7	1366789	✓	✓	✓	✓	✓
8	9517531	✓	✓	✓	× [✓]	×
9	1573934	✓	✓	✓	× [×]	×
10	964374	×	✓	✓		×

1. Satisfies all the basic conditions.
Superior number.

2. Satisfies all the basic conditions.
Superior number.

3. Does not satisfy condition (4) and also its alternate condition.
Garbage number.

4. Does not satisfy condition (3) and also its alternate condition.
Garbage number.

5. Does not satisfy condition (3) but satisfies the alternate condition.
Mutual number.

Solutions for questions 6 to 11: The four basic conditions from (a) to (d), given in the selection criteria are as shown in the table below. In case a basic condition is violated, the case is verified for the respective alternate condition given. The alternate conditions are as given below:

(e) If condition (d) is violated, but at least one relative of the candidate is presently staying in Andhra Pradesh (AP) for the last 5 years, then the candidate can be admitted.

(f) If condition (b) or (c) is violated, but not both and the candidate has a good sports record, then the candidate should be advised to approach the Principal.

(g) If both the conditions (a) and (b) are violated, but the candidate is ready to donate `1,00,000 to the college, then the candidate should be advised to approach the Secretary.

Now let us scrutinize the applicants for the basic conditions, as given in the table below (a tick mark '✓'means that the condition is fulfilled, cross mark '×' means that the condition is violated).

Question number	Name of the candidate	(a) SSC ≥ 80% or CBSE ≥ 70%	(b) Entrance exam ≥ 60%	(c) Age ≥ 16 years, male candidate	(d) Resident of AP	Remarks
6	Jahangir	✓	✓	✓	×	(d) violated
7	Rita	✓	✓	× (female)	✓	(c) violated
8	Prakash	×	✓	✓	✓	(a) violated
9	Ranga	×	×	✓	✓	(a) and (b) violated
10	Ram	×	×	? (age)	?	(a) and (b) violated
11	Rahim					(c) and (d) unknown, (a) and (b) violated

6. In this case, condition (d) is violated, i.e., Jahangir is not a resident of AP. Hence, his case is verified for the alternate condition (e). Since, a close relative of Jahangir has been staying in AP for the last 10 years (i.e., more than the required 5 years), Jahangir is selected.

7. In this case, condition (c) is violated, i.e., Rita is a female. Then the alternate condition (f) is applied. As Rita has a good sports record (represented state in basketball), she should approach the Principal.

8. In this case, condition (a) is violated. As there is no alternate condition given for violating condition (a) alone, admission cannot be granted to Prakash.

9. In this case, both the conditions (a) and (b) are violated. Then, Ranga's case is verified for the alternate condition (g). As Ranga is ready to pay a donation of `1,00,000, he should be advised to approach the Secretary of the school.

10. In this case, both the conditions (a) and (b) are violated, hence, the alternate condition (g) is applied. As Ram is ready to pay a donation of more than `one lakh, he should be advised to approach the Secretary of the school.

11. In this case both the conditions (a) and (b) are violated in lieu of which the alternate condition (g) is satisfied (i.e., Rahim can pay a donation of `1,00,000). But, no information is available to check conditions (c) and (d). Hence, we cannot take a decision as the data is inadequate.

Solutions for questions 12 to 17: The four basic conditions, from (a) to (d), given in this selection criteria are as shown in the table below.

In case a basic condition is violated, the respective alternate condition is applied in order to take a decision.

The alternate conditions are as given below:

(e) If condition (a) is violated and the hero has a success rate of greater than 50% in films but has a good success rate with the heroine he is going to work with in the film, then take the suggestion of the heroine. OR

If condition (a) is violated, but the hero is successful in the type of films the Producer is making, then take the advice of the Producer.

(f) If condition (c) is violated, but the hero demands a remuneration of less than `50 lakhs, then he can be selected.

(g) If condition (d) is violated, but the hero can work for at least 15 days in a month, may not be continuous, then the hero can be selected.

Now let us scrutinize all the applicants for the basic conditions (from (a) to (d)) as given in the table below (a tick mark '✓' means that the condition is fulfilled and a cross mark '×' means that the condition is violated):

Question number	Name of the hero	(a) Success rate as a hero ≥ 70%	(b) Time spent in the industry ≥ 5 yrs	(c) Remuneration < 10 lakhs	(d) Dates continuous ≥ one week	Remarks
12	Romeo	✓	✓	✓	✓	All conditions are satisfied
13	Chris	×	?	×	?	(b) and (d) unknown and (a) and (c) are not satisfied.

(*Continued*)

Question number	Name of the hero	(a) Success rate as a hero ≥ 70%	(b) Time spent in the industry ≥ 5 yrs	(c) Remuneration < 10 lakhs	(d) Dates continuous ≥ one week	Remarks
14	Ritesh	×	✓	✓	✓	(a) violated
15	Rajesh	✓	✓	✓	×	(d) violated
16	Hasmukh	×	✓	✓	✓	(a) violated
17	Roopesh	?	✓	✓	?	(a) and (d) unknown

12. In this case, Romeo satisfies all the conditions. Hence, he is selected as a hero.

13. In this case, condition (a) is not satisfied, as the information given regarding the success rate is not that of his success as a hero. Similarly, (c) is not satisfied, as he charged more than 10 lakhs per film. Conditions (b) and (d) cannot be checked, as Chris's experience in the industry and whether he can give dates continuously for at least one week is not known. Hence, the data is inadequate for taking a decision.

14. In this case, condition (a) is violated, then the alternate condition (e) is tested. As Ritesh has 90% hits in the type of films the producer is making, Producer's advice should be taken.

15. In this case, condition (d) is violated. But as Rajesh can give dates for 18 days in a month, (i.e. more than the required 15 days in a month, as in condition (g)), hence Rajesh is to be selected as the hero.

16. In this case, condition (a) is violated. But as Hasmukh is very successful with the heroine of the film, he fulfils the alternate condition (e). Hence, the suggestion of the heroine should be taken.

17. In this case, both the conditions (a) and (d) cannot be checked, as Roopesh's track record for all the 8 years is unknown, and also his ability to give dates is not mentioned, hence data is insufficient to take a decision.

Solutions for questions 18 to 23:

Question number	(a) Every student attended all lectures	(b) No body watched the movie earlier	(c) Theatre ≥ 3 kms	(d) Every student agrees	Remarks
18	✓	✓	✓	✓	All conditions are satisfied.
19	×	✓	✓	✓	(a) violated
20	✓	✓	×	✓	(c) violated
21	✓	×	✓	✓	(b) violated
22	✓	×	✓	✓	(b) violated
23	✓	[✓]	✓	✓	(b) violated

18. In this case, as all the conditions are satisfied. Hence, the group will watch the movie.

19. In this case, condition (a) is violated, as three students out of ten have not attended all their lectures. As three is less than half of ten (the total number of students in the group), these three students should attend their lectures and others should proceed to watch the movie, as given in the alternate condition (e).

20. In this case, the theatre is more than 3 km away. Hence, condition (c) is violated. But as at least two seniors are accompanying them to watch the movie, the alternate condition (g) is fulfilled. Hence, all of them can go to watch the movie.

21. Here, condition (b) is violated, i.e., 2 out of 10 students have already watched the movie earlier. But as the movie is a hit and more than half the total number of students (i.e., 8 out of 10) would be watching the movie for the first time, the alternate condition (f) is satisfied. Hence, all of them go to watch the movie.

22. In this case, condition (b) is violated as some students have seen the movie earlier. As the number of these students is less than half of the total number of students in the group, the alternate condition (f) is fulfilled. Hence, all of them go to watch the movie.

23. In this case, condition (b) is violated as some students have seen the movie earlier. As the number of these students is less than half of the total number of students in the group, the alternate condition (f) is fulfilled. Hence, all of them go to watch the movie.

Solutions for questions 24 to 30:

Question number	(a) Land cost < 20L	(b) Estimated cost of construction < 30L	(c) Posh locality	(d) Loan ≥ 20L @ maximum of 18% p.a.	Remarks
24	✓	×	✓	✓	(b) violated
25	✓	✓	✓	?	(d) unknown
26	×	✓	✓	✓	(a) violated
27	×	✓	✓	×	(a) and (d) violated
28	✓	✓	?	?	(c), (d) unknown
29	✓	✓	✓	×	(d) violated
30			×	✓	(c) violated

24. In this case, condition (b) is violated, as the estimated cost of construction is more than `30 lakhs. As there are flats available in that locality on the ground floor, the respective alternate condition (f) is fulfilled.

25. In this case, the loan amount is not specified, which is required to check condition (d). Hence, the data is inadequate to take a decision.

26. In this case, the cost of the land is more than `20 lakhs. Hence, condition (a) is violated. As there is no alternate condition for the same, the house cannot be constructed.

27. In this case, the land cost is `20 lakhs, whereas according to condition (a) the cost of land should be less than `20 lakhs. Hence, condition (a) is violated. As there is no alternate condition for the same, the house cannot be constructed.

28. As no information is available to check conditions (c) and (d), the data is inadequate to take any decision.

29. Here, condition (d) is violated, as the loan available is less than the stipulated `20 lakhs. But the alternate condition (e) is satisfied as the loan available is `15,00,000, i.e., more than the stipulated `12 lakhs and the interest rate is 10%, i.e., less than the stipulated 12%. Hence, the matter is to be discussed with the family members.

30. In this case, condition (c) is violated as the land is not located in a posh locality. However, as all the basic amenities are available nearby, the alternate condition (g) is satisfied. Hence, the matter should be discussed with the family members.

Solutions for questions 31 to 36:

31. It is implied in the second sentence of para 4, 'This reiterated the company's belief……' that the industry's policies should be employee friendly and the industry should adapt itself to the employees' requirements.

32. Refer to the 2nd para of the passage where it is stated that the human-centric work philosophy of Volvo did not match with the fiercely competitive work atmosphere of the 1990s.

33. It is implied in the passage that the closure of Volvo's plants at Uddevala and Kalmar convey that policies should be designed according to the needs of the time (choice A). It is implied in the second third and fourth paragraphs of the passage that choices (B) and (D) can be inferred from the failure of the policies implemented by Volvo at Uddevalla and Kalmar.

34. Refer to the last paragraph of the passage where it is stated that all the given options speak about the positive outcome of Volvo's fiasco.

35. It is implied in the passage (particularly in the last para) that valuable lessons were learnt in the area of employee relations and productivity.

36. Refer to para 5 of the passage according to which all the given options are applicable.

Solutions for questions 37 to 40:

37. The passage says that the Programme Manager sought feedback on his leadership this indicates that he is keen on doing his best. So, it is certain that he would act on the advice given to him by his team members and become more open to their suggestions. Choice (D) is incorrect as it states 'how' it would be effective but not about the effect it would have.

38. The passage speaks about the importance of networking in an organization. Hence, the skill of networking is a skill every potential manager should develop. Statement – A which talks about hierarchies is rather digressing. (B) does not capture the most essential aspect of the para. (D) and (E) are not relevant to the context.

39. Encouraging employees to discuss ideas with their colleagues in order to gain insights into their technical and market feasibility is essential because such a step would enhance the value of ideas or if they are not feasible it would be abandoned before implementation, thereby saving valuable time and resources. Hence, (A) is most logical and practical.

40. The loyalties of the old customers are already established. Hence, a retail manager need not make any special efforts to lure them. But during times of recession, when the spending is low, the best way of attracting new customers is by tempting them with attractive deals. This will serve the dual purpose of retaining old customers and attracting new ones.

Solutions for questions 41 to 43:

41. Brijesh Goswami was quoted as saying he had been appalled by the retrenchments and was not aware of the sackings of 1000 employees, but the decision to retrench 1000 employees cannot be taken without prior permission from the chairman. Hence, Brijesh Goswami had capitulated under pressure from external parties.

42. The company cannot lay off its employees without prior notice and hence,
Choice (A) is definitely a flaw in the decision of the senior business manager. The question of future recruitment comes into picture when the company survives. The present problem for the company is survival. Hence, (B) is not a flaw. Choice (C) is irrelevant in the context of the question. The decision taken by Udaan does not have any effect on other companies in the industry. Hence, (D) is not a flaw.

43. It is not known whether the company has excess planes or not and it is possible that as the situation improves the company would have a shortage of planes for its requirement. For a company in loss, it is a normal practice for the employees to take a pay out to save the job and also the company. So, his company could have considered this option after taking all the employees into confidence. Reducing fare below that of its competitors would force others to follow suit which would further bleed the industry and increase the loss. Employees with experience would have higher salaries than freshers, but as experience would count a lot in any situation, (D) is not a better way to cope with the losses.

Solution for question 44 and 45:

44. As only the trainees were allowed flexible working hours, the argument that there was a discrimination would be weakened. Hence, option (E) weakens her argument.

45. Ganesh gave Sumit all the details related to the company and its products and expected Sumit to learn the work on his own.

Solutions for questions 46 and 47:

46. Choice (A) indicates the drawback with fresh employees but does not talk about the advantage in recruiting employees of other organizations. From the passage it is clear that the organization is growing and there is a need to recruit new employees. Hence, (B) is not a reason. According to the HR manager the difficulty lies in finding the required people but not training them. Hence, (C) is not a reason. HR manager did not find a difficulty in recruiting unskilled people but the problem is with filling middle and top management posts. This implies that the HR manager is looking for experienced people. Hence, (D) is a reason.
(E) is out of context.

47. It is stated that the passive job seekers become active when a new employer approaches them through common friends. Hence,
choice (C) would help the HR manager to attract the target group.

Solutions for questions 48 to 50:

48. The panel is trying to reflect the 'you need me, but I do not need you' kind of attitude that some of the customers would show. The quality that is required in such cases is patience. The panel decided to make things unpleasant for Ravi to check how he would react when faced with a similar situation during the course of his work. The panel is trying to test his patience and his behaviour under pressure.

49. As Ravi faced a panel which was behaving in an unfriendly manner and was also asking him questions that were not directly related to insurance, he could have felt that the panel was not interested in him.

50. Ravi had kept his cool in the face of an unfriendly atmosphere. Thus, he is successful in showing good levels of patience. Ravi has seen the entire interview with

pessimism. It is clear from the sentence. The attitude of the panel seemed like….' and the sentence 'several of them are sarcastic'. This is also evident from the fact that Ravi has not asked the panel any question, though he was prepared with some questions and he was given a chance to ask questions. From this it is clear that he was pessimistic throughout. He left the interview in disgust.

Solutions for questions 51 to 60: **Situation Analysis:**

The present status of Anant Printers is, it is comfortably placed in terms of orders and the other business basics like a dedicated work force and adequate number of machines. However, the important aspect/issue that is raised in the passage is evident from the statement, 'There is good demand and it can increase its operations, if the proprietor wishes to do so'. The issue, hence, is of growth. The important decisions that are under consideration are mentioned below:

(1) Whether to expand operations / volumes or to stay at the present level of volumes.

(2) If expanding of operations is chosen, then the choice between the 'four offset machines' and the 'fully automatic machine' is to be made.

The worker relations and the final cost of production are evidently, the major criteria that need consideration.

Also, the other criteria that is required to be considered would be the wage rates, availability of skilled technicians, required capital, costs, etc.

51. The availability of funds is not explicitly mentioned as a concern/problem in the passage. Hence, it can be concluded that funds are not a major factor in making the decision. At the same time, it cannot be said that the availability of funds is not important for the decision making involved. Hence, this is a minor factor in making the decision.

52. Since the present state is that '…the proprietor has excellent relations with the workers…' and 'The whole unit is like a family…', the formation of the union will have a significant impact on these pleasant relations (and also the wage rate). This is a major factor in making the decision.

53. The final cost of production is an important factor as it affects the basic competitiveness of the press. Hence, if imported machinery leads to high cost of production it will be a major factor in making the decision.

54. As already mentioned in the solution to Q. no. 22, the fact that harmonious relationships exist between the workers and the management is an important and major factor in making the decision.

55. The entire passage is regarding the issue of expanding operations, which is the major objective in making the decision. However, to suppose that it is possible to do so, (i.e., that there will be adequate demand) is in fact a major assumption in the decision-making process.

56. Since the basic information from the passage says 'It is difficult to anticipate whether the wage rates could be maintained at the same level after the union is formed', to suppose that the union may not accept the level of wages being paid now would be a major assumption.

57. The fact whether the owner of the offset printing press is dead or alive has practically no significance or impact on the decision-making process. It is an unimportant issue.

58. If there was a possibility of losing the "present business" to rivals, then it could be considered as a major factor in making the decision. However, the passage states 'There is good demand and it can increase its operation…' This implies that the 'present business' is not under any threat. 'Potential' business being lost to rival would not be a major factor but can be considered as a minor factor in the decision-making process.

59. The issue of being in the forefront of technology has neither been mentioned nor alluded to in the passage. Hence, this is a relatively unimportant issue in the present decision-making scenario.

60. Since it is mentioned in the passage that the present business is good and that the demand is adequate, with scope for expanding operations, improving quality is not a necessity or a major factor. However, since better quality will help win more business, it cannot be considered unimportant either. Hence, it is appropriate to consider this as a minor factor.

11 Non-verbal Reasoning

Chapter

Learning Objectives

In this chapter, you will :

- Learn about different models of non-verbal reasoning questions like:
  - Series
  - Analogies
  - Odd man out
- Learn about different patterns in which elements behave, like:
  - Shifting
  - Rotation
  - Image formation
  - Increasing/reducing the number of elements
  - Substitution

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as, XAT, IIFT, MH-CET, MAT, etc.

❒ Introduction

Under Non-Verbal Section, you get combination of Reasoning questions but broadly asked in symbols/ image format.

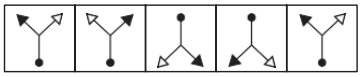
The questions could range from: Series, Analogies, to Odd man out etc. We can understand them better with the help of below exercise.

Exercises

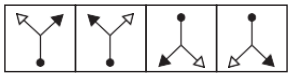
Directions for questions 1 to 5: In each of the following questions there are two sets of figures. One on the left side (problem figures) and the other on the right side marked (A), (B), (C) and (D) (answer figures). Select one figure from the answer set which will continue the same series as given in the problem set of figures.

Problem figures **Answer figures**

1.



(A) (B) (C) (D)



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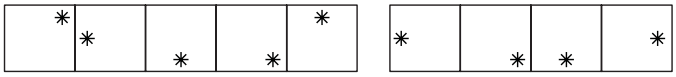

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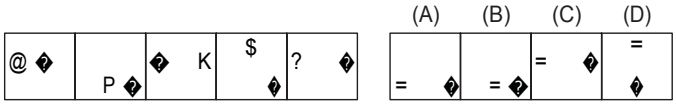

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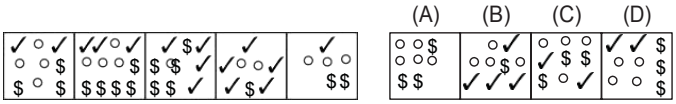

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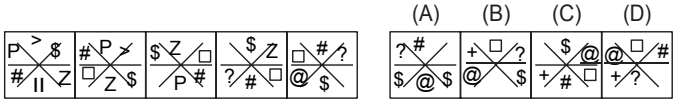
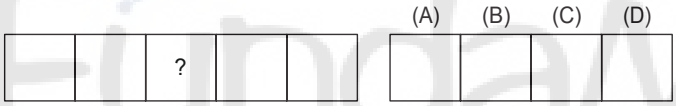


Directions for questions 6 to 10: In each of these questions there are two sets of figures. The figures on the left are 'Problem Figures' (Four figures and one question marked space) and those on the right are 'Answer Figures' indicated by A, B, C and D. A series is established if one of the four 'Answer Figures' is placed at the 'question marked space'. Figures form a series if they change from left to right according to the same rule. The number of the 'Answer Figure' which should be placed in the question marked space is the answer. All the five figures, i.e., four 'Problem Figures' and one 'Answer Figure' placed in the question marked space should be considered as forming the series.

Problem figures **Answer figures**

6.



7.

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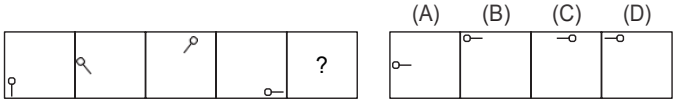

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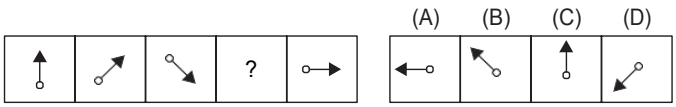

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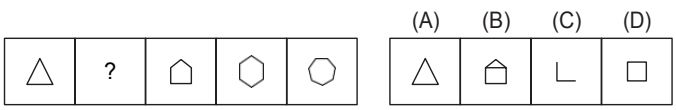
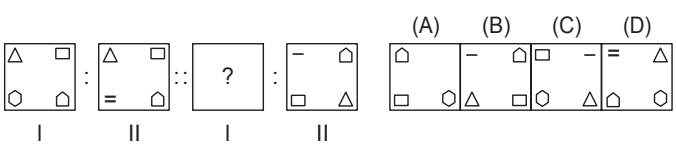


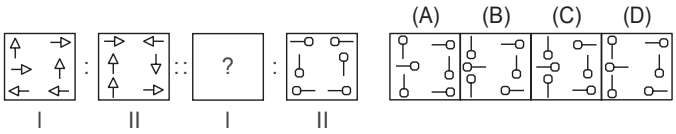
Directions for questions 11 to 15: In each of the following questions, the first two figures are related to each other in a certain way. Find out which figure from the answer figures (A), (B), (C) and (D) should be placed at the '?' mark so that the second pair so formed will have a similar relationship and can be placed at 'question mark'.

Problem figures **Answer figures**

11.



12.



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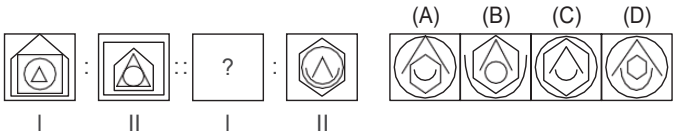

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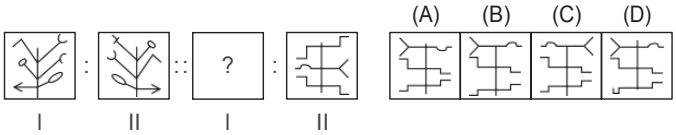

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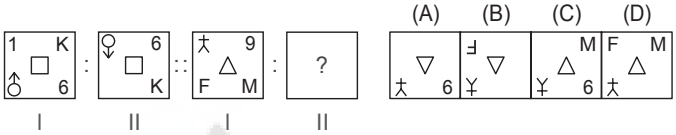
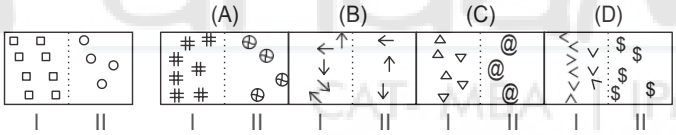


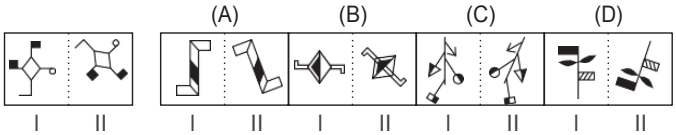
Directions for questions 16 to 20: In each of the following questions a pair of problem figures is given at the left extreme followed by four pairs of answer figures. The left figure in the problem figures bears a certain relationship with the right figure. Out of the four pairs given in the answer figures one is similar to that pair given in the problem figures. Find out the answer pair by comparison.

Problem figures **Answer figures**

16.



17.



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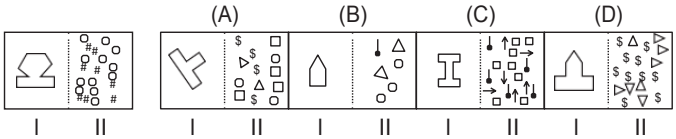

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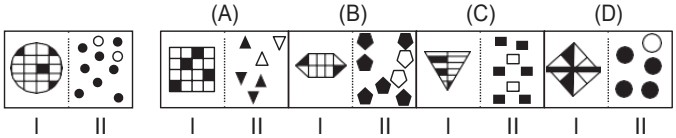

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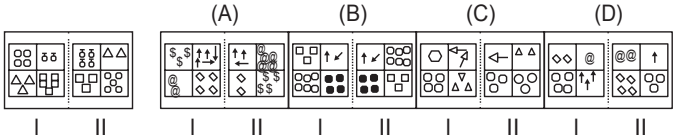
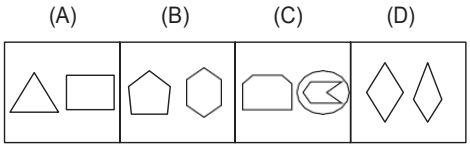


Directions for questions 21 to 25: In each of the following questions three out of the given four figures are similar in a certain way and hence, they form a group. Find the one which does not belong to that group.

21.



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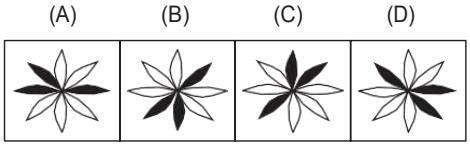

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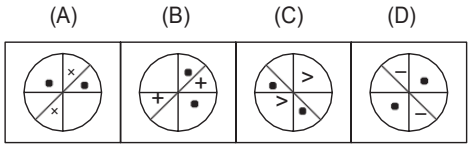

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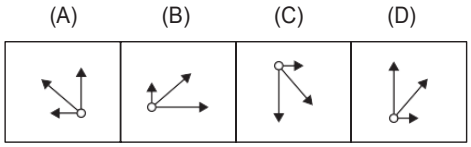
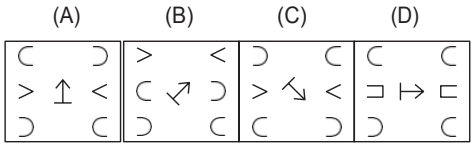
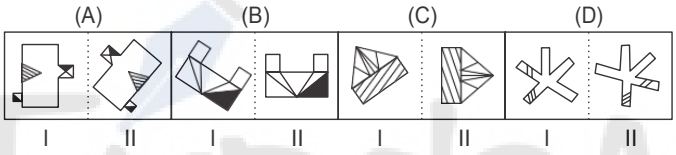


25.



Directions for questions 26 to 35: In each of the following questions, in three out of the four pairs of figures, element II is related to element I in the same particular pattern. Find out the pair in which the element II is not so related to element I.

26.



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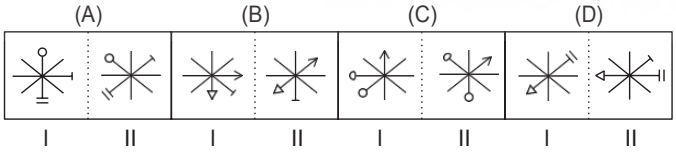
28.



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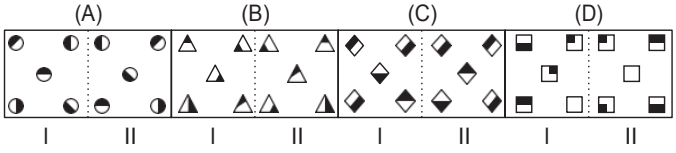

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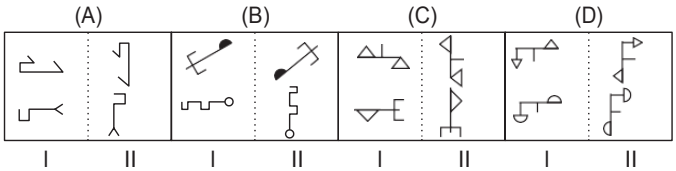

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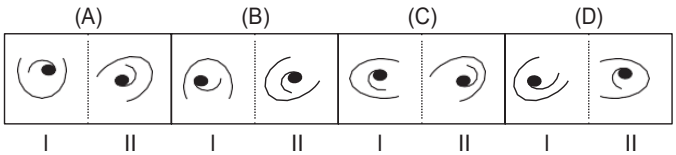

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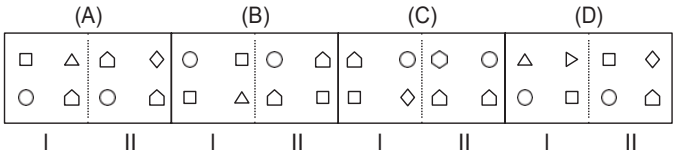
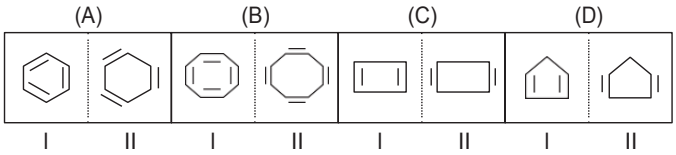
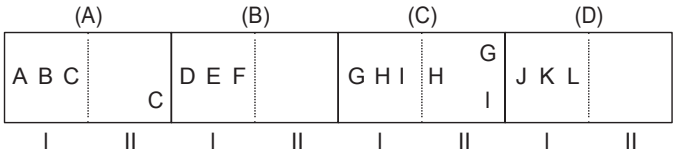


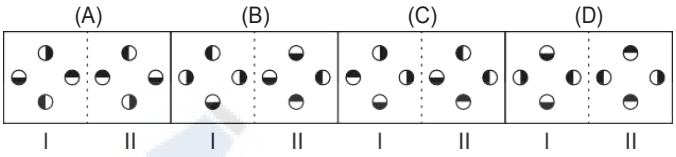
33.



34.



35.



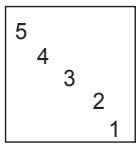
ANSWER KEYS

1. (A)	7. (B)	13. (C)	19. (C)	25. (D)	31. (C)
2. (C)	8. (D)	14. (B)	20. (A)	26. (B)	32. (A)
3. (B)	9. (A)	15. (C)	21. (D)	27. (A)	33. (D)
4. (D)	10. (D)	16. (C)	22. (A)	28. (A)	34. (C)
5. (D)	11. (A)	17. (A)	23. (D)	29. (D)	35. (B)
6. (C)	12. (D)	18. (D)	24. (D)	30. (C)	

SOLUTIONS

1. In each figure, the mirror image and the water image are taken alternately to get the appropriate answer figure (A).

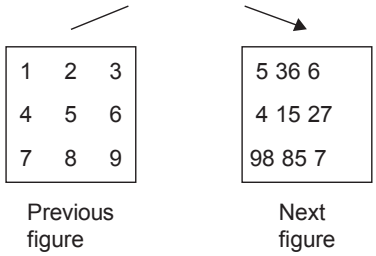
2. Let the elements in each figure be:



The elements are swapped. From the second figure to the third figure, the 2nd and the 3rd elements are swapped. Similarly, the 3rd and the 4th, the 4th and the 5th, and the 5th and the 1st elements are swapped cyclically in the remaining figures.

The appropriate answer figure is (C).

3. The elements in the first figure are rearranged as shown below to get the next figure.



A similar logic is applied from the third to the fourth and from the fifth to get the answer figure.

The appropriate answer figure is (B).

4. The element ✓ is appearing 2 times, 3 times, 4 times, 5 times, 1 time and 2 times cyclically.
The element o is appearing 4 times, 5 times, 1 time, 2 times, 3 times and 4 times cyclically.
The element $ is appearing 3 times, 4 times, 5 times, 1 time, 2 times and 3 times cyclically.

The appropriate answer figure is (D).

5. The elements are shifted to adjacent blocks in clockwise direction and opposite blocks alternately and a new element is appearing in each figure in the place of bottom left element.

The appropriate answer figure is (D).

6. The element is shifted by $\frac{1}{2}$ a side, 1 side, $1\frac{1}{2}$ sides, 2 sides in CW direction, respectively.

The appropriate missing figure is (C).

7. The element is shifted by each time $\frac{1}{2}$ a side in CW, 1 side in ACW, $1\frac{1}{2}$ sides in CW and 2 sides in ACW directions, respectively.

The appropriate missing figure is (B).

8. The element is shifted by each time $\frac{1}{2}$ a side, 1 side, $1\frac{1}{2}$ sides and 2 sides in CW direction and rotated by 45° in ACW, 90° in CW, 135° in ACW, 180° in CW, respectively.

The appropriate missing figure is (D).

9. The element is rotated by 45°, 90°, 135° and 180° in CW direction, respectively.

The appropriate missing figure is (A).

10. The number of sides of an element is increased each time by 1.

The appropriate missing figure is (D).

11. In the first pair, from the second figure frame to the first figure frame, each element is increased by one side and shifts to the next position in clockwise direction. The similar pattern is followed in figure (A).

12. The elements in the first column are rotating by 90° and the elements in the second column are rotating by 180°. The top left and the bottom left elements are rotating in clockwise direction and the middle left element is rotating in anticlockwise direction.
Answer figure (D) is related to frame (II) of the problem figure in the same way.

13. In the first pair, from the second frame to the first frame the outer two figures are interchanged and the inner two figures are interchanged. Similar pattern is followed in figure (C).

14. The left hand side top element is interchanging with right side middle element. The right hand side top element is interchanging with the left hand side middle element. The bottom two elements are interchanged. Similar pattern is followed in figure (B).

15. The top left element and the bottom left element interchanged their positions and formed water images. Similar changes have taken place for the top right and the bottom right elements. The element at the centre rotated by 180°. This pattern can be established in the second pair by replacing the question mark with the answer figure (C).

16. In the question figure, the number of elements in second segment is half of the number of elements in the first segment. Figure (C) also posses the same relationship.

17. The water image of the element in the first segment of the question figure has been rotated by 45° in anticlockwise direction.
Figure (A) also posses the similar relationship.

18. In the question figure, the number of elements in the second segment of the figure is double the number of sides in the first segment of the figure.
Figure (D) also posses the similar relationship.

19. In the first segment of the question figure, the ratio of the number of shaded to that of unshaded elements is 1 : 4 and in the second segment it is 4 : 1. The ratio between the shaded to the unshaded is constant in the first segment and in the second segment. Figure (C) also posses the similar relationship.

20. Let us represent the figure as follows:

1	2
3	4

The number of elements in each segment will always remain the same and the elements are shifting in the second segment as follows:

4 ⟶ 3
3 ⟶ 2
1 ⟶ 4
2 ⟶ 1

Figure (A) posses the similar relationship.

21. In each figure, the left element is symmetric about the vertical axis and the second element is symmetric about the horizontal axis. Figure (D) does not follow this pattern.

22. Figure (B), (C) and (D) have the same figure in different rotated forms. Figure (A) cannot be obtained by rotating any of the other figures.

23. Two out of the four small elements are exactly at opposite places inside the circles except figure (D).

24. The 90° angle between the two arrows in the straight lines is in clockwise direction, but in (D) it is in anticlockwise direction.

25. All the elements are in opposite directions except in figure (D).

26. In each figure the second segment of the figure is the mirror image of the first figure, which has been rotated by 45° in clockwise directions.

Figure (B) does not follow such pattern.

27. Here, in each figure, except figure (1), the elements which are five in number are becoming four. Similarly, the elements which are 3, 2 and 1 in number are becoming 2, 3 and 6, respectively.

Figure (A) does not follow this pattern.

28. In each figure three lines are headed by three elements, out of three, one is shifting to the next line in anticlockwise direction and the other two are shifting to next line in clockwise direction. The figure (A) does not follow this pattern.

29. Each of the elements in the frame are shifting to new position without any rotation as shown below.

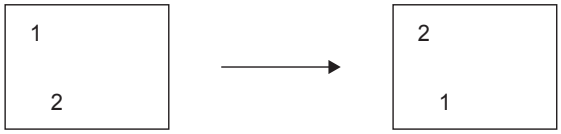


Figure (D) does not follow this pattern

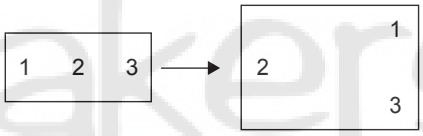
30. In each pair the mirror image of upper element is rotated by 90° in anticlockwise direction. The water image of lower element is rotated by 90° in clockwise direction. Fig. (C) does not follow the above pattern.

31. The outer element is rotated by 135° in an anticlockwise direction. The inner element is rotated by 135° in a clockwise direction. This is not true in figure (C).

32. One side is added to all the other elements except in the circle. This is not true in figure (A).

33. The number of elements connected to the main figure is equal to half of the total number of the number of sides of the main figure. This is not true in figure (D).

34. The elements are changing their position as follows:



Here, 1 is changing to its water image, 2 is changing to its mirror image and 3 is changing to its water image. This is not true in figure (C).

35. Every element is rotated by 180°. This is not followed in figure (B).

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