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DATA INTERPRETATION

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CONTENTS

1 Introduction to data Interpretation

Chapter

❏ Introduction

The study of figures and statistics has been an integral part of any medium of course. The study and manipulation of such data leads us to an important area called data interpretation. Data can be organized in a number of ways so that larger volume of data can be presented in a more compact and precise form. Data thus presented has to be deciphered correctly by the user of the data. This process of deciphering the data from its compactly presented form is called data interpretation.

Unorganized and haphazard data does not make any sense to the top management for whom time is a very valuable and rare commodity. Hence, any data, be it daily production figures, daily sales figures, financial performance or productivity, such data will have to be presented in a concise manner. However, at the same time being precise is very significant so that the top management can study it with ease and thus it also facilitates faster decision making.

In this section, we will cover data interpretation questions which is almost certainly asked in every MBA entrance exams either as a part of Mathematics or as a separate section.

Over the last few years, the people who formulate question papers for competitive exams have developed enormous liking for this area. Consequently, the variety of questions asked and the degree of difficulty have increased over a period of time.

❏ Methods of Presenting Data

Numerical data can be presented in one or more of the following ways.

1. Data tables
2. Pie charts
3. Two-dimensional graphs
4. Bar charts
5. Three-dimensional graphs
6. Venn diagrams
7. Geometrical diagrams
8. Pert charts
9. Others

The 'Others' category covers miscellaneous forms like descriptive case format, which is customized for the situation. Data can also be presented by using a combination of two or more of the above forms.

While some data can be presented in many different forms, some other data may be amenable to be presented only in a few ways. In real life situations, the style of data presentation is based on the end-objective. In certain situations, the data has to be presented as a combination of two or more forms of data presentation.

Let us understand each of the above forms of data presentation with an example.

❏ Data Table

Here data is presented in the form of simple table. While any type of data can be presented in table form, that too in a very accurate manner, interpreting the data in table format is very difficult and time consuming than the other modes, all of which are basically pictorial or graphical in presentation.

Data tables can be of a number of types. They can be of a single-table variety or combination of tables. Some examples of tables are given below.

Table 1.1 Movement of Goods by Different Modes of Transport (in 000's of metric-ton-kms)

Year	Road	Rail	Air	Water	Total
1985	1000	1500	120	20	2640
1986	1600	2000	129	24	3753
1987	2907	3090	139	28	6164
1988	4625	5200	152	27	10004
1989	6346	7540	174	33	14093
1990	7920	10250	212	40	18422
1991	9540	13780	266	50	23636

Note: All figures are fictitious.

From the table, we can deduce the following:
- Rate of growth by each mode of transport in successive years as well as cumulative annual growth.
- Rate of growth of total haulage by all modes of transport together in any year.
- Contribution by each mode of transport to the total haulage in any given year.
- Trends of growth over time for various modes of transport.
- Given the cost of transportation for each mode, we can calculate the total annual cost of transportation over the years for various modes of transport as well as make a cost comparison.
- Finding out the mode of transportation in any given year that forms the largest percentage of total haulage.
- For a given mode of transport, finding out the year in which the percentage increases in haulage over the previous year was the highest.

Table 1.2 Railway Timetable – Coromandel Express

Place	Cumulative mileage	Arrival Time (in hours)	Departure Time (in hours)
Madras	0	—	08.00
Nellore	200	11.20	11.30
Vijayawada	525	15.30	16.00
Rajahmundry	700	19.20	19.30
Visakhapatnam	1100	01.10	01.30
Bhubaneswar	1450	03.45	04.00
Kharagpur	1600	07.25	07.30
Calcutta	1925	09.30	—

From the above time table, we can obtain the following:
- Distance between various stations.
- Total idle time as a proportion of total travel time.
- Average speed between stations as well as over the entire journey.
- Minimum and maximum speeds of the train between two stations.

❒ Pie-chart

This is probably the simplest of all pictorial forms of data presentation. Here, the total quantity to be shown is distributed over one complete circle or 360 degrees. In pie charts, data is essentially presented with respect to only one parameter (unlike in two and 3-dimensional graphs described later). This form essentially presents the shares of various elements as proportion or percentage of the total quantity. Each element or group in the pie chart is represented in terms of quantity (or value, as the case may be) or as the angle made by the sector representing the elements or as a proportion of the total or as a percentage of the total.

Figure 1.1 depicts the distribution of the population in different geographical zones.
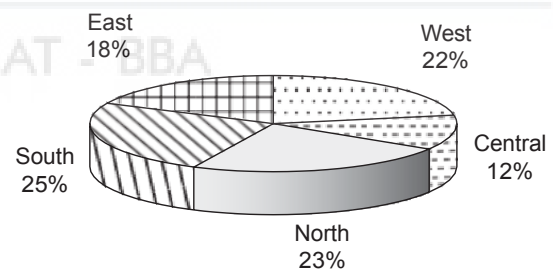

Fig. 1.1 Distribution of population in geographical zones

From the above pie chart, we can calculate the following:
- Population in any zone given the total population
- Population of any zone as a percentage of that of another zone.
- Percentage increase in the total population given the percentage increase in the population of one or more zones.

Pie charts are also very frequently used in combination with other forms of data or along with other pie charts.
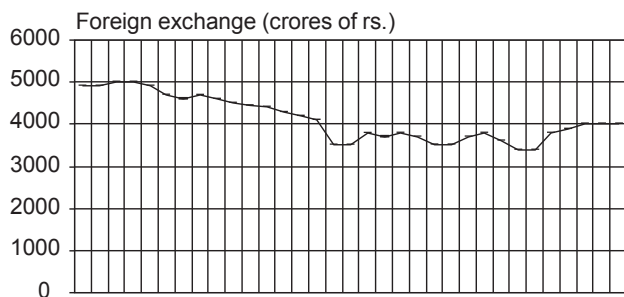
❏ two-dimensional Graphs

Fig. 1.2 Foreign exchange reserves of India

This is essentially used for continuous data but can also be used for depicting discrete data provided that we understand the limitation. The representation of this data is also known as Cartesian graphs, they represent the variation of one parameter with respect to another parameter each shown on a different axis. These types of graphs are useful in studying the rate of change or understanding the trends through extrapolations.

These graphs can be of various types and a few of them are shown below (Figure 1.2 to 1.4):

The graph in Figure 1.2 shows the changes in the foreign exchange reserves of our country during a period of time. One can find out the trends and the growth rates of foreign exchange reserves.
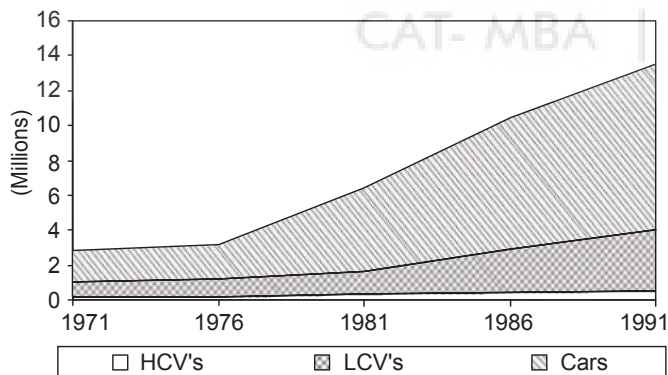

Fig. 1.3 Automobiles in India

Figure 1.3 shows a cumulative type of graph (stacked graph). This chart provides more information than the previous graph that you studied in Figure 1.2.

From the graph given in Figure 1.3, the relative proportion of different varieties of vehicles which constitute the total can be obtained along with the trends and growth rates, percentage variation, actual variations and trends for any period of time can be ascertained.
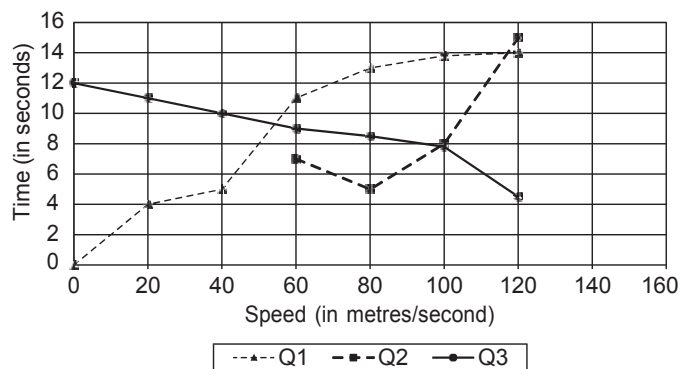

Fig. 1.4 Motion graph of Q1, Q2 and Q3

Figure 1.4 presents another type of 2-dimensional graph which is mostly used to depict scientific data like speed, velocity, vectors, etc. In the graph, the speed trends of three bodies Q1, Q2, Q3 is given.

❏ Bar

This is a type of graph which is widely used to depict data in a discrete way. They are accurate and the comparison of variables is very convenient.
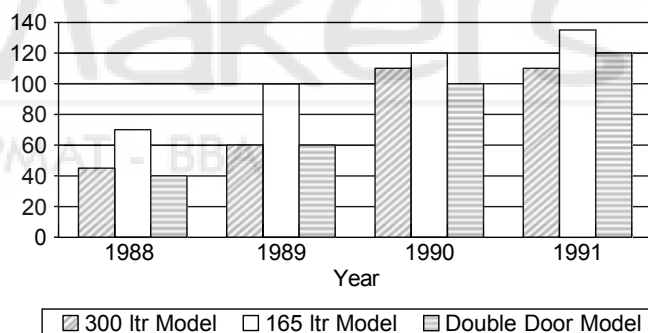
Fig. 1.5 Refrigerator sales of company abc (000's of units)

Figure 1.5 shows the model wise sales of refrigerators during four years. From this graph we can obtain the following:

- Percentage contribution of each model to the company's total sales for four years.
- Relative increase or decrease in the share of each model.
- Sales trend of various models.

Using this bar chart one can carry out a detailed performance evaluation of the company with respect to the sales of the four year period from 1988 to 1991 for any given model. These bar charts can also

be depicted horizontally. Another variation could be showing each product at one place (rather than each year at one place).

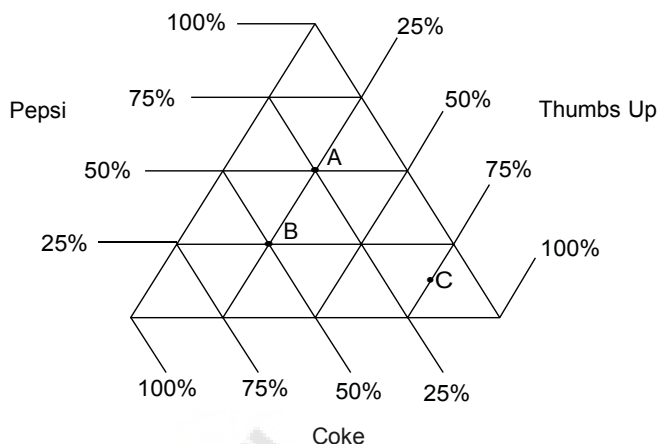## three-dimensional Graph

Fig. 1.6

The data (parameters) in a triangular graph are given on each side of the triangle. Each point represents a particular parameter in terms of the percentage, the same represents.

This graph represents the percentage of students who like the three colas, such as Pepsi, Thumbs Up and Coke in three colleges A, B and C.

Venn-Diagrams

You must be familiar with the concept of sets. Data is represented in the form of Venn diagrams when operations have to be carried out on different distinct sets of elements each following a different functional rule. All the elements in a set follow the same functional rule. By set union and intersection operations, you can establish new sets from the existing sets.

For example (Figure 1.7), consider three of the courses, such as Physics, Chemistry and Maths offered to B.Sc. students from various groups.
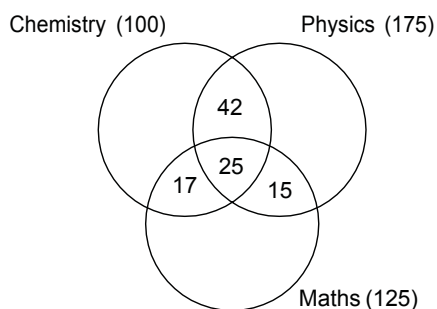

Fig. 1.7

From the chart, you can arrive at the number of students who are studying only one out of the above three subjects.

Pert

The term PERT stands for 'Project Evaluation and Review Techniques'. The progress of any project is monitored, and the execution of various activities is scheduled keeping track of the resource constraints (like labour) and time constraints. For the purpose of data interpretation questions, the data may be given in the form of a table or a chart.

Let us create a table and draw a PERT chart from the table.

Table 1.3 Interior Decoration of an Office Room

The interior decoration work of an office is taken up and the activities involved along with the time taken by each activity are given below.

Activity	Duration (in weeks)	Other activities to be completed before this activity can be taken up
False roofing	2	—
Making furniture	1	—
Fixing furniture	1	False roofing, partition systems.
Fixing venetian blinds	1	Painting of doors and windows.
Fixing air-conditioner	1	—
Painting walls	1	False roofing
Partition systems	2	False roofing, laying the carpet.
Laying of the carpet	1	False roofing, painting of doors and windows, painting of walls.
Painting of doors and windows	1	False roofing

From the table, you can arrive at the minimum time after which a particular activity can be taken up or the whole task can be completed.

2 Speed Math's

Chapter

❏ Importance of Calculation

Calculation speed plays a very important role in almost all the competitive exams—more so in MBA entrance exams. Some people have the natural ability to do calculations fast but, those of us who do not have good calculation speeds need not envy such people for their inborn talent. It is very easy to develop good calculation speed in a relatively short period of time. All it requires is taking care of one basic factor—that is spending a certain amount of time regularly practising calculations.

How does one improve calculation speed?

Spend just about 15 minutes a day over a three-to-six-month period on calculation practice and you will find the difference in your calculation speed. The practice involves basic additions, subtractions, multiplications, percentage calculations, comparing fractions and cal-culating squares.

This practice does not need any material in the form of printed exercises or test papers. Take any figures that you can think of and work out the calculations (additions, subtractions, multiplications, etc.) mentally. What you should certainly try to ensure is that you are doing the calculations mentally wherever possible. Put away your calculators and avoid doing your calculations on paper to the extent possible.

What does this chapter consist of?

While you can always take figures at random for the purpose of practicing calculations mentally, in this chapter, we have put together a number of exercises which you can use for calculation practice.

How to gain from this chapter:

Before you move to the next unit, make sure that you revise the techniques discussed in this chapter. You should also make sure that you are thorough with the following:

Multiplication Tables (up to 20×10)
Squares (up to 25)
Cubes (up to 12)
Powers of 2 (up to 12)
Powers of 3 (up to 6)
Reciprocals of numbers (up to 12)
Complements of 100 (i.e., the difference between 100 and the given two-digit number).

While taking each exercise/test paper, please follow the instructions given below:

1. Check the starting time and keep in mind the time that has been allotted for that particular exercise.
2. Do not use a calculator.
3. Write as little as possible on paper. You should try doing as much of the calculation as possible mentally.
4. If you have to do rough work, do it in the book on the same page as the question that you are answering and not at any other place in the chapter.
5. Some questions require precise calculations whereas some other questions require only approximate calculations. Please remember that the level of accuracy to which you should work out the calculations will depend on the answer choices given in the question paper. So, do not spend more time than is necessary on each question.

6. Stop the exercise/test as soon as the prescribed time is over.

7. After you complete each exercise, spend time working out the questions that you could not complete in the given time. Then, check for the correctness of your answers. Rework all the questions in the test to see whether the method that you adopted was the best/shortest.

8. Even after you use up all the exercises given in this booklet, you should continue similar calculation practice on a regular basis to ensure that your calculation speed does not drop.

For any of the MBA entrance and similar other exams you will be appearing for, there are three areas that you have to take care of:

1. **Knowledge:** It is essential to have a certain level of knowledge in every area. It is not that a very high level of knowledge is required. A tenth or twelfth standard student should be able to answer these papers very comfortably, but nevertheless, some minimum level of knowledge is required.

2. **Speed:** One very important factor which determines success in MBA entrance exams is speed. The number of questions one can attempt correctly makes all the difference between the one who gets selected and the one who does not get selected. Speed in all areas of these exams is very important.

3. **Approach:** Knowledge alone is not sufficient to do well in these exams. For example, you cannot afford to leave out 20 questions out of 30 in a section and still hope to get selected. A person who does not take care of all the areas may not get through. This is where what we refer to as 'approach' is important in tackling the test papers. When you take comprehensive test papers, we will discuss this issue of 'approach' to test-taking.

Here, we will discuss the second of the three aspects mentioned above—speed. We will concentrate on certain speed methods of calculations which will be of great use to you in most of these exams.

As far as calculations are concerned, these exams do not allow the use of calculators or any other calculating aids. The ability to perform calculations faster is an advantage and you will solve more questions than the others in the given time. Even in your day-to-day work where you need to perform calculations, try not to use a calculator. This is a habit that you have to cultivate. If you continue using calculating aids like calculators, it is difficult to improve your calculation speed. However, please remember that any of the methods discussed in this chapter are useful only if you practice these methods regularly as well as consciously use such methods in calculations in your day-to-day work also.

☐ Additions, Subtractions and Multiplications

In this chapter, we will show you a number of calculations and take you through the different steps involved in each of the calculations. These steps are put down on paper here for the purpose of explanation but, when you are performing the calculations, you should do all these steps *mentally*.

☐ Some Ways of Simplifying calculations

1. For multiplication by 5, you should multiply the figure given by 10 and then divide it by 2.
   E.g., $6493 \times 5 = 64930/2 = 32465$. This is a very simple method. You may feel that adopting this method will only save 5 seconds and wonder how you will benefit by it. If you adopt such methods at a number of places in the full paper and you can save even 4 to 5 minutes it will help you attempt at least 4/5 more questions. This itself may make all the difference to your chances of selection.

2. For multiplication by 25, you should multiply the figure given by 100 and divide it by 4. E.g., $6493 \times 25 = 649300/4 = 162325$.

3. For multiplication by 125, you should multiply the figure given by 1000 and divide by 8, e.g., $6493 \times 125 = 6493000/8 = 811625$.
   Alternatively, you can treat 125 as 100 + 25. So, multiplication by 125 can be treated as multiplication by 100 and add to this figure one-fourth of itself (because 25 is one-fourth of 100).

4. For multiplication by 11, the rule is 'for each digit add the right hand digit and write the result as the corresponding figure in the product'. For the purpose of applying the rule, it will be easier if

you assume that there is one 'zero' on either side of the given number. E.g., $7469 \times 11 \rightarrow 0|7469|0 \rightarrow 82159$.

5. For multiplication by 12, the rule is 'double each digit and add the right hand digit and write the result as the corresponding digit of the product' e.g., $0|7469|0 \times 12 = 89628$.

   The carry forward digit has to be added to the subsequent step for multiplication by 11 or 12.

6. For multiplication by 13, the rule is 'three times each digit added to the right hand digit gives the corresponding digit in the product'. E.g., $0|92856|0 \times 13 = 1207128$.

7. Multiplication by 19, can be treated as multiplication by (20 – 1); e.g., $92856 \times 19 = 92856 \times 20 - 92856 = 1764264$

   The important point to note here is that all the above calculations, after one or two examples each, should be done orally, and hence, the students also should practise accordingly. Only when large numbers are dealt with should the student put part of the figures on paper.

❑ Multiplying two numbers both of Which are close to the Same power of 10

Suppose we want to multiply 97 with 92. The power of 10 to which these two numbers are close is 100. We call 100 as the base. Write the two numbers with the difference from the base, i.e., 100 (including the sign) as shown below.

$97 \rightarrow -3$ (because 97 is obtained as $100 - 3$)

$92 \rightarrow -8$ (because 92 is obtained as $100 - 8$)

Then, take the sum of the two numbers (including their signs) along either one of the two diagonals (it will be the same in both cases). In this example, the diagonal sum is $97 - 8 = 92 - 3 = 89$. This will form the first part of the answer.

The second part of the answer is the product (taken along with the sign) of the difference from the power of 10 written for the two numbers – in this example, it is the product of –3 and –8 which is 24.

Hence, putting these two parts 89 and 24 together one next to the other, the answer is 8924, i.e., the product of 97 and 92 is 8924.

NOTE

The product of the two deviations should have as many digits as the number of zeros in the base. For example, in this case, the product of –8 and –3 has 2 digits which is the same as the number of zeroes in 100.

Two-digit/three-digit multiplication method: The usual process of multiplying two digit and three digit numbers is time consuming. For example, consider the multiplication $234 \times 186 = 43524$

$$
\begin{array}{r}
2\ 3\ 4 \\
1\ 8\ 6 \\
\hline
1\ 4\ 0\ 4 \\
1\ 8\ 7\ 2 \\
2\ 3\ 4 \\
\hline
4\ 3\ 5\ 2\ 4 \\
\hline
\end{array}
$$

In the above method, we observe that in order to find the product of 234 and 186, which is 43524, we wrote three steps (1404, 1872, 234) that are not required. By avoiding these steps we could have saved some amount of time. The amount of time saved may be only 10 seconds per calculation. However, as there will be a large number of such calculations in the exam, you will end up saving a significant amount of time by using this method.

❑ Fractions and Percentages

While solving questions on simplification, sometimes, we may come across simplification of fractions. Simplification of fractions may involve addition, subtraction, multiplication and division. In Addition as well as Subtraction of fractions, we may come across fractions with different denominators. In such cases, the denominators are to be made equal by converting the denominators to their L.C.M.

❑ Reciprocals and Its Multiples

We come across a number of calculations of percentages in data interpretation and in some parts of quant. To do the calculations faster, if we can remember the reciprocals and its multiples, then we can do the calculations at a faster rate. For example, if we want to calculate 37.5% of 896, we can do it faster if we remember 37.5% (as 3/8) = $3/8 \times 896 = 3 \times 112 = 336$.

The important reciprocals are from 1/2 to 1/12 and their multiples. Once we memorize these, upto 12, remembering its multiples is not that difficult. For example,

1/8 = 12.5 %; 2/8 = 2 × 1/8 = 2 × 12.5% = 25%; 3/8 ⇒ 3 × 1/8 = 3 × 12.5 = 37.5%; 4/8 ⇒ 4 × 1/8 = 4 × 12.5 = 50% or 4/8 = 1/2 = 50%; 5/8 ⇒ 5 × 1/8 = 5 × 12.5 = 62.5%; 6/8 ⇒ 3/4 = 75%; 7/8 ⇒ 7 × 1/8 = 7 × 12.5 = 87.5%.

Similarly, we can remember all the multiples of reciprocals upto 12.

Conversion of fractions to percentages

1/2 = 50%,	1/3 = 33.33%,	1/4 = 25%,
	2/3 = 66.66%,	3/4 = 75%,

1/5 = 20%,	1/6 = 16.66%,	1/7 = 14.28%
2/5 = 40%,	5/6 = 83.33%,	2/7 = 28.57%,
3/5 = 60%,		3/7 = 42.85%,
4/5 = 80%,		4/7 = 57.13%,
		5/7 = 71.42%,
		6/7 = 85.72%,

1/8 = 12.5%,	1/9 = 11.11%,	1/11 = 9.09%,
3/8 = 37.5%,	2/9 = 22.22%,	2/11 = 18.18%,
5/8 = 62.5%,	4/9 = 44.44%,	3/11 = 27.27%,
7/8 = 87.5%,	5/9 = 55.55%,	4/11 = 36.36%,
	7/9 = 77.77%,	5/11 = 45.45%,
	8/9 = 88.88%,	6/11 = 54.54%,
		7/11 = 63.63%,
		8/11 = 72.72%,
		9/11 = 81.81%,
		10/11 = 90.9%,

1/12 = 8.33%,
5/12 = 41.66%,
7/12 = 58.33%,
10/12 = 83.33%,
11/12 = 91.66%

It will be very useful to memorize all the above values as it will help us to do the calculations very fast.

percentage calculations

In calculating the percentage value of a number, we usually go for multiplication. But that does not give the answer easily and quickly in most cases. Hence, an easier method called 10% concept, is suggested. In this approach, we take 10% of the denominator. To get close to the answer take further values like 1% and 0.1%.

For example: 23% = 10% × 2 + 1% × 3
43.2% = 10% × 4 + 1% × 3 + 0.1% × 2.
The following is the illustration of the same.
How to calculate the value of 36% of 1325?

Here, explain the concept of 10% and 1%. Therefore, for any value, say 1264, 10% of the value is obtained by simply shifting the decimal point by one place (or digit) to the left. Note that 1264 = 1264.0

10% of 1264.0 = 126.40 (i.e., the decimal point moves to the left by one place (or digit)). Similarly, 1% of 1264.0 will be obtained by shifting the decimal point by two places to the left. Hence, 1% of 1264.0 = 12.640.

Hence, 36% of 1325 = (40% − 4%) of 1325 = (4 × 10% − 4 × 1%) of 1325 = (4 × 132.5 − 4 × 13.25) = 530 − 53 = 477.

Similarly, consider another example, say, 18% of 3250 = (20% − 2%) of 3250
= (2 × 10% − 2 × 1%) of 3250 = (2 × 325 − 2 × 32.5) = 585.

If there is a 10% increase, then the new value will become 1.1 times the old value and in general if there is an increase of p%, the new value will become $\left(1 + \dfrac{p}{100}\right)$ times the old value. But sometimes converting the percentage into fraction maybe easier than this if there is an increase of 33.33%, then the new value will be 4/3 times the old value. Calculating in this way converting $33^1/_3$ into a fraction and simplifying is faster.

Whenever percentage increase cannot easily be converted into a convenient fraction, then the approximate percentage increase p, in integer form, must be found and then 1.p has to be used.

Comparison of Fractions

Comparison of fractions will be required in a number of problems in Data Interpretation and Quantitative Ability. Let us study some of the common methods of identifying out the largest or smallest of a given set of fractions.

Type 1: When two or more fractions have the same numerators and different denominators, the fraction with the largest denominator is the smallest.

Type 2: When the numerators are different and the denominators are same, the fraction with the largest numerator is the largest.

Type 3: The fraction with the largest numerator and the smallest denominator is the largest.

Type 4: When the numerators of two fractions are unequal, we try and equate them by suitably cancelling

factors or by suitably multiplying the numerators. Thereafter we compare the denominators as in Type 1.

Type 5: *A*: *For a fraction less than* 1.

If the difference between the numerator and the denominator is same, then the fraction with the larger values of numerator and denominator will be the largest.

B: *For a fraction greater than* 1.

If the difference between the numerator and denominator is same, then the fraction with the smaller values will be the largest.

Type 6: Another method of comparing fractions is by comparing the percentage changes in denominators and numerators. The important points to remember are that when two fractions are compared, if the percentage increase in the numerator is more than the percentage increase in the denominator (where the first fraction is taken as reference), then the second fraction is greater than the first fraction. Instead, if the percentage increase in the denominator is greater than that in the numerator, then the second fraction is smaller than the first.

❏ Approximations

'Approximate calculation' is one of the approaches in solving a problem / arriving at the answer to a question at a faster rate. With the help of approximate calculations, one can save a lot of time, and this can be utilized in other areas.

In most cases in various exams, the approach towards a question depends on the answer choices. From the answer choices, one should decide which method to follow—actual calculations or approximate calculations.

In most exams, for solving questions based on simplifications, data interpretation, ratios, percentages, etc., the use of approximations is very handy for solving the question at a faster pace. Approximation in any calculation depends on the degree of accuracy required. The closer the given answer choices, the greater the need for closer approximation.

Example: For which of the following values is the increase the highest?

(a) 3164 to 4072
(b) 2422 to 3218
(c) 4234 to 5866
(d) 1876 to 2761

In order to solve the above question, if we calculate accurately, we will get 4072 – 3164 = 908; 3218 – 2422 = 796; 5866 – 5234 = 632; 2761 – 1876 = 885.

If we try approximate calculations,
Rounded off to 4072 4100
Rounded off to 3164 3200
Here, the subtraction is very simple.
4100 – 3200 = 900.

During the process of rounding off, if the last two digits are 50 or greater than 50, then the figure must be rounded off to the next highest hundred. Otherwise, it should be rounded off to the next lowest hundred. Thus, 3164 would be rounded off to 3200, while 4072 would be rounded off to 4100. In fact, in such calculations, even the hundreds (i.e., the last two zeroes) need not be considered since the two zeroes are present in every case. This means that the above calculation would be further simplified by mentally treating it as 41 – 32 = 9. Other calculations can be done in a similar manner.

In case of multiplications like 389 × 1456, suppose the answer choices are given as below:

(A) 564322   (B) 565400
(C) 566384   (D) 572356

We can go for 390 × 1450 which is 565500 whereas the actual answer here is 566384. This is far from the actual answer. But as none of the answer choices lie between these values, this is the required answer. In the above calculation, only one answer ends with 4; hence, without actually calculating, we can say that Choice (C) is the answer.

Suppose the answer choices are closer, like

(A) 565424   (B) 566644
(C) 566384   (D) 572354

then the above approximation will not be useful. Then, the approach should be 1455 × 389 which gives us 565995. Hence, the answer should be very much close to 565995 but should be more than that which is 566384.

Suppose we have to calculate 37.22% of 1384.

The actual calculation takes around 45 seconds to 75 seconds, depending on the speed of the person.

Suppose the answer choices for the above calculation are mentioned as

(A) 564   (B) 515   (C) 529   (D) 542

As the answer choices are not very close, calculating for 40% and reducing that by 3% may be sufficient for answering the question.

10% of 1384 = 138.4. Four times that is ~554 and 3% is approximately equivalent to 42. Hence, the answer is ~554 – 42, i.e., ~512.

Therefore, the closest answer is 510.

Suppose the answer choices for the above calculation are mentioned as:

(A) 510.264 (B) 515.124
(C) 519.316 (D) 522.356

It is clear that the answers are very close. But if you approximate 37.22% equivalent to 37.5%, you can simply convert the calculation into 3/8 of 1384. As 1384 goes 173 times, the answer is 519. Hence, 519.316 cannot be the answer, as it should be less than 519 but very close to 519, which is 515.124.

If the answer choices are even closer than the above example, we go for subtraction of 28%, which is approximately 1/400th part of 1384. Hence, by using approximate calculations we can answer questions at a faster rate.

Now, let us consider another question.

Find the value of $\dfrac{5843}{31200} \times 100$

(A) 17.56 (B) 18.38 (C) 18.72 (D) 16.96

This ratio can be calculated faster by two very useful methods than by conventional division.

The first approach can be called the *'ten percent method'*. In this method, 10% of the denominator is first obtained by simply shifting the decimal point in the denominator it by one place to the left. Similarly, 1% of the denominator, 0.1%, etc., can also be successively obtained by shifting the decimal point to the left by one more place in each successive step. Then, the numerator is expressed as the nearest possible multiple of 10% of the denominator along with some excess or shortfall.

For example,

10% of 31200 = 3120

and

5843 = 1 × 3120 + 2723 (excess)

Again, the excess of 2723 can be expressed as a multiple of say,

5% of denominator plus some excess.

Half of 10% of 31200 = 5% of 31200 = 1560

Hence, 2723 = 5% of 31200 + 1163

Further, 1163 is slightly less than 4 times (1% of 31200), i.e., 1248.

Thus,

5843 ≅ (10% + 5% + 4%) of 31200 ≅ 19% of 31200.

The correct figure must be slightly less than 19% of 31200. Hence, from the choices, the answer can be Choice (C).

The second approach to quickly calculate the ratio $\dfrac{5843}{31200}$ is by using of the decimal equivalent values of the reciprocals of the first few natural numbers. In this approach, the numerator and denominator are first approximated as $\dfrac{5800}{31200}$, which is further approximated to $\dfrac{5.8}{31.2}$ which is close to $\dfrac{5.8}{3 \times 10.4}$

(i.e., 4% less than 19.3),

i.e., 18.54. But since in the first approximation we had taken 5800 instead of 5843, the answer has to be slightly more than 18.54. Thus, Choice (C) is the answer.

Find the value of $\dfrac{6164}{26879} \times 100$

(A) 21.68 (B) 22.16 (C) 22.93 (D) 23.37

By observing the given choices, we understand that the answer should be close to 22.22% (i.e., 2/9) (Here, one should remember reciprocals and their multiples). The calculation is:

$\dfrac{2}{9} \times 26879 = 5973$. As 5973 is about 190 less than 6164, we need to add about 190 to 5973. But as we are interested in percentages, 190 forms slightly more than 0.5% but less than 1%. The answer should be more than 22.7% but less than 23.22%. From the choices, only choice (C) is satisfied.

Find the value of (2911 / (3784 × 4)) × 100.

(A) 17.86 (B) 18.15 (C) 21. 76 (D) 19.23

Required value = $\dfrac{\left(\dfrac{6695 - 3784}{3784}\right) \times 100}{4}$

This is approximated as:

$\dfrac{6700 - 3800}{3800 \times 4} \times 100$

$= \dfrac{2900}{38 \times 4} = \dfrac{2900}{152}$

$\dfrac{2900}{152}$ is slightly less than $\dfrac{3000}{150} = 20$

Thus, 19.23% is close to 20%. Therefore Choice (D) is correct.

Approximations for divisions can be done in two ways. The first one is cross multiplication. The examples show how to solve an approximation problem using cross multiplication.

Therefore, we understand that approximations are very useful in additions, subtractions, multiplications, divisions, percentage calculations, etc.

❏ BoDMaS—Hierarchy of Arithmetic Operations

To simplify arithmetic expressions, which involve various operations like brackets, multiplication, addition, etc. a particular sequence of the operations has to be followed. For example, $2 + 3 \times 4$ has to be calculated by multiplying 3 with 4 and the result 12 added to 2 to give the final result of 14 (you should not add 2 to 3 first to take the result 5 and multiply this 5 by 4 to give the final result as 20). This is because in arithmetic operations, multiplication should be done first before addition is taken up.

The hierarchy of arithmetic operations are given by a rule called BODMAS rule. The operations have to be carried out in the order in which they appear in the word BODMAS, where different letters of the word BODMAS stand for the following operations:

(V   Vinculum)
B   Brackets
O   Of
D   Division
M   Multiplication
A   Addition
S   Subtraction

There are four types of brackets:

1. **Vinculum:** This is represented by a bar on the top of the numbers. For example,

    $2 + 3 - \overline{4 + 3}$; Here, the figures under the vinculum have to be calculated as $4 + 3$ first and the 'minus' sign before 4 is applicable to 7. Thus the given expression is equal to $2 + 3 - 7$ which is equal to -2.

2. **Simple Brackets:** These are represented by ( )

3. **Curly Brackets:** These are represented by { }

4. **Square Brackets:** These are represented by [ ]

The brackets in an expression have to be opened in the order of vinculum, simple brackets, curly brackets and square brackets, i.e., $[\{ (\overline{}) \}]$ to be opened from inside outwards.

After brackets is O in the BODMAS rule standing for 'of' which means multiplication. For example, 1/2 of 4 will be equal to $1/2 \times 4$ which is equal to 2.

After O, the next operation is D standing for division. This is followed by M standing for multiplication.

After Multiplication, A standing for addition will be performed. Then, S standing for subtraction is performed.

❏ Squares and cubes

In competitive examinations, there can be questions on direct application of squares, cubes, square-roots and cube-roots. For example, there can be a question which asks you to find the tens-digit of a four-digit perfect square. Also, an understanding of squares and cubes of useful while performing calculations.

Remembering squares (upto first 25 natural numbers), cubes (upto first 12 natural numbers) is very important in calculations. By remembering these (squares upto 25), one can calculate squares of any natural number from 26 to 125 in no time, which in turn will help in solving some other questions too. Similarly, by remembering cubes (upto 12) one can calculate cubes of any two-digit number with greater speed. Given below are some methods for finding squares and cubes of numbers.

How to find the square of a number ending in 5:

Getting the square of a number ending in 5 is very simple. If the last digit of the number is 5, the last two digits of the square will be 25. Consider the earlier part of the number and multiply it with one more than itself and that product will be the first part of the answer. (The second part of the answer will be 25 itself.)

$35^2 = 1225$ (Here, $3 \times 4 = 12$, so, the answer is 1225)
$45^2 = 2025$
$55^2 = 3025$
$75^2 = 5625$
$95^2 = 9025$
$125^2 = 15625$
$175^2 = 30625$
$195^2 = 38025$
$235^2 = 55225$
$245^2 = 60025$

So, now we know the squares of numbers 35, 45, 55, 75, etc. If we want to find the square of any other number ending in 5, we can find it using these squares which we already know.

To find the square of a number which is one more than the number whose square we already know:

For 26^2, we will go from 25^2; for 31^2 we go from 30^2 and so on.

One way is by writing $26^2 = (25+1)^2$. But we need not even calculate $(a + b)^2$ by adopting the following method;

$26^2 = 25^2 + 26^{th}$ odd number, i.e., $625 + 51 = 676$
$(a + b)^2 = a^2 + 2ab + b^2$

$26^2 = (25 + 1)^2$

$(25)^2 + 2(25 \times 1) + (1)^2$

$625 + 50 + 1 = 625 + 51 = 676$

But we will look at a different method which will enable the student perform the calculations for squares mentally.

$1^2 = 1 = 1$

$2^2 = 4 = 1 + 3$

$3^2 = 9 = 1 + 3 + 5$

$4^2 = 16 = 1 + 3 + 5 + 7$

$5^2 = 25 = 1 + 3 + 5 + 7 + 9$

i.e., to get n^2, we add up the first n odd numbers. If we want 13^2, it will be the sum of the FIRST 13 odd numbers.

n^{th} odd number is equal to $(2n - 1)$.

Suppose we want to find out 6^2, knowing what 5^2 is, we can move from 5^2 to 6^2.

6^2 will be the sum of 1st 6 odd numbers. But the sum of the first 6 odd numbers can be written as 'sum of the first 5 odd numbers' + 'sixth odd number'. Since we already know that the sum of the first 5 odd numbers is 5^2, i.e., 25, we need to add the sixth odd number, i.e., $(2 \times 6 - 1 =)$ 11 to 25 to give us $6^2 = 36$.

Similarly

$31^2 = 900 + 31\text{st odd number} = 900 + 61 = 961$

$36^2 = 1225 + 36^{th} \text{ odd number} = 1225 + 71$

$= 1296$ (Since $35^2 = 1225$)

$41^2 = 1600 + 81 = 1681$

$46^2 = 2025 + 91 = 2116$

$126^2 = 15625 + 251 = 15876$

$196^2 = 38025 + 391 = 38416$

$216^2 = 46225 + 431 = 46656$

We have now seen how to find the squares of numbers which are one more than those numbers whose squares we already know (e.g., 25, 30, 35, etc.)

To find the square of a number which is one less than the number whose squares we already know

Similarly, we can find the squares of numbers which are one less than the numbers whose squares are known. For example,

$29^2 = 30^2 - 30^{th} \text{ odd number}$

$= 900 - 59 = 841$

$39^2 = 40^2 - 40^{th} \text{ odd number} = 1600 - 79 = 1521$

$34^2 = 1225 - 69 = 1156$

$54^2 = 3025 - 109 = 2916$

$74^2 = 5625 - 149 = 5476$

$94^2 = 9025 - 189 = 8836$

$214^2 = 46225 - 429 = 45796$

Thus, we have seen how to arrive at the squares of numbers which are one more or one less than the numbers whose squares we already know (i.e., 25, 30, 35, 40, 45, 50, 55, etc.).

To find the square of a number which is 2 more than the number whose squares we already know:

Now, we will see how to get the squares of numbers which are 2 more (or less) than the numbers whose squares we already know.

$27^2 = 26^2 + 27^{th} \text{ odd number} = 25^2 + 26^{th} \text{ odd number} + 27^{th} \text{ odd number}$.

The sum of the 26th odd number and 27th odd number is the same as 4 times 26. Hence,

$27^2 = 25^2 + 4 \times 26 = 625 + 104 = 729$

$57^2 = 3025 + 224 \text{ (4 times 56)} = 3249$

$77^2 = 5625 + 304 \text{ (4 times 76)} = 5929$

$97^2 = 9025 + 384 \text{ (4 times 96)} = 9409$

To find the square of a number which is 2 less than the number whose squares we already know

Similarly, we can find out the squares of numbers which are 2 less than the numbers whose squares we know.

$28^2 = (30^2 - 4 \text{ times } 29) = 900 - 116 = 784$

$53^2 = (55^2 - 4 \text{ times } 54) = 3025 - 216 = 2809$

$93^2 = 9025 - 376 = 8649$

$243^2 = 60025 - 976 = 59049$

$143^2 = (145^2 - 4 \times 144) = 21025 - 576 = 20449$

To find the square of a number from 26 to 50

The squares of numbers from 26 to 50 can be calculated by writing down and adding two parts as explained below:

The first part is as many times 100 as the number is more than 25, for example in finding 31^2, as 31 is 6 more than 25, the first part is $100 \times 6 = 600$.

The second part is the square of the number that is as much less than 25 as the number is more than 25, i.e., in finding 31^2, the second part is the square of 6 less than 25, i.e., $(25 - 6)^2 = 19^2 = 361$.

Hence, $31^2 = $ First part + Second part $= 600 + 361 = 961$.

The above method can be summarized as

1. Finding 31^2
   (i) $31 = 25 + 6$
   (ii) $25 - 6 \rightarrow 19^2 \rightarrow 361$
   (iii) $31^2 = 6 \times 100 + 361 = 961$
2. Finding 33^2
   (i) $33 = 25 + 8$
   (ii) $25 - 8 \rightarrow 17^2 \rightarrow 289$
   (iii) $31^2 = 8 \times 100 + 289 = 1089$

To find the square of a number from 51 to 75:

The squares of numbers from 51 to 75 can be calculated by writing down two parts, each of which is a two-digit number, adjacent to each other as explained below:

The second part is the two-digit number formed by the two digits which are to the extreme right of the square of the number by which the given number is more than 50.

For example, in finding 63^2, as 63 is 13 more than 50, the second part will be the two digits to the extreme right of 13^2 (= 169), i.e., 69. Since there are more than two digits in 13^2, the digit to the extreme left, i.e., 1, is taken as carry forward and is to be added to the first part.

The first part is the sum of (i) the carry forward, if any, from the second part and (ii) the sum of 25 (for this range (i.e., 51 to 75) 25 is taken as the base) and the number by which the given number is more than 50.

As 63 is 13 more than 50, the first part will be 25 + 13 + 1 (carry forward from the second part) = 39

Therefore 63^2 = 39 69

The above can be summarized as

      First Part   Second Part
1. 63^2 = (25 + 13) / 13^2 = 38 / 69 = 38 + 1 / 69
   = 39 69
                         C.F

      First Part   Second Part
2. 61^2 = (25 + 11) / 11^2 = 36 / 21 = 37 21
                         C.F

      First Part   Second Part
3. 56^2 = (25 + 6) / 6^2 = 31 / 36 = 31 36

> **NOTE**
>
> This process is faster for squares in the range of 50 to 60, as there is no carry forward.

To find the square of a number from 76 to 100:

The squares of numbers from 76 to 100 can be calculated by writing down two parts, each of which is a two-digit number, adjacent to each other as explained below:

The second part is the two-digit number formed by the two digits to the extreme right of the square of the number by which the given number is less than 100.

For example in 88^2, as 88 is 12 less than 100, the second part will be the two digits to the extreme right of 12^2 (= 144), i.e., 44. Since there are more than two digits in 12^2, the digit to the extreme left, i.e., 1, is taken as carry forward and is to be added to the first part.

The first part is the sum of (i) the carry forward, if any, from the second part and (ii) the difference between the given number and the number by which the given number is less than 100. As 88 is 12 less than 100, the first part will be 88 – 12 + 1(carry forward from the second part) = 77.

Therefore, 88^2 = 77 44

The above can be summarized as

      First Part   Second Part
1. 88^2 = (88 – 12) / 12^2 = 76 / 44 = (76 + 1) / 44
   = 77 44
                         C.F

      First Part   Second Part
2. 89^2 = (89 – 11) / 11^2 = 78 / 21 = 79 21
                         C.F

      First Part   Second Part
3. 96^2 = (96 – 4) / 4^2 = 92 / 16 = 92 16

> **NOTE**
>
> This process is faster for squares in the range of 90 to 100, as there is no carry forward.

To find the square of a number from 101 to 125:

The squares of numbers from 101 to 125 can be calculated by writing down two parts, each of which is a two-digit number, adjacent to each other as explained below:

The second part is the two-digit number formed by the two digits to the extreme right of the square of the number by which the given number is more than 100. For example, finding 112^2, as 112 is 12 more than 100, the second part will be the two digits of 12^2 (= 144), i.e., 44. Since there are more than two digits in 12^2, the digit to the extreme left, i.e., 1, is taken as carry forward and is to be added to the first part.

The first part is the sum of (i) the carry forward, if any from the second part and (ii) the sum of the given number and the number by which the given number is more than 100. As 112 is 12 more than 100, the first part will be 112 + 12 + 1 (carry forward from the first part) = 125.

Therefore, 88^2 = 125 44

The above can be summarized as

      First Part   Second Part
1. 112^2 = (112 + 12) / 12^2 = 124 / 44 = (124 + 1) / 44 = 125 44
                         C.F

2. $113^2 = (113 + 13) / 13^2 = 126 / 169 = 127\ 69$

$\underset{\text{C.F}}{\curvearrowright}$

3. $106^2 = (106 + 6) / 6^2 = 112/36 = 112\ 36$

By observing and remembering a few properties regarding the behaviour of the last digits of numbers and of their squares and cubes, it is sometimes possible to solve certain kinds of questions. Hence, some of the important properties of the last digits of numbers are given below:

Last digit of any number 0 1 2 3 4 5 6 7 8 9
Last digit of its square 0 1 4 9 6 5 6 9 4 1
Last digit of its cube 0 1 8 7 4 5 6 3 2 9

Some important observations:

1. The square of a number can never end with 2, 3, 7 or 8.
2. Any power of any number ending in 0, 1, 5 or 6 ends with 0, 1, 5, 6, respectively.
3. If the last digits of two numbers are 10's complements, then the last digits of their squares will be equal. Hence, if the last digit of the square of a number is given, it is not possible to determine the last digit of that number uniquely. For example if n^2 ends with 9, n may end with 3 or 7.
4. We can uniquely determine the last digit of a number given the cube of that number, for example $(...)^3 = \_3$, the number can end only in 7.
5. If the last digits of two numbers are 10's complements, then last digits of their cubes will be also 10's complements.
6. The square of a number with only n 1's, where n is a single digit number, will always be a palindrome. For example:
$11^2 = 121$; $111^2 = 12321$; $1111^2 = 1234321$. In general, $(1111...\ n\ \text{times})^2 = 123...n^{n-1}...1$
7. The last two digits of any power of a number ending in 25 or 76 always end in 25 and 76, respectively.
8. (a) If the square of any number is ending in 1, then the ten's digit of that square should be an even number.
   (b) If the square of any number is ending in 4, then the ten's digit of that square should be an even number.
   (c) If the square of any number is ending in 5, then the ten's digit of that square should be 2.
   (d) If the square of any number is ending in 6, then the ten's digit of that square should be an odd number.
   (e) If the square of any number is ending in 9, then the ten's digit of that square should be an even number.

❏ powers of 2 and 3

Remembering powers of 2 up to 12 and powers of 3 up to 8 will be of great help. It has been observed that various competitive examinations have direct questions on the application of these.

Property for the powers of 2:

$2^0 = 1,$ $\quad 2^1 = 2,$ $\quad 2^2 = 4,$ $\quad 2^3 = 8$
$2^4 = 16,$ $\quad 2^5 = 32,$ $\quad 2^6 = 64,$ $\quad 2^7 = 128$
$2^8 = 256,$ $\quad 2^9 = 512,$ $\quad 2^{10} = 1024,$ $\quad 2^{11} = 2048$

By observing the following, we can see that

$2^0 + 2^1 \qquad\qquad\qquad = 3 = 2^2 - 1$
$2^0 + 2^1 + 2^2 \qquad\qquad = 7 = 2^3 - 1$
$2^0 + 2^1 + 2^2 + 2^3 \qquad = 15 = 2^4 - 1$

Similarly,

$2^0 + 2^1 + 2^2 + 2^3 + 2^4 = 31 = 2^5 - 1$

That is, the sum of powers of 2 from 0 to any number k will be equal to $2^{k+1} - 1$.

The above concept can be used in the following example:

For example, the sum $2^0 + 2^1 + ...\ 2^n$ is equal to $(2^{n+1} - 1)$. This can help us arrive at the answer to a question like 'If ten brothers have some marbles each, such that every brother, except the youngest, has twice the number of marbles than that the brother immediately younger to him has, then find the least possible total number of marbles with the ten brothers'.

To have the least total, the youngest should have the least number of marbles, i.e., only one marble.

The second youngest will have 2 (i.e., 2^1), the next brother will have 4 (i.e., 2^2) and so on.

The eldest will have 2^9. The sum of all the marbles with them will be $2^0 + 2^1 + 2^2 + ...\ 2^9 = 2^{9+1} - 1 = 2^{10} - 1$ $= 1024 - 1 = 1023$.

Property for the powers of 3:

$3^0 = 1,$ $\quad 3^1 = 3,$ $\quad 3^2 = 9,$ $\quad 3^3 = 27$
$3^4 = 81,$ $\quad 3^5 = 243,$ $\quad 3^6 = 729,$ $\quad 3^7 = 2187$
$3^0 + 3^1 + 3^2 + 3^3 = 40$

Using a combination of these numbers, each occurring at the most once, we can obtain all the numbers from 1 to 40 by using the operation of only addition and/or subtraction.

The above concept can be used in the following example.

Solved Examples

2.01. 342 + 557 + 629 + 746 + 825 =?

Sol: When we are adding three-digit numbers, first add two-digits at a time (units and tens place). 42 + 57 + 29 + 46 + 25 = 199.

To add 42 and 57, mentally treat 57 as 50 + 7 (50 would facilitate quick addition).

Thus, 42 + 57 = (42 + 50) + 7 = 92 + 7 = 99.

Similarly, 99 + 29 = (99 + 20) + 9 = 128.

128 + 46 = (128 + 40) + 6 = 174.

174 + 25 = (174 + 20) + 5 = 199.

The last two digits (the units place and the tens place) of the addition are 99, while the digit 1 is to be carried forward).

Now add

1(carried) + 3 + 5 + 6 + 7 + 8 = 30.

∴ The result of the addition is 3099.

The same logic can be extended to four-digit additions.

2.02. 6965 + 3246 + 1234 + 9847 + 8238 =?

Sol: Part II

[2∗ + 69]	= 71	69
[(71 + 30) + 2]	= 103	32
[(103 + 10) + 2]	= 115	12
[(115 + 90) + 8] ∗∗	= 213	98
[(213 + 80) + 2]	= 295	82
		295

Part I

65

46	[(65+40)+ 6]	= 111
34	[(111+30) + 4]	= 145
47	[(145+40) + 7]	= 192
38	[(192+30)+ 8]	= 230 from here, we carry forward 2

30

[∗ The 2 shown here is the carry forward indicated at bottom-right].

[∗∗ Alternatively, this calculation can be performed as 115 + 100 − 2 = 215 − 2 = 213].

2.03. 1598 + 5423 + 4627 +7953 + 8675 =?

Sol: Part II

(2∗ + 15)	= 17	15
[(17 + 50) + 4]	= 71	54
[(71 + 40) + 6]	= 117	46
[(117 + 70) + 9]	= 196	79
[(196 + 80) + 6]	= 282	86
		282

Part I

98

23	[(98 + 20) + 3]	= 121
27	[(121 + 20) +7]	= 148
53	[(148 + 50) + 3]	= 201
75	[(201 + 70) + 5]	= 276
76		

2.04. 987 − 256 =?

Sol: Instead of taking a single digit at a time, subtractions would be faster by taking two digits i.e., 87 − 56 = 31.

900 − 200 = 700

∴ The result of 987 − 256 = 731

2.05. 824 − 587 =?

Sol: Take 100s complement of 87 (i.e., 100 − 87) which is 13 and add it to 24. The result is 37. This gives the units and tens digits of the result. Since 24 < 87, we have actually subtracted 87 from 124, i.e., we have borrowed 1 from 8 (of 824). Therefore we now do (7 − 5) = 2. The result is 237.

2.06. 9217 − 858 =?

Sol: Adding 100s complement of 58 (which is 42) to 17, we get (42 + 17) = 59 which gives the units and 10s digits of the result.

Since 58 is greater than 17, we have to borrow 1 from 92 which leaves us with 91. So, the first part of the answer is 91− 8(= 83)

Hence, the result is 8359.

2.07. 934 − 286 + 847 − 798 =?

Sol: When we have a combination of additions and subtractions, first add all the numbers with + sign before them and add all the numbers with − sign before them.

i.e., (934 + 847) − (286 + 798) = 1781 − 1084.

By applying the method explained in previous examples, 1781 − 1084 = 697.

2.08. Find the product of 113 and 118.

Here, both the numbers are greater than 100 and the base here is 100. Taking the difference of the two numbers 113 and 118 from the base, we get +13 and +18 and write them as below.

113	→	+ 13
118	→	+ 18
--------		--------
131		234

The first part of the answer is the cross-total of 113 and +18 which is 131. The second part of the answer, i.e., the product of the deviations (+13 and +18) is equal to 234. But we said there should be as many digits in this product as the number of zeroes in the base (which is 100 here). Since the base has two zeroes, the second part of the answer should also have two digits. Since 234 has three digits, we should retain two digits 4 and 3 and carry forward the third digit 2 to the first part of the answer. Hence, the first part of the answer now becomes 133 and the second part is 34. The product of 113 and 118 is thus equal to 13334.

2.09. Find the product of 109 and 93.
Here, one number is greater than 100 and the other is less than 100. Write the differences from 100 (the closest power of 10) along with the sign of the deviation.

```
109        →        +9
 93        →        −7
-----              -----
102                −63      Ans. 10137
```

The first part of the answer is the cross-total (of 109 and −7 or of 93 and +9) 102. The second part of the answer is the product of +9 and −7 which is −63. Since we cannot have a negative figure as a part of the answer, we need to convert this to a positive number. For this purpose, we borrow the necessary figure from the first part of the answer. Each unit borrowed from the first part of the answer, when it is brought to the second part, becomes equal in value to the base used. If we borrow 1 from the first part (102 here), we are left with 101 for the first part and the 1 that is borrowed becomes 100 for the second part. The second part now is 100 (borrowed) plus -63 (originally there) which is equal to 37. The final result is obtained by putting the first and the second part together. Hence, the product of 109 and 93 is 10137.

2.10. Find the product of 117 and 88.

```
117        →        +17
 88        →        −12
-----              --------
105                −204     Ans. 10296
```

Please note that to take care of −204 of the second part, borrowing a 1 from the first part is not sufficient (because the 100 it becomes when it comes to the second part is not numerically

greater than −204). So, we should borrow 3 from 105 (leaving 102 as the first part) which becomes 300 in the second part to which −204 should be added giving us 96. Hence, the product of 117 and 88 is 10296.

2.11. Find the product of 997 and 983.
Here, both the numbers are close to 1000 – they are both less than 1000.

```
997        →        −3
983        →        −17
-----              ------
980                +51      Ans. 980051
```

The second part 51 has only two digits whereas the base 1000 has three zeroes—so, 51 will be written as 051. Hence, the product is 980051.

2.12. Find the product of 1013 and 981.

```
1013       →        +13
 981       →        −19
------             ------
 994               −247     Ans. 993753
```

The second part is −247 and if we borrow 1 from the first part (the first part itself will then become 993), it becomes 1000 in the second part. So, the second part will effectively be 1000 − 247 = 753. Since the base is 1000, the second part should have three digits and 753 has three digits. Hence, the product of 1013 and 981 is 993753.

We can also extend this method to find the product of two numbers which may not be close to a power of 10 but both of which are close to a multiple of a power of 10. This requires a little bit of modification to the method as discussed in the examples below.

2.13. Find the product of 297 and 292.
Here, the numbers are not close to any power of 10 but are close to 300 which is a multiple of 100 which itself is a power of 10. So, we adopt 300 as a 'temporary base'. This temporary base is a multiple (or a sub-multiple) of the main base 100. Here, the temporary base 300 = 3 × 100. Then, the procedure of finding out the deviation from the base, getting the cross-totals and the product of the deviations should be done in a manner similar to the previous cases except that the deviations will be taken from the temporary base.

```
297        →        −3        (289 × 3 = 867)
292        →        −8
-----              ------
289                +24     Ans. 86724
```

We have got the first part of the answer as 289 and the second part of the answer as 24. But before we put these two parts together to get the final result, one more step is involved. The first part of the answer is not the final figure—this is an intermediate stage of the first part. This first part should be multiplied by the same figure with which the power of 10 is multiplied to get the temporary base. In this case, we multiplied 100 (which is the power of 10) by 3 to get the temporary base 300. So, the intermediate stage figure of the first part (289) will also have to be multiplied by 3 to get the final figure for the first part. Hence, the first part will be 867 (= 3 × 289). Now putting the first and the second parts together, the product of 297 and 292 is 86724 (Please note that the product of the deviations should still have as many digits as the number of zeroes in the base—in this case two because 100 has two zeroes).

2.14. Find the product of 287 and 281.

```
287      →       −13      (268 × 3 = 804)
281      →       −19
-----            ------
268              247      Ans. 80647
```

Here, the product of the deviations is 247—there are three digits in this whereas the base has only two zeroes. So, the digit 2 has to be carried forward to the first part of the answer but this carrying forward should be done only after the intermediate stage figure of the first part is multiplied suitably to get the final figure of the first part (in this case, 268 multiplied by 3 gives 804 as the first part of the answer). To this add 2 which is the carry forward digit from the second part and we get 806. Hence, the product of 287 and 281 is 80647.

2.15. Find the product of 317 and 291.

```
317      →       +17      (3 × 308 = 924)
291      →       −9
-----            ------
308              −153     Ans. 92247
```

Here, since one number is greater than 300 and the other is less than 300, the product of the deviations is negative. To make the second part positive, we need to borrow from the first part. But the borrowing should be done only after the intermediate stage figure of the first part is multiplied by the suitable digit to get the final figure of the first part. In this case, we get 308 × 3 = 924 as the final form of the first part. Now to take

care of the negative second part of −153, we need to borrow 2 from the first part because the main base is 100, 2 borrowed becomes 200). The final form of the second part is 200 − 153 = 47. So, the product of 317 and 291 is 92247.

2.16. Find the product of 513 and 478.

```
513      →       +13      (491 × 5 = 2455)
478      →       −22      300 − 286 = 14
-----            -------
491              −286     Ans. 245214
```

We can look at one more extension of this method where the numbers are not close to the same power of 10 but are close to two different powers of 10. We can multiply such numbers by making a simple modification to this method.

2.17. Find the product of 979 and 92.
(by adding 0 to the number 92, it becomes 920)

```
979      →       −21
920      →       −80
-----            --------
899              +1680    Ans. 900680
```

Here, 979 is close to 1000 and 92 is close to 100. For finding the product, we force 92 also close to 1000 by taking it as 920. Then, apply our regular method and find the product of 979 and 920. From the resulting product drop the zero at the units place to give the correct result for the product of 979 and 92.

So, drop the 0 in units place. Hence, the product of 979 and 92 is 90068.

In some cases, the algebraic rule $a^2 - b^2 = (a - b)(a + b)$ will be very helpful to find the product of two numbers. For example, if we have to find the product of 132 and 118, rather than applying the method discussed in detail above, we can use the algebraic rule discussed just now.

132 can be written as $(125 + 7)$ and 118 can be written as $(125 − 7)$. So, the product of 132 and 118 will be $125^2 − 7^2$. Since we have already discussed methods for calculating squares faster, this method can thus prove to be of immense help in a number of situations provided the student practices sufficiently.

There will be other short cut methods also for a variety of calculations, but the student has to note that none of these will be useful to him in an examination situation unless regular practice is there in using such methods. The student himself should take figures and keep applying various methods for practice on a regular basis.

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2.18. Find the product of 24 and 56.

Sol: Step 1:

$6 \times 4 = 24$

to be carried forward (C.F.) to the next step.
Step 2:
$(2 \times 6) + (4 \times 5) + 2 \text{ (C.F.)}$

$= 34$

to be carried forward (C.F.) to the next step.
Step 3:

$(5 \times 2) + 3 \text{ (C.F.)}$

$= 13$

∴The product of 24 and 56 is 1344.
By observing the above calculation, we summarise the calculations as:
Step 1: Multiply the right most digits vertically (i.e., 6 4)
Step 2: Cross multiply and add the carry forward (C.F.) number $(6 \times 2 + 5 \times 4 + \text{C.F.})$
Step 3: Multiply the left most digits vertically and add the C.F. (i.e., $5 \times 2 + \text{C.F.}$)

2.19. Find the product of 346 and 527.

Sol: Step 1:

$7 \times 6 = 42$

to be carried forward (C.F.) to the next step.

Step 2:
$(7 \times 4) + (2 \times 6) + \text{(C.F.)}$

$= 44$

Step 3:

$7 \times 3 + 2 \times 4 + 5 \times 6 + 4 \text{ (C.F.)}$

$= 63$

Step 4:
$2 \times 3 + 5 \times 4 + 6 \text{(C.F.)}$

$= 32$

to be carried forward (C.F.) to the next step.
Step 5:
$5 \times 3 + 3 \text{ (C.F.)}$

$= 18$

∴The product of 346 and 527 is 182342.
With the help of the above methods, we can also find the square of any number. For example to find the square of 44,

2.20. $\dfrac{4}{9} + \dfrac{13}{18} + \dfrac{7}{54} = ?$

Sol: The L.C.M. of the denominators 9, 18 and 54 is 54. [The L.C.M. should be calculated mentally] Let us find the numerators.

As 9 has to be multiplied by 6 to get 54, the numerator 4 is multiplied by 6, i.e., $4 \times 6 = 24$.

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Similarly $13 \times 3 = 39$ and $7 \times 1 = 7$.

$$\therefore \frac{4}{9} + \frac{13}{18} + \frac{7}{54} = \frac{24}{54} + \frac{39}{54} + \frac{7}{54}$$

$$= \frac{24 + 39 + 7}{54} = \frac{70}{54} = \frac{35}{27}$$

2.21. $\dfrac{7}{18} - \dfrac{11}{24} + \dfrac{13}{36} = ?$

Sol: The L.C.M. of the denominators 18, 24 and 36 is 72.

36 is divisible by 18, so, the L.C.M. of 18 and 36 is 36. To find the L.C.M. of 24 and 36, take the larger number, i.e., 36 and its multiples 72, 108, etc. 36 is not divisible by 24. So, L.C.M. is not 36. 72 is divisible by 24. So, the L.C.M. is 72. The denominator of the resultant fraction is 72.

$$\frac{7}{18} - \frac{11}{24} + \frac{13}{36} = \frac{28}{72} - \frac{33}{72} + \frac{26}{72} = \frac{21}{72} = \frac{7}{24} =$$

2.22. 37.5 % of 1248 =

Sol: 37.5% = 3/8

$$\therefore 37.5\% \text{ of } 1248 = 3 \not{8} \times 1248$$
$$= 3 \times 156 = 468$$

2.23. 42.85% of 2114 =

Sol: 42.85% = 3/7

$$\therefore 42.85\% \text{ of } 2114 = 3 \not{7} \times 2114 = 3 \times 302 = 906$$

2.24. 63.63% of 2233 =

Sol: 63.63% = 7/11

$$\therefore 63.63\% \text{ of } 2233 = 7 \not{11} \times 2233 = 7 \times 203 = 1421$$

2.25. 58.33% of 2184 =

Sol: 58.33% = 7/12

$$\therefore 58.33\% \text{ of } 2184 = 7 \not{12} \times 2184 = 7 \times 182 = 1274$$

2.26. 44.44% of 8127 =

Sol: 44.44% = 4/9

$$\therefore 44.44\% \text{ of } 8127 = 4 \not{9} \times 8127 = 4 \times 903 = 3612$$

2.27. What is 20% of 1205?

Sol: Method 1
20% = 1/5
20% of 1205 = 1/5 of 1205 = 241
Method 2

$$10\% = \frac{10}{100} = 0.1$$

10% of 1205 = (0.1) (1205) = 120.5
∴ 20% of 1205 = 120.5 × 2 = 241

2.28. Find 22% of 4568

Sol: 20% (10% × 2) = 456.8 × 2 = 913.6
+ 2% = 1/10 × 20% = 91.36
22% = 1004.96

2.29. Find 36% of 183.5

Sol: Method 1
30% (10% × 3) = 183.5 × 3 = 550.5
+ 6% = 1/5 × 30% = 110.1
36% = 660.6
Method 2
40% (10% × 4) = 183.5 × 4 = 734
− 4% = 1/10 of 40% = − 73.4
36% = 660.6

2.30. Find the value of 26% of 496.

Sol: 26% = 25% + 1%
25% of 496 = 1/4 of 496 = 124
$\quad$ + $\qquad\qquad$ +
1% of 496 $\qquad$ = 4.96
26% of 496 $\qquad$ = 128.96

2.31. Find the value of 35.6% of 928.

Sol: 10% of 928 $\quad$ = 92.8
30% of 928 $\quad$ = 92.8 × 3 = 278.4
5% of 928 $\quad$ = 46.4
0.1% of 928 $\quad$ = 0.928
35.6% $\qquad$ = 30% = 278.4
+5% $\qquad$ = 46.4
+0.5% $\qquad$ = 4.6
+0.1% $\qquad$ = 0.9
$\qquad\qquad$ 330.3
30% + 5% + 0.5% + 0.1% =
278.4 + 46.4 + 4.6 + 0.9 = 330.3

2.32. 39 is what percent of 186?

Sol: The number that follows 'of' should always come in the denominator.

So, $\dfrac{39}{186} \times 100$ is to be calculated.

10% of the denominator is 18.6
20% of the denominator is 18.6 × 2 = 37.2
1% of the denominator is 1.86
21% of the denominator is 37.2+ 1.86 ~ 39

$$\therefore \frac{39}{186} \square 21\%$$

2.33. 457 is what percent of 1382?

Sol: 1/3 × 1382 ≅ 461 = 33.33%
461 − 457 = 4 ≅ 3 x 1.38 = 0.3%

$$\therefore \frac{457}{1382} = 33.33\% - 0.3\% = 33.03\%$$

2.34. Which of the following fractions is the smallest?

$$\frac{3}{5}, \frac{3}{7}, \frac{3}{13}, \frac{3}{8}$$

Sol: 13 is the largest denominator, hence, 3/13 is the smallest fraction. 5 is the smallest denominator, hence, 3/5 is the largest fraction.

2.35. Which of the following fractions is the smallest?

$$\frac{7}{5}, \frac{9}{5}, \frac{4}{5}, \frac{11}{5}$$

Sol: As 4 is the smallest numerator, the fraction 4/5 is the smallest.
As 11 is the largest numerator, the fraction 11/5 is the largest.

2.36. Which of the following fractions is the largest?

$$\frac{19}{16}, \frac{24}{11}, \frac{17}{13}, \frac{21}{14}, \frac{23}{15}$$

Sol: As 24 is the largest numerator and 11 is the smallest denominator, $\frac{24}{11}$ is the largest fraction.

2.37. Which of the following fractions is the largest?

$$\frac{64}{328}, \frac{28}{152}, \frac{36}{176}, \frac{49}{196}$$

Sol: $\frac{64}{328} = \frac{32}{164} = \frac{16}{82} = \frac{8}{41} \approx \frac{1}{5}$

$\frac{28}{152} = \frac{14}{76} = \frac{7}{38} \approx \frac{1}{5.5}$

$\frac{36}{176} = \frac{18}{88} = \frac{9}{44} \approx \frac{1}{5}$

$\frac{49}{196} = \frac{7}{28} = \frac{1}{4}$

As all the numerators are 1 and the least denominator is 4, the fraction $\frac{49}{196}$ is the largest.

2.38. Which of the following fractions is the largest?

$$\frac{71}{181}, \frac{214}{519}, \frac{429}{1141}$$

$\frac{71}{181} = \frac{71 \times 6}{181 \times 6} = \frac{426}{1086}$

$\frac{214}{519} = \frac{214 \times 2}{519 \times 2} = \frac{428}{1038}$

Sol: The numerators are now all almost equal (426, 428 and 429). The smallest denominator is 1038. Hence, the largest fraction must be

$\frac{428}{1038}$, i.e., $\frac{214}{519}$

2.39. Which of the following fractions is the largest?

$$\frac{31}{37}, \frac{23}{29}, \frac{17}{23}, \frac{35}{41}, \frac{13}{19}$$

Sol: The difference between the numerator and the denominator of each fraction is 6. Therefore, the fraction with the largest numerals, i.e., 35/41 is the greatest and the fraction with the smallest numerals, i.e., 13/19 is the smallest.

2.40. Which of the following fractions is the largest?

$$\frac{31}{27}, \frac{43}{39}, \frac{57}{53}, \frac{27}{23}, \frac{29}{25}$$

Sol: As the difference between the numerator and the denominator is same, the fraction with the smallest values, i.e., $\frac{27}{23}$, is the largest.

We can also compare fractions as follows.
For example, to compare 5/13 and 9/20 make the numerator 1 for all the fractions by approximately dividing the denominator with the respective numerator (upto first decimal place).

$\therefore \frac{5}{13} \cong \frac{1}{2.6}$ and $\frac{9}{20} \cong \frac{1}{2.2}$

Now, clearly $\frac{1}{2.6} < \frac{1}{2.2}$ (from rule (ii) above)

$\Rightarrow \frac{5}{13} < \frac{9}{20}$

2.41. Which of the following fractions is the largest?

$$\frac{15}{17}, \frac{23}{29}, \frac{31}{34}, \frac{11}{15}$$

Sol: Comparing fractions

$\frac{15}{17}$ and $\frac{23}{29}$

The numerator of the fraction has increased from 15 to 23, i.e., $\frac{8}{15}$, i.e., a little more than 50%. The denominator of the fraction has increased from 17 to 29, i.e., 12/17, i.e., well over 50%. As the percentage increase in the numerator is less than the percentage increase in the denominator, the

fraction $\dfrac{15}{17} > \dfrac{23}{29}$ Now compare. $\dfrac{15}{17}$ with $\dfrac{31}{34}$

As the change in the numerator is more than double (15 to 31), and the change in the denominator is exactly double, the fraction $\dfrac{15}{17} < \dfrac{31}{34}$.

$\left(\text{Alternately, } \dfrac{15}{17} = \dfrac{30}{34} \quad \dfrac{15}{17} < \dfrac{31}{34}\right)$

Now compare $\dfrac{11}{15}$ and $\dfrac{31}{34}$.

The numerator has almost tripled from 11 to 31 whereas the denominator has just over doubled from 15 to 34. Since the increase in numerator is greater than the increase in the denominator,

$$\dfrac{11}{15} < \dfrac{31}{34}$$

So, $\dfrac{31}{34}$ is the largest fraction.

2.42. Find the value of x.

$$\dfrac{38}{154} = \dfrac{x}{190}$$

Sol: $x = \dfrac{38 \times 190}{154} = \dfrac{19}{77} \times 190 \approx \dfrac{1}{4} \times 190 \approx 47.5$

The second method is to find the approximate ratio of the numerators or denominators and arrive at the solution. This is illustrated in the following two examples.

2.43. Find the value of x.

$$\dfrac{54}{238} = \dfrac{11}{x}$$

Sol: $x = \dfrac{119}{27}(11) = \dfrac{108 + 11}{27}(11) = 44 + \dfrac{121}{27}$

$= 44 + 4\dfrac{13}{27} \cong 48.5$

2.44. Find the value of x

$$\dfrac{125}{220} = \dfrac{176}{x}$$

175 is 40% more than 125
$\therefore x$ is ~40% more than 220, i.e., 308.

2.45. $16 + \dfrac{3}{4}$ of

$\left[32 - 16 \div 4 \times 6 + \overline{23 - 11} + 3 - 2 \times 6\right] = ?$

(A) 89/4 (B) 77/4
(C) 97/4 (D) 81/4

Sol: $16 + \dfrac{3}{4}$ of $\left[32 - 24 + 12 + 3 - 12\right] = 16 + \dfrac{3}{4}$ of $[1]$

$= 16 + \dfrac{3}{4} \times 11 = 16 + \dfrac{33}{4} = \dfrac{97}{4}$

2.46. $\dfrac{1.7 \times 0.0028}{0.068 \times 0.014} = ?$

(A) 5 (B) 10 (C) 20 (D) 15

Sol: $\dfrac{1.7 \times 0.0028}{0.06 \times 0.012} = \dfrac{17 \times 28}{68 \times 14} \times 10 = 5$

2.47. $3\dfrac{2}{9} + 5\dfrac{1}{4}\left[\left(16\dfrac{2}{3} \div 13\dfrac{4}{6}\right) \div 6\dfrac{3}{4}\right] = ?$

(A) 3140/369 (B) 1342/369
(C) 1456/369 (D) 1539/369

Sol:
$3\dfrac{2}{9} + 5\dfrac{1}{4}\left[\left(16\dfrac{2}{3} \div 3\dfrac{4}{6}\right) \div 6\dfrac{3}{4}\right]$

$= \dfrac{29}{9} + \dfrac{21}{4}\left[\left(\dfrac{50}{3} \times \dfrac{6}{82}\right) \div \dfrac{27}{4}\right]$

$= \dfrac{29}{9} + \dfrac{21}{4} \times \dfrac{50}{3} \times \dfrac{6}{82} \times \dfrac{4}{27}$

$= \dfrac{29}{9} + \dfrac{350}{9 \times 41} = \dfrac{1539}{369}$

2.48. 40% of $\left[\left\{\left(\overline{16 - 8} + \overline{18 - 12}\right) \times 5 - 6\right\} \times 2 + 3\right] = ?$

(A) 262/5 (B) 271/5
(C) 267/5 (D) 313/5

Sol: 40% of $[\{(8 + 6) \times 5 - 6\} \times 2 + 3]$

$= \dfrac{2}{5}$ of $[64 \times 2 + 3] = \dfrac{2}{5} \times 131 = \dfrac{262}{5}$

2.49. $5\dfrac{7}{6} + 16\dfrac{2}{3} + 18\dfrac{4}{9} - 13\dfrac{5}{6} = ?$

(A) 187/9 (B) 247/9
(C) 319/9 (D) 419/9

Sol: $5\dfrac{7}{6} + 16\dfrac{2}{3} + 18\dfrac{4}{9} - 13\dfrac{5}{6} = \dfrac{37}{6} + \dfrac{50}{3} + \dfrac{166}{9} - \dfrac{83}{6}$

$= \dfrac{54}{6} + \dfrac{166}{9} = \dfrac{247}{9}$

2.50. Find the cube of 12.

Step 1: Cube the left most digit, i.e., 1 in this case, and write it down on the extreme left.

Step 2: Write three more numbers to its right such that the ratio of successive pairs of numbers is same as the ratio of the digits (1 : 2) in the original number. We get the following 1 2 4 8. (1 : 2 = 2 : 4 = 4 : 8)

Step 3: Double the second number (i.e., 2) and the third number (i.e., 4) of the above four numbers and write the result (i.e., $2 \times 2 = 4$ and $2 \times 4 = 8$) under the respective numbers.

Step 4: Add the two rows—one column at a time—such that each column contributes only one digit to the total. (If any column gives more than one digit, the additional digits are carried forward)

```
    1 ←——————— carry forward
    1    2    4    8
             4    8
    ----------------------
12³ = 1    7    2    8
    ----------------------
```

2.51. Find the cube of 23.

Step 1 : Cube the left most digit (i.e., $2^3 = 8$) and write it down on the extreme left.

Step 2 : Write three numbers next to the above, such that the ratio between any two successive numbers is the same as the ratio of the digits of the given number. (Therefore, in the number 23, the ratio of the digits is 2 : 3). We get 8 12 18 27

Note: It may sometimes be difficult to find the numbers, i.e., 12, 18 and 27. Note that these numbers are obtained, as $12 = 8 \times 3/2$; $18 = 12 \times 3/2$; $27 = 18 \times 3/2$. Therefore, to get any number, multiply the previous number by the units digit value (i.e., 3) and divide by the ten's digit value (i.e., 2).

Step 3 : Double the 2nd number (i.e., 12) and the 3rd number (i.e., 18) and write them down below the respective numbers.

```
8 12      18      27
24        36
```

Step 4: Add all the numbers, column wise, as shown below, each time carrying forward all digits except the units digit.

```
4      5      2 ←——————— carry forward
8      12     18     27
              24     36
--------------------------------
12     1      6      7
```

∴ 23³ = 12167

2.52. Find the cube of 37.

```
23          47          34 ←————————— carry forward
27          63          147     343
            1 2 6       2 9 4
-----------------------------------------------
50          6           5       3
```

∴ 37³ = 50653

2.53. A trader uses only five weights which together weigh 31 kg. With these five weights he can measure all integer weights from 1 kg to 31 kg, with the weight kept only in one pan of the weighing scale. Find the individual weights of the five pieces.

Sol: For measuring all integer weights up to 31 kg, the individual weights needed are the powers of 2, i.e., 2^0, 2^1, 2^2, 2^3 and 2^4

∴ if we have weights of 1 kg, 2 kg, 4 kg, 8 kg and 16 kg, we can measure all integer weights upto 31 kg.

For example, if we have to measure 23 kg, we have to use the weights 16 kg, 4 kg, 2 kg and 1 kg on one pan.

If you want to write any number from 1 to M as a sum of one or more of the integers of a given set of integers (each integer being used at the most once), it can be done by using the powers of 2. The set of integers we can use consists of all the powers of 2 starting from 1 (i.e., 2^0) to the largest power of 2 less than or equal to M. For example, if you want to build all the integers upto 255, the numbers 1, 2, 4, 8, 16, 32, 64, 128 are sufficient.

2.54. A trader uses only four weights, which together weigh 40 kg. With the four weights he could measure all integer weights from 1 kg to 40 kg, placing weights in both the pans. Find the weights of the four pieces.

Sol: For measuring all weights upto 40 kg, the weights needed are the powers of 3 whose sum adds upto 40, i.e., 3^0, 3^1, 3^2 and 3^3 ... if we have weights of 1 kg, 3 kg, 9 kg and 27 kg, we can measure all weights from 1 to 40 kg.

For example, if we have to measure 33 kg, we have to keep the 27 kg and 9 kg weights on one pan and 3 kg weight on the other, i.e., $27 + 9 - 3 = 33$ kg.

Directions for questions 1 to 55 : For the multiple choice questions, select the correct alternative from the given choices. For the non-multiple choice questions, write your answer in the blank space provided.

1. 8563 + 3947 + 5760 + 5691= _____.

2. 99786 − 5584 − 934 − 88 − 9 = _____.

3. 35408 + 81563 − 41341 − 51464 = _____.

4. 1012 × 98 = _____.

5. 1372 × 125 = _____.

6. 2113 × 2117 = _____.

7. 239 × 251 = _____.

8. 7869 × 982 = _____.

9. 14.28% of 322 = _____ .

10. What percentage of 751 is 362_____.

11. 433 is what percentage of 1444_____.

12. 106×812 is what percent of 464×4_____.

13. 128.57% of 1694 = (to the nearest integer)_____.

14. 84.71% of 742 = _____.

15. 11 × 4% of 18 × 2 is what percentage more than 14 × 1% of 12 × 8_____.

16. $\dfrac{5}{24} + \dfrac{7}{36} + \dfrac{11}{48} =$ _____ .

17. $\dfrac{12}{17} - \dfrac{11}{15} + \dfrac{18}{19} =$ _____.

18. $\dfrac{5}{7} + \dfrac{9}{10} + \dfrac{11}{14} + \dfrac{8}{35} =$ _____.

19. $\dfrac{x}{540} = \dfrac{237}{681}$. Find x_____.

20. 120.01 × 4.99 + 5.99 × 80.01 =
    (A) 1020   (B) 1040   (C) 1060   (D) 1080

21. $\sqrt[3]{91} \times 162\%$ of 48 = _____ ^{3}
    (A) 4   (B) 5   (C) 7   (D) 9

22. $\dfrac{(8.99)(7.01)(2.05) + (17.05)(29.88)(15.01)}{(2.01)(16.01)(19.9)} =$
    (A) 14   (B) 10   (C) 11   (D) 12

23. 534.95 − 15.23 + 35 × 6.78 + 40% of 478 =
    (A) 256   (B) 354   (C) 478   (D) 956

24. $\sqrt[3]{216400} + \sqrt{280} + \sqrt{322} =$
    (A) 651   (B) 361   (C) 85   (D) 95

25. $\dfrac{\sqrt{532.69} + \sqrt[3]{30.15}}{\sqrt{290.96} + \sqrt[3]{64.56}} =$
    (A) 1   (B) 3   (C) 5   (D) 6

26. 78927.95 ÷ 448.29 + 3425.6925 =
    (A) 1600   (B) 2600   (C) 4600   (D) 3600

27. $\sqrt{36.1} \times 34 + 15\sqrt{8.92} =$ _____ $\times (14.28\%$ of 217$)$
    (A) 10   (B) 6   (C) 8   (D) 11

28. _____ ^{3} + 23456 − 21246) ÷ 31421 = 25
    (A) 65   (B) 80   (C) 69   (D) 92

29. $\dfrac{1}{8}$ of $\dfrac{1}{7}$ of $\dfrac{7}{3}$ of 144 + _____ = $13^2 - 5^2$
    (A) 140   (B) 132   (C) 134   (D) 138

30. $[8 - (7 \text{ of } 16 \div 8 - 10 + 7)] \times \left[\dfrac{36 \times 14 \times 81}{7 \times 72 \times 3} + 30 \right] =$
    (A) −171   (B) −59   (C) −3   (D) −161

31. $\left\{ \dfrac{1^2 + 2^2 + 3^2 - 11}{78 - (4^2 + 5 \text{ of } 6 + 2)} \right\} \left\{ \dfrac{-15 - (16 - 12 + 12)2}{18 \times 4 - 2 \times 6^2 - 1} \right\}$
    (A) −1   (B) 3   (C) −1/3   (D) 1

32. 60% of 1300 = _____% of 1700 + 30^2 ÷ 90 − 20% of 400
    (A) 30   (B) 50   (C) 60   (D) 80

33. $\dfrac{2}{5}$ of $\left\{ \left(36 \div \overline{28 \div 7} \times \dfrac{1}{9} \right) + \dfrac{1}{9} \right\} =$
    (A) $\dfrac{1}{9}$ (B) $\dfrac{2}{9}$ (C) $\dfrac{5}{9}$ (D) $\dfrac{4}{9}$

34. 45% of 60% of 80% of $\left[\dfrac{714}{8} \div \dfrac{17}{64} \right]$ ÷ 378 × 1125 =
    (A) 116   (B) 126   (C) 184   (D) 216

35. $\overline{(24 - 20)^3 + (24 - 24)^3} \times 16\dfrac{2}{3}\%$ of _____ = 84
    (A) 4   (B) 6   (C) 8   (D) 2

36. $[12 - (9 \text{ of } 24 \div 12 - 14 + 5)] \times \left[\dfrac{48 \times 22 \times 108}{11 \times 96 \times 9} + 36 \right] =$

(A) 126   (B) 132   (C) 138   (D) 144

37. $\left\{ \dfrac{30(7 + 4 - 12)}{-5 + 6 + 9} \right\} \div \left\{ \dfrac{(8 \times 9 - 32)3}{(17 + 15 - 31)10} \right\}$

(A) –4   (B) –1   (C) –1   (D) –1/4

38. $\dfrac{9}{15}$ of $\dfrac{45}{81} \left\{ \dfrac{49}{6} \times \left(\dfrac{16}{7} - 2 \right) \right\}$ of $\dfrac{24}{5} \div \dfrac{16}{15} =$

(A) 7/2   (B) 2/7   (C) 3/7   (D) 5/9

39. $\sqrt[3]{\dfrac{}{32768}} = \dfrac{15}{32}$

(A) 3375   (B) 3500   (C) 4560   (D) 4975

40. $\sqrt{42025} \times \sqrt{3481} - (83)^2 = \sqrt{} + (72)^2$

(A) 488   (B) 484   (C) 464   (D) 488

41. $\sqrt{46656} + \sqrt{4096} \times 52 = ()^2 + 115$

(A) 48   (B) 52   (C) 57   (D) 68

42. $\sqrt{9218} \times \sqrt{2210} \div \sqrt[3]{028} =$

(A) 104   (B) 114   (C) 141   (D) 144

43. $(225)^2 \div \sqrt[3]{5625} = \underline{}^2$

(A) 25   (B) 35   (C) 45   (D) 55

44. $19^3 - 18^3 = \underline{}.$

45. $(84)^3 - (84)^2 =$

(A) 585468   (B) 558468   (C) 558648   (D) 585648

46. $324^2 + 576^2 + 324 \times 576 = \underline{}.$

47. AB is a two digit number $(AB)^2 = CDA$, which is a three-digit number. How many values can AB take?

(A) 3   (B) 0   (C) 1   (D) 2

48. Among the options given below, which pair does not represent the combination of a number and its cube?

(A) 45 and 91125   (B) 72 and 373248
(C) 78 and 474552   (D) 87 and 658483

49. Which of the following is a perfect square?

(A) 4021025   (B) 1170875
(C) 1130375   (D) 9030025

50. A perfect square is added to twice of itself. The resulting number will

(A) never end with 8.
(B) never be a perfect square.
(C) never end with a 6.
(D) satisfy more than one of the above.

51. P and Q are natural numbers satisfying the equation $P^2 - Q^2 = 889$. How many integral values are possible for (P, Q)?

(A) 1   (B) 2   (C) 3   (D) infinite

52. Find the smallest natural number with which 9000 is to be multiplied to make it a perfect square.

(A) 10   (B) 2   (C) 5   (D) 45

53. What is the smallest natural number with which 1080 should be multiplied to make it a perfect cube?

(A) 50   (B) 75   (C) 100   (D) 25

54. $(132)^2 = \underline{}.$

55. $(10.12)^2 = \underline{}.$

ANSWER KEYS

Exercise-1

1. 23961	12. 23%	23. (D)	34. (D)	45. (D)
2. 93171	13. 2178	24. (D)	35. (C)	46. 623376
3. 24166	14. 628.55.	25. (A)	36. (D)	47. (D)
4. 99176	15. 15%	26. (D)	37. (D)	48. (D)
5. 171500	16. 91/144	27. (C)	38. (A)	49. (D)
6. 4473221	17. 4457/4845	28. (D)	39. (A)	50. (D)
7. 59989	18. 92/35	29. (D)	40. (B)	51. (B)
8. 7727358	19. 188	30. (A)	41. (C)	52. (A)
9. 45.98	20. (D)	31. (B)	42. (C)	53. (D)
10. 48.20%	21. (C)	32. (B)	43. (C)	54. 17424
11. 29.98%	22. (D)	33. (D)	44. 1027	55. 102.4144

SOLUTIONS

EXERCISE-1

1. The sum is 23961.

2. The answer is 93171.

3. The answer is 24166.

4. 1012×98

= (1000 + 12) (100 −2)

= 100000 + 1200 − 2000 − 24 = 99176

5. $1372 \times 125 = 1372 \times \dfrac{1000}{8}$

$= \dfrac{1372}{8} \times 1000 = 171.5 \times 1000 = 171500 = 171.5$

6. 2113 = 2110 + 3 and 2117 = 2110 + 7

The base for 2113 and 2117 is 2110.

And he sum of the units digits is 3 + 7 = 10

For such numbers, the ten's digit and units digit will be $3 \times 7 = 21$

The other five digits starting from the ten lakh's place to the hundred's place will be $211 \times 212 = 44,732$

(211 is common to both the numbers. Therefore the product of 211 and its successive positive integers should be considered)

∴ The product of 2113 and 2117 will be 4473221.

7. 239 (250 + 1)

$= 239 \times \dfrac{100}{4} + 239 \times 1$

= 59750 + 239 = 59989

8. $7869 \times 982 = 7869 \times (1000 − (20 − 2))$

= 7869000 − 141642 = 7727358

Solutions for questions 9 to 11:

By using ten percent one percent concept, we can calculate the required percentage values.

9. 14.28% of 322 is 45.98

10. 362 is close to half of 751.

∴ By using the ten percent one percent concept, we can find that 362 is 48.20% of 751.

11. $\dfrac{1}{4} \times 144 = 361$

Now, 433 – 361, i.e., 72 is very close to 5% of 1440.

∴ The required answer is 29.98%

12. 25% of 464 × 4 = 116 × 10

106 × 812 is 9 × 288 less than 464 × 4. As 9 × 288 is 2% of 464 × 4, 106 × 812 is 23% of 464 × 4.

13. 128.57% of 1694 = 100% of 1694 + 28.57% of 1694

$= 1694 + \dfrac{2}{7} \times 1694 = 1694 + 484 = 2178$

14. 84.71% of 742

= (85.71 − 1)% of 742 = 628.55.

15. $11 \times 4\% \text{ of } 18 \times 2 = \dfrac{114}{1000} \times 18.2$

$= \dfrac{114}{1000} \times (2 \times 9 + 0.2)$

$= \dfrac{228 \times 9 + 228}{1000} = 2.0748$

14×1% of 12×8

$= \dfrac{141}{1000} \times (10 + 2 + 0.8)$

$= \dfrac{1410 + 282 + 11.28}{1000} = 1.804$

$= \dfrac{2.07 - 1.80}{1.80} \times 100 = 15 \ (\text{approximately})$

16. The L.C.M. of 24 and 48 is 48.

By prime factorization $36 = 2^2 \times 3^2$

And $48 = 2^4 \times 3^1$

The L.C.M. of 36 and 48 = $2^4 \times 3^2 = 144$

$\dfrac{5}{24} = \dfrac{5 \times 6}{24 \times 6} = \dfrac{30}{144}$

$\dfrac{7}{36} = \dfrac{7 \times 4}{38 \times 4} = \dfrac{28}{144}$

$$\frac{11}{48} = \frac{11 \times 3}{48 \times 3} = \frac{33}{144}$$

$$\therefore \frac{30}{144} + \frac{28}{144} + \frac{33}{144} = \frac{91}{144}$$

17. $\frac{12}{17} - 1 + \frac{4}{15} + 1 - \frac{1}{19}$

$$= \frac{4}{15} + \frac{12}{17} - \frac{1}{19} = \frac{4457}{4845}$$

18. $\frac{5}{7} = \frac{5 \times 10}{7 \times 10} = \frac{50}{70}$

$$\frac{9}{10} = \frac{9 \times 7}{10 \times 7} = \frac{63}{70}$$

$$\frac{11}{14} = \frac{11 \times 5}{14 \times 5} = \frac{55}{70}$$

$$\frac{8}{35} = \frac{8 \times 2}{35 \times 2} = \frac{16}{70}$$

$$\frac{50}{70} + \frac{63}{70} + \frac{55}{70} + \frac{16}{70} = \frac{184}{70} = 92/35.$$

19. $\frac{681}{540} \cong \frac{680}{540} = 1.26$

Let $x \times 1.25 = 237$

$x = 237 \times \frac{4}{5} = 189.6$

Since $x \times 1.25 = 237$

$x \times 1.26 < 237$

Hence, the answer will be approximately 188.

20. $? = 120 \times 5 + 6 \times 80 = 600 + 480 = 1080$

21. $?^3 \cong 4.5 \times 77.76$

$?^3 = 351$

$\Rightarrow ?^3 \cong 7^3 \Rightarrow \therefore ? = 7.$

22. $\frac{(8.99)(7.01)(2.05) + (17.05)(29.88)(15.01)}{(2.01)(16.01)(19.9)}$

$$\cong \frac{9 \times 7 \times 2 + 17 \times 30 \times 15}{2 \times 16 \times 20}$$

$$= \frac{7776}{640} \cong 12.$$

23. $? \cong 535 - 15 + 35 \times 7 + 191$

$\Rightarrow ? = 956.$

24. $\sqrt[3]{216400} + \sqrt{280} + \sqrt[3]{22}$

$= 60 + 16.5 + 18 = 94.5 \cong 95$

25. $\frac{\sqrt{532.69} + \sqrt{230.15}}{\sqrt{290.96} + \sqrt[3]{64.56}} = ?$

$\Rightarrow ? \cong \frac{23 + 15}{17 + 19} = \frac{38}{36}$

$\Rightarrow ? \cong 1.$

26. $? = 176.06 + 3423.6925$

$\Rightarrow ? = 3599.75 \cong 3600.$

27. $\sqrt{36.1} \times 34 + 15\sqrt{8.92} = ? \times (14.28\% \text{ of } 217)$

$\Rightarrow 6 \times 34 + 15 \times 3 = ? \times 1/7 \times 217$

$\Rightarrow 249 = ? \times 31 \Rightarrow ? = \frac{249}{31} = 8.$

28. $(?^3 + 2210) = 25 \times 31421$

$\Rightarrow ?^3 = 785525 - 2210$

$\Rightarrow ?^3 = 783315 \Rightarrow ? = \sqrt[3]{783315}$

$\therefore ? \cong 43.$

29. $? = 13^2 - 5^2 - \frac{1}{8} \text{ of } \frac{1}{7} \text{ of } \frac{7}{3} \text{ of } 144$

$169 - 25 - \frac{1}{8} \times \frac{1}{7} \times \frac{7}{3} \times 144$

$= 144 - 6 = 138$

30. $8 - \{7 \text{ of } 16 \div 8 - 10 + 7\} \times \left[\frac{36 \times 14 \times 81}{7 \times 72 \times 3} + 30\right]$

$\Rightarrow \left[8 - \left(\left(\frac{7 \times 16}{8} - 10 + 7\right)\right)\right] \times 57 = -171$

31. $\left(\frac{-15\left(16 - \overline{12 + 12}\right)2}{18 \times 4 - 2 \times 6^2 - 1}\right) \times \frac{1^2 + 2^2 + 3^2 - 11}{78 - \left(4^2 + 5 \div 6 + 2\right)}$

$= \left(\frac{15 - (16 - 24)2}{72 - 72 - 1}\right) \times \frac{3}{-1}$

$= -1 \times -3 = 3$

32. $\dfrac{60}{100} \times 1300 = \dfrac{?}{100} \times 1700 + \dfrac{900}{90} - \dfrac{20}{100} \times 400$

$\Rightarrow ? \times 17 + 10 - 80 = 780$

$\Rightarrow ? \times 17 = 780 + 70 = 850$

$\Rightarrow ? = \dfrac{850}{17} = 50$

33. $? = \dfrac{2}{5}$ of $\left\{\left(36 \div 4 \times \dfrac{1}{9}\right) + \dfrac{1}{9}\right\}.$

$\Rightarrow ?\dfrac{2}{5} \left\{1 + \dfrac{1}{9}\right\}$

$\Rightarrow ?\dfrac{2}{5} \times \dfrac{10}{9} = \dfrac{4}{9}$

34. $? = \dfrac{45}{100} \times \dfrac{60}{100} \times \dfrac{80}{100} \times \left[\dfrac{714}{8} \times \dfrac{64}{17}\right] \times \dfrac{1}{378} \times 1125$

$\Rightarrow ? = \dfrac{9}{20} \times \dfrac{3}{5} \times \dfrac{4}{5} \times [42 \times 8] \times \dfrac{1}{378} \times 1125$

$\Rightarrow ? = 24 \times 9 = 216.$

35. $\overline{(24-20)^3 + (24-25)^3} + (24-25)^3 \times 16\dfrac{2}{3}\%$ of$? = 84$

$\Rightarrow (64 - 1) \times \dfrac{1}{6}$ of$? = 84 \Rightarrow ? = 8$

36. $? = [12 - (216 \div 12 - 14 - 5)] \times \left[\dfrac{48}{96} \times \dfrac{22}{11} \times \dfrac{108}{9} + 36\right]$

$[12 - (18 - 14 + 5)] \times \left[\dfrac{1}{2} \times 2 \times 12 + 36\right]$

$= [12 - 9] \times [12 + 36]$

$= 3 \times 48 = 144$

37. $\dfrac{30(7 + 4 - 12)}{-5 + 6 + 9} \div \dfrac{(8 \times 9 - 32)3}{(17 + 15 - 31)10}$

$= -3 \div 12 = -1/4.$

38. $\dfrac{9}{15}$ of $\dfrac{5}{9}\left\{\dfrac{49}{6} \times \dfrac{2}{7}$ of $\dfrac{24}{5} \times \dfrac{15}{16}\right\} = ?$

$\Rightarrow ? = \dfrac{9}{15} \times \dfrac{5}{9}\left\{\dfrac{7}{3} \times \dfrac{9}{2}\right\}$

$\Rightarrow ? = \dfrac{7}{2}.$

39. $\dfrac{?}{32768} = \left(\dfrac{15}{32}\right)^3 = \dfrac{3375}{32768}$

$\therefore ? = 3375.$

40. $205 \times 59 - 6889 = \sqrt{?} + 5184$

$\Rightarrow \sqrt{?} = 12095 - 6889 - 5184$

$\Rightarrow \sqrt{?} = 22 \Rightarrow ? = (22)^2$

$\therefore ? = 484.$

41. $\sqrt[3]{46656} + \sqrt[4]{4096} \times 52 = (?)^2 + 115$

$\Rightarrow (?)^2 + 115 = 36 + 64 \times 52$

$\Rightarrow (?)^2 = 3364 - 115 = 3249$

$\Rightarrow ? = \sqrt{3249} = 57.$

42. $\dfrac{\sqrt{9218 \times 2210}}{\sqrt{1028}} = ? \Rightarrow \dfrac{\sqrt{9216 \times 2209}}{\sqrt{1024}} = ?$

$\Rightarrow ? = \dfrac{96 \times 47}{32} = 141.$

43. $(?)^2 = 225 \times 225 \times \dfrac{1}{25}$

$\Rightarrow (?)^2 = 2025 \Rightarrow ? = \sqrt{2025}$

$\therefore ? = \pm 45.$

44. $19^3 - 18^3$ is of the form $a^3 - b^3$ where $a = 19$ and $b = 18$.

$a^3 - b^3$ is defined as $(a - b)(a^2 + b^2 + ab)$.

Hence, $19^3 - 18^3 = (19 - 18)$

$(19^2 + 18^2 + 19 \times 18) = 1027$

45. $(84)^3 - (84)^2 = ?$

$\Rightarrow ? = (84)^2 [84 - 1] = 84 \times 83$

$\therefore ? = 585648.$

46. $324^2 + 576^2 + 324 \times 576$

$= 324^2 + 576^2 + 2 \times 324 \times 576 - 324 \times 576$

$= (324 + 576)^2 - (18^2 \times 24^2) = 900^2 - 432^2$

$= (900 + 432) \times (900 - 432) = 1332 \times (400 + 60 + 8)$

$= 623376$

47. $(AB)^2 = CDA$

CDA is a three-digit perfect square.

$\therefore A$ cannot be 2, 3, 7, or 8 $\hspace{3cm}$ (1)

(∵ No Perfect square ends in 2, 3, 7, or 8)

$(AB)^2 < 1000. \therefore AB \le 31.$ (2)

From (1) and (2), $A = 1$,

$(1B)^2 = CD1.$

$B = 1$ or 9.

$AB = 11$ or 19.

$\therefore AB$ can take 2 values

48. Going by the options, as the numbers whose cubes are given are multiples of 3, the cubes of the numbers must be multiples of 3^3, i.e., 27.

Hence, the cubes must be multiplies of 9.

The sum of the digits of 91125, 373248 and 474552 are multiples of 9 whereas the sum of the digits of 658483 is not a multiple of 9.

Hence, 658483 is not a cube of 87.

49. Any perfect square ending with a 5 must end with 25. Only choices (A) and (D) have the last two digits as 25.

Checking 4021025, using the rule of finding squares of numbers ending in 5, we need to find factors of the form (n) $\times (n + 1)$ [where n is a natural number] for 40210. Similarly for 90300. $200 \times 201 = 40200$. Hence, choice (A) is eliminated. But $90300 = 300 \times 301$. Therefore $9030025 = (3005)^2$.

50. Consider perfect square X^2

$X^2 + 2X^2 = 3X^2$

X^2 can end with 0, 1, 4, 5, 6, 9

$\therefore 3X^2$ can end with

0, 3, 2, 5, 8, 7

$\therefore$ Choice (C) is true, and choice (A) is false.

Besides the product of a non–perfect square and a perfect square can never be a perfect square.

$\therefore$ Choice (B) is also true.

51. $P^2 - Q^2 = 889$

$\therefore (P + Q) (P - Q) = 127 \times 7 = 889 \times 1$

These are the only two ways of expressing 889 as a product of two natural numbers

Case 1: $P + Q = 127, P - Q = 7$

$\Rightarrow P = 67, Q = 60$

Case 2: $P + Q = 889, P - Q = 1$

$P = 445, Q = 444$

52. $9000 = 3^2 \times 5^3 \times 2^3$

The smallest natural number to be multiplied with to make it a perfect square = $5 \times 2 = 10$.

53. $1080 = 108 \times 10$

$= 18 \times 6 \times 10 = 2 \times 3^2 \times 2 \times 3 \times 2 \times 5 = 2^3 \times 3^3 \times 5$

The least natural number to be multiplied to make it a perfect cube = $5 \times 5 = 25$.

54. $(132)^2 = (100 + 32)^2$

$= 10,000 + 6400 + 1024 = 17424$

55. $(10. 12)^2$

$= (10)^2 + (0.12)^2 + 2(10) (0.12)$

$= 100 + 0.0144 + 2.4 = 102.4144$

1

Tables

Chapter

In this chapter, you will:
- Gain understanding of various types of data presented in the form of tables.
- Develop calculation skills.
- Get exposed to different types of questions based on tables.
- Learn different shortcut methods and techniques in solving the questions.

❑ DATA

Here data is presented in the form of simple table. While any type of data can be presented in table form, that too in a very accurate manner, interpreting the data in table format is very difficult and time consuming than the other modes, all of which are basically pictorial or graphical in presentation.

Data tables can be of a number of types. They can be of a single-table variety or combination of tables. Some examples of tables are given below.

Table 1.1 Movement of Goods by Different Modes of Transport (in 000's of metric-ton-kms)

Year	Road	Rail	Air	Water	Total
1985	1000	1500	120	20	2640
1986	1600	2000	129	24	3753
1987	2907	3090	139	28	6164
1988	4625	5200	152	27	10004
1989	6346	7540	174	33	14093
1990	7920	10250	212	40	18422
1991	9540	13780	266	50	23636

Note: All figures are fictitious.

From the table we can deduce the following:

- Rate of growth by each mode of transport in successive years as well as cumulative annual growth.
- Rate of growth of total haulage by all modes of transport together in any year.
- Contribution by each mode of transport to the total haulage in any given year.
- Trends of growth over time for various modes of transport.
- Given the cost of transportation for each mode, we can calculate the total annual cost of transportation over the years for various modes of transport as well as make a cost comparison.
- Finding out the mode of transportation in any given year that forms the largest percentage of total haulage.
- For a given mode of transport, finding out the year in which the percentage increases in haulage over the previous year was the highest.

Table 1.2 Railway Time Table – Coromandel Express

Place	Cumulative mileage	Arrival Time (in hours)	Departure Time (in hours)
Madras	0	—	08.00
Nellore	200	11.20	11.30
Vijayawada	525	15.30	16.00
Rajahmundry	700	19.20	19.30
Visakhapatnam	1100	01.10	01.30
Bhubaneswar	1450	03.45	04.00
Kharagpur	1600	07.25	07.30
Calcutta	1925	09.30	-—

From the above timetable, we can obtain the following:

- Distance between various stations.
- Total idle time as a proportion of total travel time.
- Average speed between stations as well as over the entire journey.
- Minimum and maximum speeds of the train between two stations.

Solved Examples

Directions for questions 1.01 to 1.05: These questions are based on the following table, which gives the details of the sports liked by students in all the classes of a school.

The table gives the number of students in each class and the percentage of students in the class who like Cricket, Volleyball, Basketball and Football.

Class	Number of students	Cricket	Volleyball	Basketball	Football
6	120	60%	70%	50%	60%
7	140	50%	60%	60%	50%
8	160	40%	65%	55%	45%
9	180	65%	75%	65%	55%
10	240	70%	80%	75%	45%

1.01: How many students in the school like cricket?
(A) 436   (B) 432
(C) 491   (D) 511

Sol: Number of students who like cricket

$$= \frac{60}{100}(120) + \frac{50}{100}(140) + \frac{40}{100}(160) + \frac{65}{100}(180)$$

$$+ \frac{70}{100}(240) = 491$$

1.02: By what percentage is the number of students who like volleyball in class 6 more/less than those who like basketball in class 10?
(A) 40% less   (B) 50% more
(C) 53.33% less   (D) 56.67% more

Sol: Number of students who like volleyball in class 6

$$= \frac{70}{100}(120) = 84$$

Number of students who like basketball in

class 10 $= \frac{75}{100}(240) = 180$

84 is less than 180 by $\frac{180 - 84}{180}(100)$

$$= 53.33\%$$

1.03: The number of students who like cricket in class 7 is what percentage of the number of students who like football in class 8?
(A) 88%   (B) 93.5%
(C) 95.6%   (D) 97.2%

Sol: Number of students who like cricket in class 7

$$= \frac{50}{100}(140) = 70$$

Number of students who like football in class 8

$$= \frac{45}{100}(160) = 72$$

Required percentage = $\frac{70}{72} \times 100 = 97.2\%$

1.04: In how many of the given classes can more than 90 students like all the four games?
(A) 4   (B) 3
(C) 1   (D) 2

Sol: In any class, the maximum value of the number of students who like all the four games would be the number of students who like the game liked by the least number of students.
In class 6, the percentage of students who like a game is the least for basketball. The number of students who like basketball

$$= \frac{50}{100}(120) = 60 < 90$$

In class 7, the percentage of students who like a game is the least for cricket and football. The number of students who like cricket

$$= \frac{50}{100}(140) = 70 < 90$$

In class 8, the number of students who like a game is the least for cricket. The number of students who like cricket

$$= \frac{40}{100}(160) = 64 < 90$$

In class 9, the percentage of students who like a game is the least for football. The number of students who like football

$$= \frac{55}{100}(180) = 99 > 90$$

In class 10, the percentage of students who like a game is the least for football. The number of students who like football

$$= \frac{45}{100}(240) = 108 > 90$$

∴ In two classes, more than 90 students can like all the games.

1.05: What can be the maximum percentage of students in class 6 who do not like any of the given games?
(A) 40%   (B) 10%
(C) 50%   (D) 30%

Sol: In class 6, the maximum percentage of students who like a game = the percentage of students who like volleyball, i.e., 70%. The percentage of students who like at least one game would be minimum when all students who like other games are also the same ones who like volleyball.
∴ Maximum percentage required
= 100 - 70 = 30%

EXERCISE-1

Direction for questions 1 to 5: Answer these questions based on the information given below.

The below table gives the number of accidents and deaths in five districts P, Q, R, S and T during the period from 2008 to 2014.

	P		Q		R		S		T	Accidents
	Deaths	Accidents	Deaths	Accidents	Deaths	Accidents	Deaths	Accidents	Deaths	
2008	826	143	546	88	1465	189	1002	156	593	72
2009	802	139	589	94	1520	213	1089	161	526	78
2010	945	132	647	91	1680	221	1102	168	487	84
2011	765	141	672	105	1740	234	1162	174	462	81
2012	1012	173	745	112	1432	243	1175	183	493	76
2013	1126	168	685	132	1562	252	1286	189	514	87
2014	1432	195	720	127	1613	236	1315	191	554	98

Note: The maximum number of deaths in any accident was 2.

1. At least what percentage of the accidents in district P in the year 2009 resulted in deaths?
(A) 8.7 (B) 9.2
(C) 9.6 (D) 10.4

2. The total number of deaths in district P from 2008 to 2010 is approximately what percentage of the number of deaths in that district in 2014?
(A) 194.2 (B) 198.7
(C) 204.8 (D) 212.3

3. The total number of deaths in 2012 is approximately what percentage of all the accidents in that year?
(A) 14.1% (B) 15.0%
(C) 16.2% (D) 17.3%

4. In which year was the total number of deaths in all the five districts the highest?
(A) 2011 (B) 2012
(C) 2013 (D) 2014

5. What was the highest percentage increase in the number of deaths in district R in any year, when compared to the previous year?
(A) 11.8% (B) 12.7%
(C) 13.4% (D) 14.2%

Direction for questions 6 to 10: Answer these questions based on the information given below.

The table shows the number of fan regulators rejected and the percentage of those accepted by quality control department, out of the total number of fan regulators assembled by five machines P, Q, R, S and T.

Machine	Number of fan regulators rejected	Percentage of acceptance of fan regulators
P	600	90
Q	1000	80
R	550	90
S	840	86
T	1650	85

6. How many fan regulators assembled by machine R were accepted?

7. Which machine assembled the highest number of regulators? (Type 1 for P, 2 for Q and so on till S for T)

8. Approximately by what percentage is the number of rejections of regulators assembled by P more than that of R? (approximated to the closest integer)

9. By what percentage is the number of fan regulators assembled by T more than the total number of fan regulators assembled by P and Q?

10. What is the average number of regulators assembled by machines R and S?

Direction for questions 11 to 15: Answer these questions based on the information given below.

Number of employees in five companies

Name of the company	Classification based on the age of the employee			
	Above 20 years but below 30 years	Above 20 years but below 40 years	Above 20 years but below 50 years	50 years or above but below 60 years
Pallis	125	148	165	36
Dagritech	96	153	187	60
Starshine	108	127	141	72
Greenhorn	68	93	213	68
Farmtech	97	125	148	48

Note: The age of an employee lies between 20 years and 60 years.

11. In which of the following companies is the ratio of number of employees aged thirty years or above but below 50 years to the total number of employees of that company the highest?

(A) Pallis   (B) Dagritech
(C) Greenhorn   (D) Farmtech

12. In which of the following age groups is the number of employees of all the given companies, together the highest?
(A) More than 20 years but below 30 years.
(B) Thirty years or more but less than fifty years.
(C) Forty years or more but less than 50 years.
(D) Thirty years or more.

13. If 27 employees aged below 25 years but above 20 years join Greenhorn company, what percentage of the employees aged below 50 years but above 20 years, does the group of aged below 40 years but above 20 years constitute?
(A) 25%   (B) 50%
(C) 45%   (D) 200%

14. Which of the following could be the average age of the employees of Pallis?
(A) 26 years   (B) 34 years
(C) 43 years   (D) 51 years

15. Which of the following companies has the highest number of employees?
(A) Pallis   (B) Agritech
(C) Greenhorn   (D) Dagritech

Direction for questions 16 to 20: Answer these questions based on the information given below.
The below table gives the distribution of recognized educational institutions in a few states in India.

State / Union territory	Primary schools	Middle schools	High schools	Colleges for general education	Colleges for professional education	Deemed universities
Andhra Pradesh	58249	14472	14255	1080	279	22
Arunachal Pradesh	1303	333	184	7	1	1
Assam	33236	8019	4832	298	63	6
Bihar	53351	13571	5008	742	47	18
Goa	1267	443	448	20	10	1
Gujarat	15602	21143	6343	422	112	12
Haryana	11013	1892	4228	150	52	5
Himachal Pradesh	10877	1768	1954	65	12	3
Jammu & Kashmir	10926	3728	1504	33	12	4
Karnataka	22404	27712	8612	916	304	16
Kerala	6758	2973	4182	186	62	8
Madhya Pradesh	62530	25090	8471	413	78	16
Maharashtra	45971	24574	16059	1208	535	29
Manipur	1752	795	637	15	7	2
Uttar Pradesh	88927	20429	9063	758	189	27

16. If all the given states are arranged in the ascending order of the total number of primary and middle schools, then which state is the fourth from the last?
(A) Bihar   (B) Andhra Pradesh
(C) Kerala   (D) Maharashtra

17. A state in which the number of primary schools is more than the number of high schools, while the number of colleges for professional education is more than half that of the colleges for general education is said to be good in educational infrastructure. How many states are good in educational infrastructure?
(A) 0   (B) 1
(C) 2   (D) 3

18. In how many states is the number of high schools more than the number of colleges for general education by at least 300%?
(A) 15   (B) 14
(C) 11   (D) None of these

19. In all the states in which the number of primary schools is more than 50,000, the respective state governments own 50% of these primary schools. Find the least number of such states that should be clubbed together so that the total number of primary schools owned by the state governments of the states is more than 1,00,000.
(A) 2   (B) 3
(C) 4   (D) 5

20. Which state has the largest difference between the total number of primary and middle schools as compared to the number of Deemed Universities?
(A) Bihar   (B) Madhya Pradesh
(C) Andhra Pradesh   (D) Uttar Pradesh

Direction for questions 21 to 24: Answer these questions based on the information given below.

The details of the employees in five companies P, Q, R, S and T.

Company	No. of employees	Ratio of male to female employees	Avg. age of female employees	Avg. age of all employees
P	17865	2 : 1	28	32
Q	18183	8 : 11	31	30
R	21384	7 : 5	26	29
S	27185	3 : 2	29	28
T	16568	3 : 5	34	37

21. In which company is the number of female employees, the highest?

22. By how much does the number of male employees in companies R and S together exceed the number of male employees in the other three companies?

23. What is the average age (approximated to the closest integer) of the male employees in company R?

24. What is the difference between the number of female employees in the company with the highest number of male employees and the number of male employees in the company with the lowest number of female employees?

Direction for questions 25 to 28: These questions are based on the following table, in which the number of persons living in a residential area and their choices of certain brands of chocolates are given.

	Dairy Milk	Eclairs	Kit Kat	Perk	Amul	Bar One	Temptations	Munch
Dairy Milk	256	222	139	127	242	111	73	63
Eclairs	214	498	144	109	268	121	53	129
Kit Kat	118	152	178	102	149	892	47	112
Perk	128	134	76	144	82	74	48	108
Amul	214	232	151	112	286	124	34	123
Bar one	79	64	58	43	61	124	63	72
Temptations	43	29	31	68	48	53	88	59
Munch	74	83	91	69	107	121	118	132

(A) The number in each cell denotes the number of people who prefer different brands. The brand in the row represents first preference and the brand in the column represents second preference.

(B) Row 1, Column 1 = 256 (i.e., there are 256 people whose only choice of chocolates is Dairy Milk) Row 1, Column 2 = 222 (i.e., there are 222 people whose first preference is Dairy Milk and second preference is Eclairs)

25. The number of people who like only Bar One form approximately what per cent of those who like only Kit Kat?
(A) 150%   (B) 143%   (C) 70%   (D) 67%

26. The price of a piece each of Perk and Munch is `12 and `8, respectively. What is the ratio of total sales of Perk and Munch, if the persons buying only Perk and only Munch are considered in the given area? Assume each person buys only one chocolate of his first preference.
(A) 3 : 2   (B) 96 : 37
(C) 5 : 6   (D) None of these

27. What is the total number of people who like only one brand of chocolates?
(A) 1706   (B) 1233
(C) 1126   (D) 2008

28. The number of people whose first preference is Eclairs and second preference is Munch is what percentage more than the number of people whose first preference is Munch and second preference is Eclairs?
(A) 35.65%   (B) 55.42%
(C) 51.38%   (D) 38.42%

Direction for questions 29 to 32: Answer these questions based on the information given below.

The percentage growth in sales turnover of five companies over the respective previous years.

Name of the Company	1998	1999	2000	Projected for 2001
A	10	20	30	45
B	15	15	30	38
C	8	20	30	30
D	5	30	20	40
E	12	20	28	42

29. In which of the following companies, is the percentage growth in sales turnover highest from 1997 to 2000?
(A) A   (B) B
(C) D   (D) E

30. Company D had earned a profit of `41 crores, which was 25% of its total sales in 2000. What was its sales in 1997 approximately?
(A) `64 crores
(B) `88 crores
(C) `164 crores
(D) `100 crores

31. In 1999, the sales of company B and company D are `100 crores and `130 cores, respectively. What was the ratio of their sales in 1997?
(A) 420 : 529
(B) 10 : 13
(C) 529 : 710
(D) 11 : 19

32. In 1999 the sale of each company was `130 crores. How many companies had sales below `100 crores in 1997?
(A) 2   (B) 4
(C) 5   (D) 1

Direction for questions 33 to 37: These questions are based on the following table, which shows the cumulative distribution of number of employees regarding the amount claimed as transportation expenses by employees.

The employees are from five departments HR, Marketing, Logistics, Accounts and Administration of Company XYZ. The number of employees in the departments in the same order are 20, 30, 15, 25 and 40, respectively. Every employee in the company has claimed transportation expenses in each of the given months.

Department	March < `400	< `500	< `600	< `700	April < `400	< `500	< `600	< `700	May < `400	< `500	< `600	< `700
HR	8	10	14	16	12	15	16	17	11	14	15	18
Marketing	15	18	21	27	16	17	22	25	14	16	18	26
Logistics	9	10	12	13	8	9	13	14	8	11	12	15
Accounts	13	15	19	21	18	20	21	23	20	21	22	24
Administration	20	26	31	35	22	27	32	36	31	33	35	37

33. Considering any department in any month, what is the least number of employees who claimed at least `400 but less than `600 as transportation expenses?
(A) 2   (B) 3
(C) 4   (D) 6

34. What is the maximum number of employees in the company who claimed at least `450, but at most `750 as transportation expenses in the month of March?
(A) 52   (B) 58
(C) 65   (D) 67

35. Which of the following statements is true?
- **(A)** The total number of employees who claimed more than `700 towards transportation expenses in the month of April is 15.
- **(B)** Considering the Marketing department, the number of employees who claimed at least `600 towards transportation expenses in March is more than the number of employees who claimed at least `400 but less than `600 in the month of May.
- **(C)** In the month of May, considering all the departments, the number of employees who claimed at least `600 but less than `700 as transportation expenses is 17.
- **(D)** The total number of employees in the accounts department who claimed at least `400 but less than `500 as transportation expenses in all the given three months is 18.

36. For which of the following departments is the number of employees claiming at least `600 as transportation expenses the highest in any month?
- **(A)** HR
- **(B)** Marketing
- **(C)** Accounts
- **(D)** Administration

37. What is the maximum number of employees claiming exactly `600 as transportation expenses in the month of April?
- **(A)** 8
- **(B)** 9
- **(C)** 10
- **(D)** 11

Direction for questions 38 to 42: Answer these questions based on the information given below.

There was an inter-school competition of different events. The following table gives the details of students who participated and the prizes they won.

School	Sports		Essay writing		Painting		Music	
	A	**B**	**A**	**B**	**A**	**B**	**A**	**B**
P	100	20	16	4	100	30	60	10
Q	60	10	20	9	80	28	100	12
R	40	4	40	10	50	16	40	7
S	80	32	80	24	120	25	10	1
T	120	48	70	14	50	8	30	5

A – The number of students participating
B – The number of students who won prizes

In any event a school X is said to perform better than school Y, if the ratio of the number of prizes won to the number of students who participated in that event is greater for school X than school Y.

For all questions assume that no student takes part in more than one event.

38. What percentage of the participants won prizes in painting?
- **(A)** 22.5%
- **(B)** 25%
- **(C)** 26.25%
- **(D)** 26.75%

39. Which school performed the best in music?
- **(A)** P
- **(B)** R
- **(C)** S
- **(D)** T

40. What was the highest ratio of the number of prizes won per student participated for any single event for any of the five schools?
- **(A)** 0.35
- **(B)** 0.40
- **(C)** 0.45
- **(D)** None of these

41. What percentage of the students from school S did not win any prize?
- **(A)** 71.7
- **(B)** 74.2
- **(C)** 76.8
- **(D)** 78.5

42. The prizes won by students of schools Q and R in sports and essay writing is approximately what percentage of the prizes won by all the students?
- **(A)** 9.7
- **(B)** 10.4
- **(C)** 10.8
- **(D)** 11.5

Direction for questions 43 to 46: Answer these questions based on the information given below.

The following table gives the details of a project which is divided into ten tasks from I through X. The tasks can be done in any order as long as the other tasks which are required to be done before them are completed. The project is said to be completed when all the tasks are completed.

Task	Duration (in hours)	Other tasks to be completed before starting this task
I	2	—
II	3	—
III	5	I
IV	2	II, III
V	7	I, II
VI	1	IV
VII	5	II, V
VIII	2	I, II
IX	6	V, VII
X	4	II, IV, VIII

43. What is the shortest time (in hours), from the start, in which task IV can be completed?

44. What is the maximum number of tasks that can be completed in 10 hours from the start?

36

45. What is the minimum time (in hours), from the start, in which task X can be completed?

46. What is the minimum time taken (in hours) for the project to be completed?

Direction for questions 47 to 50: Answer these questions based on the information given below.

Prices of Cycles of Five Brands

Brand	Price per Cycle (in `)
Neon	1400
Ranger	2200
Hercules	2500
Atlas	1200
Avon	1100

Collections from the sales of cycles of the above five brands over a five-year period (in ` crore)

Brand	Year				
	2011	2012	2013	2014	2015
Neon	46	35	21	63	70
Ranger	77	33	27.5	49.5	115.5
Hercules	62.5	31.25	81.25	50	75
Atlas	30	48	54	66	30
Avon	27.5	38.5	44	55	71.5

There are two rating companies, namely TRICIL and CRICIL which rank the brands of cycles on the basis of two distinct parameters.

TRICIL ranks the brands from 1 to 5 on the basis of (decreasing order of) the collections in a year while CRICIL ranks brands from 1 to 5 on the basis of (decreasing order of) the number of cycles sold in that year.

If a brand is ranked first in TRICIL ratings, it gets 100 points for that year. If rated second, it gets 90 points. If rated third, 80 points and so on. The brand placed fifth, therefore, gets 60 points.

47. Which brand collected the maximum number of TRICIL points over the five-year period?
(A) Ranger
(B) Hercules
(C) Atlas
(D) Neon

48. Which brand is ranked 1st in the CRICIL charts the maximum number of times?
(A) Atlas
(B) Ranger
(C) Neon
(D) Avon

49. Which brand is ranked 2nd in the CRICIL ratings in the year 2015?
(A) Atlas
(B) Avon
(C) Neon
(D) Ranger

50. Which brand showed the highest percentage drop in the number of cycles sold in any year from 2012 to 2015 with respect to the year immediately preceding it?
(A) Neon
(B) Avon
(C) Ranger
(D) Atlas

EXERCISE-2

Direction for questions 1 to 4: The table below gives the population ratio of males to females and the percentage of literates in a region across six years.

Year	Population (lakhs)	Males : Females	Percentage of literate males	Percentage of literates
2010	7.3	1031 : 1000	61.2	52.6
2011	8.4	1073 : 1000	63.7	54.1
2012	8.7	1061 : 1000	64.5	55.2
2013	9.2	1089 : 1000	64.8	56.3
2014	8.1	1007 : 1000	65.2	56.5
2015	7.8	981 : 1000	64.5	55.7

1. What was the percentage increase in the number of males from 2011 to 2012?
(A) 2
(B) 3
(C) 4
(D) 5

2. In which year was the percentage increase in the number of females, when compared to the previous year, the highest?
(A) 2011
(B) 2012
(C) 2013
(D) 2014

3. What was the percentage of literate females in 2013?
(A) 44.8
(B) 47.0
(C) 48.2
(D) 49.6

4. In which of the given years was the ratio of literate males to literate females, the highest?
(A) 2010
(B) 2011
(C) 2012
(D) 2013

Direction for questions 5 to 9: Answer these questions based on the information given below.

External Debt and Debt Indicators of Various Countries for the Year 1994

S. No.	Country	EDT (US $ billion)	EDT as a percentage of GNP	PVD as a percentage of GNP	PVD as a percentage of XGS	TDS as a percentage of XGS	Concessions as a percentage of EDT
1.	Brazil	150	26.8	32	310	32.1	1.8
2.	China	120	19.3	16	75	8.9	15.9
3.	Indonesia	97	56.5	54	186	30	29.9
4.	Argentina	77	27.8	29	406	32	3.2
5.	India	99	34.2	26	214	26.3	48.2
6.	Turkey	66	57.4	38	188	31.2	12.1
7.	Thailand	61	43.1	39	96	15.6	11.3
8.	Malaysia	25	36.9	34	38	7.7	13.5
9.	Philippines	39	59.3	56	163	18.5	28.7
10.	Mexico	128	35.2	33	224	33.9	1.3
11.	Russia	94	25.0	13	158	6.2	7.0
12.	Korea	54	15.3	1.4	45	6.8	9.0

EDT → External Debt (Total)
PVD → Present Value of Debt
GNP → Gross National Product
XGS → Export of Goods and Services
TDS → Total Debt service

Expense type	2012	2013	2014	2015
Rent	27.2	29.2	28.5	27.9
Food	14.3	15.1	16.2	15.6
Travel	6.2	5.8	6.0	5.7
Entertainment	5.3	4.8	5.1	5.8
Education	22.7	23.5	22.8	24.2
Others	24.3	21.6	21.4	20.8

5. What is the approximate total debt service on the present value of the debt of Turkey (in US $ billion)?

6. For which of the given countries is the Gross National Product the greatest? (type the S. No. for the country)

7. What is the TDS of Malaysia as a percentage of its GNP (approximately)?

8. How many of the countries listed above have a GNP of at least US $200 billion?

9. For how many of the countries listed does the GNP exceed the XGS by 900% or more?

Direction for questions 10 to 13: Answer these questions based on the information given below.

The following table gives the percentage break up of expenses of the Sharma family on different items from 2012 to 2015.

10. If the expenses on rent increased by 10% every year from 2012, then what is the approximate percentage increase in the education expenses from 2012 to 2015?

11. If entertainment expenses showed a 50% increase from 2012 to 2015, then the expenses on food in 2015 is what percentage of that in 2012?

12. The expenses under which head showed the highest percentage increase from 2013 to 2015?

13. If the expenses on travel in the given period was the highest in 2014, then the total expenses in 2015 is at most what percentage of the total expenses in 2014?

Direction for questions 14 to 18: Answer these questions based on the information given below.

	PP$_1$	PP$_2$	PP$_3$	PP$_4$
GD$_1$	234	576	384	473
GD$_2$	346	278	272	968
GD$_3$	570	225	483	354
GD$_4$	425	840	372	527
GD$_5$	640	920	486	225
GD$_6$	725	386	680	324

	GD$_1$	GD$_2$	GD$_3$	GD$_4$	GD$_5$	GD$_6$
D$_1$	580	663	721	816	917	1127
D$_2$	640	1006	927	834	339	556
D$_3$	775	713	916	614	572	1157
D$_4$	480	576	812	537	528	911
D$_5$	574	847	1108	913	737	668
D$_6$	386	902	778	786	748	1248
D$_7$	447	853	883	488	497	625
D$_8$	533	912	525	845	1216	359

The two tables provide the information regarding the distances between four printing presses PP$_1$ to PP$_4$ and six godowns from GD$_1$ to GD$_6$ and the distances between the six godowns and the eight destinations from D$_1$ to D$_8$. All the distances are in kilometres and the cost of transporting one tonne of material for every kilometre is `250.

14. The maximum cost per tonne of transporting material from any printing press to any destination is
(A) `5.34 lakhs
(B) `6.24 lakhs
(C) `4.70 lakhs
(D) `7.80 lakhs

15. The approximate difference between the maximum and minimum cost per tonne of transporting the material from PP$_4$ to D$_5$ is
(A) `2.02 lakhs
(B) `2.15 lakhs
(C) `3.56 lakhs
(D) `3.05 lakhs

16. In how many distinct ways can the material be transported to D$_7$ from PP$_1$ or PP$_3$?
(A) 16
(B) 96
(C) 12
(D) None of these

17. The least total distance for transporting material between any printing press and any destination is
(A) 814 km
(B) 497 km
(C) 722 km
(D) 564 km

18. The number of distinct ways of transporting materials from any printing press to any destination is
(A) 18
(B) 24
(C) 48
(D) None of these

Direction for questions 19 to 23: Answer these questions based on the information given below.

The following tables give the details regarding 100 banks that were started after 1990. The details are the respective NPAs, profits and the number of branches.

Table-1		Table-2		Table-3	
NPAs	Number of Banks	Profit (`Crore)	Number of Banks	Number of Branches	Number of Banks
10%	3	1000	4	700	6
9%	11	900	12	650	13
8%	16	800	18	600	19
7%	24	700	23	550	28
6%	39	600	34	500	36
5%	49	500	42	450	44
4%	71	400	58	400	53
3%	84	300	73	350	75
2%	93	200	86	300	82
1%	98	100	91	250	89

In each of the above three tables, the numbers in the second column give the number of banks for which the value of the relevant parameter is greater than the corresponding value mentioned in the first column. For example, from the second row of Table-2, there are 12 banks which have a profit of more than `900 crore. When any two banks are compared, the bank with the higher profit always has a lower level of NPAs but more number of branches than the bank with a lower profit.

19. How many of the 100 banks have a profit more than `400 crore but not more than `700 crore and also have more than 400 branches?

20. How many of the given 100 banks have more than 500 branches but NPAs of not more than 4%?

21. How many of the given 100 banks have a profit of not more than `100 crore and NPAs of more than 1% but do not have more than 250 branches?

22. How many of the given 100 banks have NPAs of more than 2% but not more than 8% and also have a profit of more than `200 crore but not more than `800 crore?

23. For how many of the given banks are the NPA's not more than 5% but has a profit more than `700 crore?

39

Direction for questions 24 to 27: Answer these questions based on the information given below.

The following table gives the marks scored by four students, namely Anand, Balu, Chetan and Deepak in the three areas Verbal, Quant and Reasoning of a mock CAT paper. The four students are disguised in the tables as A, B, C and D in no particular order.

Section	Student			
	A	**B**	**C**	**D**
Verbal	24	41	40	27
Quant	34	36	35	32
Reasoning	36	31	36	32

It is also known that, in reasoning, none of the other three students scored more than Chetan. Balu's total score in the three sections differs from that of Anand's by 3 marks.

24. What can be said regarding the following two statements?
Statement 1: Deepak scored the lowest marks in the reasoning section.
Statement 2: Anand's total score in the three sections is more than that of Deepak.
(A) If Statement 1 is true, then Statement 2 is necessarily true.
(B) If Statement 1 is true, then Statement 2 is necessarily false.
(C) Both Statement 1 and Statement 2 are true.
(D) Neither Statement 1 nor Statement 2 is true.

25. What can be said regarding the following two statements?
Statement 1: Balu's lowest score is in the reasoning section.
Statement 2: Anand's lowest score is in the quantitative section.
(A) If Statement 2 is true, then Statement 1 is necessarily false.
(B) If Statement 1 is false, then Statement 2 is necessarily true.
(C) If Statement 1 is true, then Statement 2 is necessarily true.
(D) None of the above

26. What can be said regarding the following two statements?
Statement 1: Anand had the highest score in the verbal section.
Statement 2: Balu had the highest score in the quant section.
(A) Both the Statements could be true.
(B) At least one of the Statements must be true.
(C) At most one of the Statements must be true.
(D) None of the above

27. If Deepak got his lowest score in the verbal section, then which of the following is true?
(A) Chetan's lowest score is in the reasoning section.
(B) Chetan's lowest score is in the quant section.
(C) Chetan's lowest score is in the verbal section.
(D) No definite conclusion is possible.

Direction for questions 28 to 31: Answer these questions based on the information given below.

The following table gives the number of students who passed in four subjects Maths, Physics, Chemistry and Biology in the three sections A, B and C in class X of a school. Each section had a student strength of 40.

Section	Maths	Physics	Chemistry	Biology
A	28	31	39	26
B	34	32	37	33
C	26	34	31	29

28. The number of students in section A who passed in all the four given subjects is at most_____.

29. The number of students in section C who passed in all the four subjects is at least_____.

30. At most how many students in section B passed in exactly one of the four subjects?

31. The number of students who passed in both Physics and Chemistry in the three sections combined is at most_____.

Direction for questions 32 to 35: The following table gives the information about the population and the literacy rate for different countries.

Country	Population (in lakhs)	% of male population	Female literacy rate (%)	% of illiterate population
A	500	54	35	52
B	280	56	42	46
C	740	50	32	40
D	360	58	28	56
E	410	55	36	50

$$\text{Per capita income} = \frac{\text{Total income}}{\text{Total population}}$$

32. The female population of country B is _____.
(A) 118.4 lakhs
(B) 123.2 lakhs
(C) 126.4 lakhs
(D) 128.8 lakhs

33. The ratio of the number of female literates to that of total literates is the least for country
(A) A   (B) B
(C) C   (D) D

34. What is total the number of literates in country C (in million)?
(A) 40.6   (B) 41.2
(C) 47.2   (D) 44.4

35. In how many countries is the total number of illiterates more than two crore?
(A) 5   (B) 2
(C) 3   (D) 4

Direction for questions 36 to 39: Answer these questions based on the information given below.

Details of five families, namely A, B, C, D and E.

Detail	Family				
	A	**B**	**C**	**D**	**E**
Number of members	5	6	3	6	8
Annual income (`lakhs)	3.6	4.8	6.0	4.0	7.2
Number of working members	2	1	2	1	2
Number of children	1	2	1	2	0
Own house / rented house	Rented	Own	Rented	Own	Own
Own a car / two-wheeler	Two-wheeler	Car	Car	Two-wheeler	Car

Activities taken-up by the families during weekends (Saturday and Sunday) in the month of January.

	Number of times an activity was taken up by the family				
Family	Hotel	Films	Courtesy calls	Temple	Resort
A	1	0	4	2	1
B	3	3	2	0	0
C	1	2	0	3	1
D	2	3	1	2	0
E	3	3	0	1	1

Note: Any family can take up at most two activities (not necessarily distinct) during a weekend. However, any family taking up the activity 'Resorts' on a weekend cannot take up any other activity on that weekend.

36. If January 3rd falls on a Sunday, at the most how many of the given families may not have taken up any of the given activities during at least one weekend of the month?
(A) 5   (B) 2
(C) 3   (D) 4

37. Find the number of families which satisfy each of the following three criteria.
  (i) Average annual income per member is more than `70,000.
 (ii) The number of visits made by the family to temple on a weekend is at least one in the month of January.
(iii) The family does not stay in a rented house.
(A) 1   (B) 2
(C) 3   (D) 4

38. If January 10th falls on a Monday, then how many of the given five families have an average annual income of at least `3.00 lakh per working member and also went to a resort on at least one weekend but definitely did not go to a film on more than two weekends in the month of January?
(A) 0   (B) 1
(C) 3   (D) 4

39. If January 30th falls on a Sunday, what is the maximum number of families going to a hotel, without clubbing any other kind of activity with it, during at least one weekend in the month of January?
(A) 5   (B) 2
(C) 3   (D) 4

Direction for questions 40 to 44: These questions are based on the following information. Four activities A_1, A_2, A_3 and A_4 are carried out daily in an organization. The following data represents the ten people, to whom the activities are assigned. The activities may be executed in any order.

Person	Activities			
	A_1	**A_2**	**A_3**	**A_4**
Rani	✓	✗	✗	✓
Ranjan	✗	✗	✓	✗
Aakash	✗	✓	✗	✓
Biplab	✓	✓	✓	✗
Menon	✓	✓	✗	✓
Manoj	✓	✗	✗	✗
Mukesh	✗	✗	✗	✓
Amitabh	✓	✗	✓	✓
Priya	✗	✓	✓	✓
Priyanka	✗	✓	✓	✗

'✓' indicates that the activity is assigned to the person while '✗' indicates that the activity is not assigned to the person. For

example, Rani is assigned the activities A_1 and A_4 but is not assigned the activities A_2 and A_3.

The following data indicates the minimum and the maximum time period required to complete the activity by any person, to whom the work is assigned. The time (in hrs) taken to complete any activity is an integral number.

Activities	Minimum time (hrs)	Maximum time (hrs)
A_1	1	4
A_2	2	4
A_3	2	5
A_4	2	5

No person can execute two different activities at the same time. Any activity can be completed only by the person who started executing it.

40. If Amitabh is more efficient than Mukesh by X% in executing the activity A_4, then which of the following cannot be the value of X?
(A) 60
(B) 50
(C) 25
(D) 100

41. If on a day, every person started executing the activities assigned to him at 9 a.m., what could be the maximum possible number of persons who could have completed all the activities assigned to them in the next four hours?
(A) 9
(B) 1
(C) 6
(D) 5

42. What is the least possible time in which a team of exactly two persons working together can complete each of the four activities exactly once?
(A) 4
(B) 3
(C) 7
(D) None of these

43. If a group of three persons working together completed all the activities in less than 2 hours, which amongst the following can be the group?
(A) Rani, Ranjan and Aakash
(B) Aakash, Biplab and Menon
(C) Amitabh, Priya and Priyanka
(D) None of these

44. If Manoj and Mukesh started and completed the respective activities assigned to them at the same time, then which of the following cannot be the time (in hrs) taken by Manoj to complete the activities assigned to him?
(A) 5
(B) 1
(C) 2
(D) More than one of the above

Direction for questions 45 to 48: Answer these questions based on the information given below.

Six candidates who were interviewed for faculty positions in a reputed coaching institute are ranked according to their performances in six parameters, such as Educational qualification (E), Analytical Ability (A), Logical Ability (L), Communication Skills (V), Teaching Skills (T) and Creativity (C). No two candidates got the same rank in any single parameter and the ranks of a candidate in no two parameters are the same. The six candidates considered for selection were Vani, Pallavi, Raju, Martin, Asma and Scarlet and the ranks obtained by them in some of the parameters are given below.

Parameters	Person					
	Vani	Pallavi	Rajiv	Martin	Asma	Scarlet
Educational Qualification (E)	3			1		
Analytical Ability (A)	2					4
Logical Ability (L)	1	2	3	4	5	6
Communication Skills (V)			4			
Teaching Skills (T)	6				3	
Creativity (C)			1	3		2

A candidate gets 12 points for each parameter in which he/she gets the first rank, 8 points for rank 2, 5 points for rank 3, 3 points for rank 4, 2 points for rank 5 and 1 point for rank 6.

45. If only parameters A, C, V and T are considered, then which candidate got the fourth highest total score?
(A) Vani
(B) Pallavi
(C) Rajiv
(D) Martin

46. If only parameters E, A, L and T are considered, then which candidate got the second highest total score?
(A) Martin
(B) Rajiv
(C) Vani
(D) Asma

47. If the parameters other than L and T are considered, then the difference between the scores of the candidates getting the highest score and the least score is
(A) 6
(B) 8
(C) 10
(D) 14

48. If only parameters E, A and V are considered and only the candidates getting the top four scores are selected, then which of the candidates are not selected?
(A) Martin and Rajiv
(B) Rajiv and Scarlet
(C) Scarlet and Martin
(D) Rajiv and Vani

Direction for questions 49 and 50: Answer these questions based on the information given below.

Literacy rates (in percentages) among various classes in India.

Years	Scheduled Castes (C)	Scheduled Tribes (T)	Other Categories (O)
1961	10·27	8·54	28·30
1971	14·67	11·30	34·45
1981	21·38	16·35	43·57
1991	37·41	29·60	52·21
2001	54·69	47·10	64·80

Note: These three classes account for the whole of India's population.

49. If in the year 2001, the ratio of the population of the classes O, C and T was 7 : 3 : 1, then what was the approximate literacy rate in India in that year?
(A) 56%
(B) 58%
(C) 60%
(D) 62%

50. If none of the given classes constituted more than 50% or less than 25% of India's population in any of the years, in how many of the given years was the number of literates in India at least one-third of the total population?
(A) 4
(B) 3
(C) 2
(D) 1

EXERCISE-3

Direction for questions 1 to 5: Answer these questions based on the information given below.

A group of six colleges, 1 to 6, conducted a common written test with four different sections, each with a maximum of 50 marks. The following table gives the aggregate as well as section cut off marks fixed by the six colleges. A student will get admission only if he/she gets marks greater than or equal to the cut off marks in each of the sections and his/her aggregate marks are at least equal to the aggregate cut off marks as specified by the college.

	School cut off marks				Aggregate cut off marks
	Section A	Section B	Section C	Section D	
College 1	38			37	151
College 2	37		41		157
College 3			42		159
College 4		41		35	156
College 5		35		39	162
College 6	41	38	40		160

1. Shyam got calls from all the six colleges. What could be the minimum aggregate marks obtained by him?

2. Anand got calls from three colleges. What could be the maximum aggregate marks scored by him?

3. Priya got calls from two colleges. What could be the minimum marks obtained by her in a section?

4. Ramesh did not get calls from even a single college. What could be the maximum aggregate marks obtained by him?

5. What is the maximum difference between the aggregate marks obtained by two students who got calls from exactly one college?

Direction for questions 6 to 10: Answer these questions based on the information given below.

A company started manufacturing solar power generators in the year 2008. The panels used in the generators can be used for exactly one year and is discarded after that. The company provides panels, free of cost, for the first two years in which they have to be replaced. After that, the panels bought from company costs `2000 while third party vendors provide it for `1500. Every year, 30% of the customers buy the panels from the company while the remaining opt for the cheaper option available. The following table gives the number of filters sold or given free by the company and sold by third-party vendors in each year from 2012 to 2016. Three of the values have been left blank. Assume that all solar power generators manufactured from 2008 are working currently.

Replacement source	2012	2013	2014	2015	2016
Company				3900	4460
Third party	840	1610	2170	2800	3640

6. How many solar power generators were sold in 2013?
   (A) 1000   (B) 1100
   (C) 1200   (D) 1300

7. How many solar power generators were sold from 2008 to 2010?
   (A) 1800   (B) 2000
   (C) 2100   (D) 2300

8. In 2012, how many panels did the company sell or replace?
   (A) 2260   (B) 2410
   (C) 2640   (D) 2760

9. How many solar power generators were sold in 2010?
   (A) 800   (B) 1000
   (C) 1100   (D) 1200

10. How many solar power generators did the company sell in 2015?
   (A) 1200   (B) 1400
   (C) 1500   (D) Cannot be determined

Direction for questions 11 to 14: Answer these questions based on the information given below.

The below table represents the results of the annual performance appraisal in a company. Each individual's performance is rated on a scale of 1 – 20 and it is represented in the table under various parameters like designation, experience, etc. For example, 6 managers with an experience of 2 years, got an appraisal in the range from 12 – 14 with at least one of them getting a 12 and one of them getting a 14.

Experience (in years)	Performance appraisal score	
	Engineers	Managers
1	1(12, 12)	6(15 – 17)
2	4(10 – 13)	6(12 – 14)
3	3(12 – 16)	10(10 – 12)
4	5(9 – 15)	5(10 – 13)
Total	13	27

11. At the most, what percentage of the employees of the company have an appraisal score equal to or more than 15?
   (A) $46\frac{2}{3}$ %   (B) $33\frac{1}{3}$ %
   (C) 30%   (D) $43\frac{1}{3}$ %

12. The average performance appraisal score among the following is the highest for
   (A) All the managers with 2 years' experience
   (B) All the engineers with 3 years' experience
   (C) All the managers
   (D) Cannot be determined

13. Among those with three and four years of experience, the average performance appraisal score of managers differs from that of engineers by points
   (A) At least 3
   (B) At least 4
   (C) At most 2.12
   (D) At most 3.79

14. What is the minimum average appraisal score for all the managers in the company?
   (A) 12.25   (B) 12.06
   (C) 11.89   (D) 11.72

Direction for questions 15 to 17: Answer these questions based on the information given below.

The table gives the details of the number of people (in the age group from 30 to 50 years) in five different companies, namely A, B, C, D and E in the years 2011 and 2016. No employee joined or left these companies or shifted to another company.

Company	2011	2016
A	27	38
B	46	39
C	50	60
D	74	82
E	110	110

15. What is the minimum possible number of employees who crossed the age of 50 years between 2011 and 2016?
   (A) 7   (B) 29
   (C) 22   (D) None of these

16. If the number of employees who crossed the age of 50 years between 2011 and 2016 in company C is the maximum possible, then what is the number of employees who entered the age group of 30 to 50 years between 2011 and 2016?

(A) 50   (B) 10
(C) 60   (D) 40

17. What is the least possible number of employees who entered the 30 to 50 years of age group between 2011 and 2016?

(A) 20   (B) 29
(C) 22   (D) 26

Direction for questions 18 to 21: Answer these questions based on the information given below.

Details of the Indian widget industry

Ratio	2010	2011	2012	2013	2014	2015
Profit Margin	0.27	0.3	0.24	0.3	0.33	0.36
DS Ratio	0.70	0.75	0.90	1.00	1.10	1.20
EXIM Ratio	0.60	0.64	0.72	0.50	0.60	0.68

(Header: **Year** spanning 2010–2015)

$$\text{Profit Margin} = \frac{\text{Average selling price per widget}}{\text{Average cost price per widget}} - 1$$

$$\text{DS Ratio} = \frac{\text{Industry demand (by volume) for widgets}}{\text{Industry supply (by volume) for widgets}}$$

$$\text{EXIM Ratio} = \frac{\text{Volume of exports of widgets}}{\text{Volume of imports of widgets}}$$

Note:

(i) Industry demand includes domestic demand as well as export demand.

(ii) Industry supply includes domestic supply as well as imported supply.

(iii) The average export price per widget = The average selling price per widget.

(iv) The average import price per widget = The average cost price per widget.

18. In which of the given years was the average selling price per widget was the lowest, given that there was a uniform increase of 20% in the average cost price per widget every year?

(A) 2010   (B) 2012
(C) 2013   (D) 2014

19. Find the volume of widgets exported in the year 2012 as a percentage of the industry demand for widgets in that year.

(A) 64%
(B) 80%
(C) 83⅓%
(D) Cannot be determined

20. If the total value of widgets imported in the year 2013 was ₹200 crore, then what was the total value of the widgets exported in that year?

(A) ₹30 crore
(B) ₹60 crore
(C) ₹130 crore
(D) ₹220 crore

21. If the volume of widgets imported increased by a steady 16% every year, then during which of the following periods did the volume of widgets exported increase by the maximum percentage?

(A) From 2011 to 2012
(B) From 2013 to 2014
(C) From 2014 to 2005
(D) From 2010 to 2011

Direction for questions 22 to 25: These questions are based on the following information.
The following table provides the rankings of twenty companies based on eight parameters.

Ranks on different parameters

Company	Parameter							
	Market capitalization as on 1st April, 2017	Percentage growth in market capitalization over 1st April, 2016	Sales in 2016-17	Percentage change in sales over 2015-16	Gross profit in 2016-17	Percentage change in gross profit over 2015-16	Net profit in 2016-17	Percentage change in net profit over 2015-16
A	9	6	7	10	15	8	20	4
B	7	19	17	14	5	12	5	20
C	16	10	6	6	10	20	12	9
D	13	14	16	20	3	6	8	16
E	6	1	13	8	20	14	16	1
F	20	18	8	1	14	10	4	7
G	8	8	5	15	16	1	10	13
H	15	2	15	13	9	19	13	11
I	18	7	14	18	19	5	19	17
J	2	5	1	2	2	15	6	6
K	10	11	9	19	11	11	1	12
L	11	15	18	3	6	7	11	2
M	17	13	2	16	17	18	17	18
N	1	9	11	12	8	2	14	14
O	14	16	19	7	13	16	9	10
P	12	3	3	4	4	13	7	8
Q	3	17	20	17	18	9	2	15
R	19	12	10	9	7	3	18	3
S	4	4	4	5	1	17	15	19
T	5	20	12	11	12	4	3	5

For all questions, assume that the same twenty companies were ranked in all the given years.

22. How many of the given companies had a market capitalization which was definitely less than that of company K, as on 1st April 2016?

23. If profitability is the ratio of net profit to sales, how many of the given companies have a profitability which was definitely more than that of company M in 2016–17?

24. What could have been the best rank of company E in terms of sales in 2015–2016?

25. If Tax paid = Gross profit – Net profit, then how many of the given companies could have paid the highest tax in 2016–17?

ANSWER KEYS

Exercise 1

1. (A)	9. 0	17. (A)	25. (C)	33. (A)	40. (C)	47. (C)
2. (D)	10. 5750	18. (A)	26. (D)	34. (C)	41. (A)	48. (A)
3. (C)	11. (C)	19. (B)	27. (A)	35. (B)	42. (B)	49. (D)
4. (D)	12. (D)	20. (D)	28. (B)	36. (B)	43. 9	50. (C)
5. (B)	13. (B)	21. S	29. (D)	37. (D)	44. 7	
6. 4950	14. (B)	22. 3006	30. (D)	38. (D)	45. 13	
7. 5	15. (C)	23. 31	31. (A)	39. (B)	46. 21	
8. 9	16. (D)	24. 1036	32. (B)			

Exercise 2

1. (B)	10. 38	18. (D)	27. (C)	36. (C)	45. (C)
2. (A)	11. 150	19. 30	28. 26	37. (A)	46. (A)
3. (B)	12. Entertain-	20. 29	29. 0	38. (B)	47. (A)
4. (D)	ment	21. 9	30. 8	39. (A)	48. (B)
5. 8	13. 105.25	22. 66	31. 94	40. (A)	49. (C)
6. 2	14. (A)	23. 23	32. (B)	41. (C)	50. (C)
7. 7	15. (B)	24. B	33. (C)	42. (A)	
8. 7	16. (C)	25. (C)	34. (D)	43. (D)	
9. 3	17. (D)	26. (C)	35. (D)	44. (D)	

Exercise 3

1. 163	5. 24	9. (C)	13. (D)	17. (B)	20. (C)	23. 15
2. 189	6. (C)	10. (B)	14. (C)	18. (A)	21. (B)	24. 8
3. 6	7. (D)	11. (C)	15. (A)	19. (D)	22. 4	25. 3
4. 173	8. (A)	12. (D)	16. (C)			

SOLUTIONS

1. If we assume that every accident in district P resulted in 2 deaths, at least 70 accidents resulted in deaths.

The required value = $\dfrac{70}{802}$ ×100 = 8.7%.

2. The total number of deaths from 2008 to 2010 = 143 + 139 + 132 = 414
The number of deaths in 2014 = 195

The required percentage = $\dfrac{414}{195}$ ×100 = 212.3%

3. Total deaths in 2012 = 173 + 112 + 243 + 183 + 76 = 787
Accidents is 2012 = 1012 + 745 + 1432 + 1175 + 493 = 4857

The required percentage = $\dfrac{787}{4857}$ ×100 = 16.2%

4. We can see that with every passing year, the number of deaths in each state is generally increasing. So, we need to check for only 2013 and 2014.

The total deaths in 2013 = 168 + 132 + 252 + 189 + 87
= 828.
Total deaths in 2014 = 195 + 127 + 236 + 191 + 98 = 847
The highest is in 2014.

5. The highest percentage increase was in 2009 = $\dfrac{24}{189}$ × 100 = 12.7%

6. Number of fan regulators accepted = (550/10) (90) = 4950.

7. Percentage of assemblies rejected from machines P, Q, R, S, T is 10%, 20%, 10%, 14%, 15%, respectively.
So, 10% of production of assemblies of P = 600.
20% of production of assemblies of Q = 1000.
10% of production of assemblies of R = 550.
14% of production of assemblies of S = 840.
15% of production of assemblies of T = 1650.
So, 10% of production of T = 1650/15 × 10 = 1100.
By observation we can say that the number of assemblies by machine T is the highest.

8. Number of fan regulators from P, that were rejected = 600
Number of fan regulators from Q, that were rejected = 550
Required percentage = $\frac{600 - 550}{550} \times 100\% = 9\frac{1}{11}\%$

9. Number of fan regulators assembled by
T = (1650/15) (100) = 11,000.
Number of fan regulators assembled by
P = 600/10 × 100 = 6000.
Number of fan regulators assembled by
Q = 1000/20 × 100 = 5000.
Number of fan regulators assembled by T is equal to the total number of fan regulators assembled by P and Q. Therefore, required percentage is zero.

10. Number of fan regulators assembled by machine R and S are 550/10 × 100 = 5500 and 840/14 × 100 = 6000 respectively.
Their average number of assemblies
$$= \left(\frac{5500 + 6000}{2}\right) = 5750$$

11. In Pallis, the number of employees of age 30 years and above but below 50 years = 165 − 125 = 40.
Total number of employees in Pallis = Those below 50 years + Those aged 50 years and above = 165 + 36 = 201.
The required ratio = $\frac{40}{201} \approx \left(\frac{1}{5}\right)$

Similarly, the ratio for Dagritech
$$= \frac{187 - 96}{187 + 60} = \frac{91}{247}, \text{ which lies between } \frac{1}{2} \text{ and } \frac{1}{3}$$

For Greenhorn = $\frac{213 - 68}{231 + 68} = \frac{145}{299} \cong \frac{1}{2}$

For Farmtech = $\frac{148 - 97}{148 + 48} = \frac{51}{196} \approx \frac{1}{4}$

For Starshine = $\frac{141 - 108}{141 + 72} = \frac{33}{213} \cong \frac{1}{7}$

The highest ratio is $\frac{145}{299}$.

12. The total number of employees aged above 20 years but below 30 years for all the companies = 494.
Those aged above 20 years but below 50 years = 854.
Those aged 30 years or above but below 50 years = 854 − 494 = 360.
Those aged forty years or above but less than 50 years = 854 −646 = 208.
Those aged 50 years or above but below 60 years = 284.
Those aged 30 years or more = 360 + 284 = 644.
In this age group, there are maximum number of employees.

13. In Greenhorn with the inclusion of 27 employees, those aged below 50 years but above 20 years = 213 + 27 = 240. Those aged below 40 years but above 20 years will be 93 + 27 = 120.
The required percentage = $\frac{120}{240} \times 100 = 50\%$.

14. In Pallis, the minimum age of the employees in the age group of above 20 years and below 30 years can be nearly 20 years and maximum age will be nearly 30 years. In the age group of 30 years to below 40 years, minimum age is 30 years. Maximum age will be 40 years. Considering the lower bounds in each case, we get the minimum average age as

$$= \frac{20 \times 125 + 30 \times 23 + 40 \times 17 + 50 \times 36}{125 + 23 + 17 + 36}$$

$$= \frac{5670}{201} = \frac{5670}{200}$$

= 28 years. (approximately)
Maximum average age

$$= \frac{30 \times 125 + 40 \times 23 + 50 \times 17 + 60 \times 36}{201}$$

$$= \frac{7680}{201} = \frac{7680}{200}$$

= 38 years.
(Actually 29 years should be considered, but by considering 30, the average will not be affected). Therefore, the average age of the employees of Pallis should lie between 28 years and 38 years and among the given choices only Choice (B) satisfies this condition.

15. By adding the number of employees aged below 50 years and those aged 50 years or above, the total number of employees of a company can be determined. By observation we can say that Greenhorn is the company with the highest number of employees, i.e., 213 + 68 = 281.

16. As the question asks for the state ranked 4th from the last after arranging the given states in ascending order, instead of arranging them in ascending order first and then finding the answer, the question can be easily answered by arranging the given states in descending order and finding the fourth state ranked from the top.
By observation, Uttar Pradesh has the highest number of primary schools as well as middle schools. Similarly, Madhya Pradesh is in second position with a total of 87,620. Andhra Pradesh is in third position at 72,721, whereas the state ranked fourth is Maharashtra with 70,545.

17. By observation, in all the given states, the number of primary schools is more than the number of high schools. Also observing the given data, in none of the states is the number of professional colleges more than half that of the colleges of general education.

18. As the number of high schools is to be more than the number of colleges of general education by more than 300%, they should be at least four times the number of colleges of general education. By observation, in all the states, the number of high schools is more than the number of colleges of general education by at least four times.

19. By observation Uttar Pradesh, Madhya Pradesh and Andhra Pradesh accounts for more than 2,00,000 schools. As the respective state governments own 50% of these schools, these three states must be clubbed together for the state governments to have more than 1,00,000 schools.

20. Observing the given data Uttar Pradesh has the highest number of **primary** and middle schools, whereas in all cases the number of deemed universities is negligible (or very small) when compared to the number of schools. Hence, the difference will be maximum for Uttar Pradesh.

Solution for questions 21 to 24: The numbers of male and female employees in the different companies are as follows.

Company	Male employees	Female employees
P	11910	5955
Q	7656	10527
R	12474	8910
S	16311	10874
T	6213	10355

21. The number of female employees is the highest in company S.

22. Male employees in companies R and S together = 28,785
The number of male employees in companies P and Q together = 25779
The difference = 3,006

23. Total age of employees in company
R = 21384 × 29 = 620136
Total age of female employees in company
R = 8910 × 26 = 231660

$\therefore$Average age of male employees = $\dfrac{388476}{12474}$ = 31

24. The required difference = 11910 – 10874 = 1036.

25. Number of people who like only Bar one = 124.
Number of people who like only Kit Kat = 178.

$$\dfrac{124}{178} \times 100 = 69.6\% \text{ or } 70\%$$

26. Number of people who like perk = 144.
Number of people who like Munch = 132.
Ratio of sales = 144 × 12 : 132 × 8 = 18 : 11

27. In whichever square the 'brand' in the column and the brand in the row meet, that gives the exact number of chocolates of the brand. The number of each brand of chocolates is in the diagonal form starting with 256 and ending with 132.
Adding all these values, we get:
256 + 498 + 178 + 144 + 286 + 124 + 88 + 132 = 1706

28. The number of people whose first preference is Eclairs and second preference is munch are 129 and the number of people whose first preference is munch and second preference is Eclairs are 83.

$$\% = \dfrac{129 - 83}{83} \times 100 = \left(\dfrac{129}{83} - 1\right) \times 100$$

$$= (1.55 - 1)\,100 \cong 55\%$$

29. Out of the given choices, the increase in B will be greater than that of A, since 15% of 115 will be greater than 20% of 110 which is greater than 20% of 108. The tie is between A and E only.
The overall percentage increase from 1997 to 2000 in case of A = 1.3 × 1.2 × 1.1 × 1 = 171.6
In case of E = 1.28 × 1.1 × 1.12 × 1 = 172.03
The increase in E is the greatest.

30. Profit in 2000 = 41 crore
$\therefore$ sales in 2000 = $\dfrac{100}{25} \times 41 = 164$ cr
Let the sales in 1997 be x.
$x \times 1.05 \times 1.30 \times 1.20 = 164$
$\therefore x$ = 100.12 crore

31. Sales of B in 1999
100 crores = 1.15 × 1.15 × sales in 1997

Sales of B in 1997 = $\dfrac{100}{1.15 \times 1.15}$

Sale of D in 1999 = `130 crores = 1.05 × 1.3 × sales in 1997

Sales of D in 1997 = $\dfrac{130}{1.05 \times 1.3}$

Ratio of sales of B and D in 1997

$$= \dfrac{100}{1.15 \times 1.15} : \dfrac{130}{1.05 \times 1.3}$$

$$= 420 : 529$$

32. Had the sales of company A in 1997 been 100, the sales in 1999 would have been 100 × 1.1 × 1.2 = 132.
Given that the sales was 130.

$\therefore$Actual sales of 1997 = $\dfrac{130 \times 100}{132}$ which is less than 100.

Similarly, sales turnover of B in 1997

$$= \dfrac{130 \times 100}{132.5} \text{ less than 100 crores}$$

Sales turnover of C in 1997 = $\dfrac{130 \times 100}{129.6}$ more than 100

Sales turnover of D in 1997 = $\dfrac{130 \times 100}{136.5}$ less than 100

Sales turnover of E in 1997 = $\dfrac{130 \times 100}{134.4}$ less than 100

There is only one company, whose sales turnover was more than 100 crores.

33. Number of employees who claimed at least `400 but less than `600 in March for HR = 14 – 8 = 6
Marketing = 21 – 15 = 6
In this way we observe that in March the least number is 12 – 9 = 3.
Considered other months, we get the least number as 2 for the month of May for the employees of the accounts department.

34. Since we require the greatest number of employees, we can consider that all the employees other than those claiming less than `400 fall in this range.
The number of such employees for HR = 20 – 8 = 12
Marketing = 30 – 15 = 15
Logistics = 15 – 9 = 6
Accounts = 25 – 13 = 12
Administration = 40 – 20 = 20
The required number = 12 + 15 + 6 + 12 + 20 = 65

35. Statement (A) may or may not be true as we do not know the number of those have claimed `700 and the number of employees who claimed more than `700.
Number of employees in the marketing department who claimed at least `600 in March = 30 – 21 = 9.
Number of employees in the marketing department who claimed at least `400 but less than `600 in May = 18 – 14 = 4
Statement (B) is true.

36. The number of employees claiming less than `600 is the highest for HR in March. Those claiming at least `600 will be the highest, i.e., 20 – 14 = 6
For Marketing the corresponding value is 30 – 18 = 12 (in May).
The corresponding values for Logistics, Accounts and Administration departments are 3, 6 and 9.

37. In April, from HR department those who claimed less than `700 = 17 and those who claimed less than `600 = 16.
Those paying at least `600 but less than `700 = 17 – 16 = 1.
This one person could have paid `600.
Similarly, for Marketing = 25 – 22 = 3.

For Logistics = 14 – 13 = 1
For Accounts = 23 –21 = 2
For Administration = 36 – 32 = 4
The greatest number of employees paying exactly `600 is 1 + 3 + 1 + 2 + 4 = 11

38. The number of participants in painting = 400
Number of people who won prizes = 107

The required percentage = $\dfrac{107}{400}$ × 100 = 26.75%.

39. As the ratio of prizes won to students participated is highest for school R, (the ratio of B/A for music) it has performed the best.

40. For school Q, 45% of the students who participated won prizes in essay writing.

41. Total number of participants from school S = 290.
Number of students who won prizes = 82.
Number of students who did not win prizes = 208.

The required percentage = $\dfrac{208}{290}$ × 100 = 71.7%.

42. Prizes won by students of Q and R in sports and essay writing = 33.
Total prize won by all the students = 114 + 61 + 107 + 35 = 317.

The required percentage = $\dfrac{33}{317}$ × 100 = 10.4%.

Solution for questions 43 to 46: The shortest possible time to complete each task would be as follows:
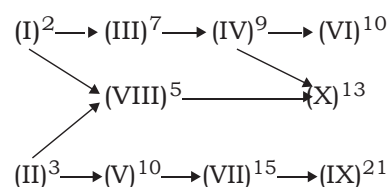
(The number above each task denotes the minimum time (in hours) taken to complete that task.)

43. Task (IV) can be completed in 9 hours from the start.

44. The tasks that can be completed in 10 hours from the start are I, II, III, IV, V, VI and VIII, a maximum of seven tasks.

45. Task X can be completed in 13 hours from the start.

46. The project would be complete when all the tasks are over. The last task to be over would be task IX and it would be over in 21 hours from the start.

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47.

Brand	Year and Points					Total Points (TRICIL Rating)
	2011	**2012**	**2013**	**2014**	**2015**	
Neon	80	80	60	90	70	380
Ranger	100	70	70	60	100	400
Hercules	90	60	100	70	90	410
Atlas	70	100	90	100	60	420
Avon	60	90	80	80	80	390

ATLAS collected the maximum TRICIL points.

48. Number of cycles sold (in lakhs).

Brand	Year				
	2011	**2012**	**2013**	**2014**	**2015**
Neon	3.3	2.5	1.5	4.5	5
Ranger	3.5	1.5	1.5	2.5	5.25
Hercules	2.5	1.25	3.25	2	3
Atlas	2.5	4	4.5	5.5	2.5
Avon	2.5	3.5	4	5	6.5

Atlas tops the CRICIL charts 3 times in the 5-year period.

49. RANGER was placed 2nd in the CRICIL ratings in the year 2015.

50. Ranger showed a maximum percentage decline in the number of cycles sold from the year 2011 to 2012.

EXERCISE-2

1. The number of males in 2011

$$= \frac{1073}{2073} x 8.4 = 4.351 \text{ lakhs.} \times 8.4 = 4.351 \text{ lakhs}$$

The number of males in 2012

$$= \frac{1061}{2061} x 8.7 = 4.48 \text{ lakhs.} \times 8.7 = 4.48 \text{ lakhs}$$

The required percentage

$$= \frac{0.13}{4.35} x 100 = 3\%. \times 100 = 3\%.$$

2. The number of females in the different years are

$$2010 = \frac{1000}{2031} x 7.3 = 3.59 \times 7.3 = 3.59$$

$$2011 = \frac{1000}{2073} x 8.4 = 4.05 \times 8.4 = 4.05$$

$$2012 = \frac{1000}{2061} x 8.7 = 4.22 \times 8.7 = 4.22$$

$$2013 = 2013 \frac{1000}{2089} x 4.2 = 4.40 \times 4.2 = 4.40$$

$$2014 = \frac{1000}{2007} x 8.1 = 4.03 \times 8.1 = 4.03$$

$$2015 = \frac{1000}{1981} x 7.8 = 3.93 \times 7.8 = 3.93$$

The percentage increase is the highest in 2011.

3. The number of males in 2013 = 9.20 – 4.40 = 4.80 lakhs.
The total literates

$$= \frac{56.3}{100} x 9.2 = 5.18 \text{ lakhs.} \times 9.2 = 5.18 \text{ lakhs}$$

The number of literate males

$$= \frac{64.8}{100} x 4.8 = 3.11. \times 4.8 = 3.11$$

The number of literates among females
= 5.18 – 3.11 = 2.07.
The percentage of literates among females

$$= \frac{2.07}{4.40} x 100 = 47.0\%. \times 100 = 47.0\%.$$

4. As the ratio of males to females was the highest in 2013 and the total population was also the highest in that year, the ratio of literate males to literate females would be the highest in that year.

5. For Turkey $\frac{PVD}{XGS} = \frac{188}{100}$ and $\frac{TDS}{XGS} = \frac{31.2}{100}$

$$\frac{PVD}{XGS} \times \frac{XGS}{TDS} = \frac{188}{100} \times \frac{100}{31.2}$$

$$\Rightarrow \frac{PVD}{TDS} = \frac{188}{31.2} \Rightarrow TDS = PVD \times \frac{31.2}{188}$$

But $PVD = \frac{PVD}{GNP} \times EDT \times \frac{GNP}{EDT}$

$$\Rightarrow TDS = \frac{38}{100} \times \frac{100}{57.4} \times 72 \times \frac{31.2}{188}$$

$$\cong \frac{2}{3} \times 72 \times \frac{1}{6} \cong 8$$

6. From observation the answer must be either Brazil or China.
For Brazil,

$$\frac{EDT}{GNP} = \frac{26.8}{100}$$

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EDT = $150 billion

$$\diagdown \quad \frac{150}{GNP} = \frac{26.8}{100}$$

GNP = $\frac{150 \times 100}{26.8}$ = US $ 559 billion.

Similar for China,

$$GNP = \frac{120 \times 100}{19.3} \cong 621.8$$

US$ 621 billion.

7. For Malaysia,

$$\frac{PVD}{GNP} = \frac{34}{100}$$

$$\frac{PVD}{XGS} = \frac{38}{100}$$

$$\frac{TDS}{XGS} = \frac{7.7}{100}$$

$$\frac{GNP}{PVD} \times \frac{PVD}{XGS} \times \frac{XGS}{TDS} = \frac{100}{34} \times \frac{38}{100} \times \frac{100}{7.7}$$

$$\frac{GNP}{TDS} = \frac{1900}{130.9} = \frac{19000}{1309}$$

$$\frac{TDS}{GNP} = \frac{1309}{19000} \cong 7\%.$$

8. $\dfrac{EDT}{EDS \text{ as \% of } GNP} \geq 200$ US $ billion

This is true only for Brazil, China, Argentina, India, Mexico, Russia and Korea. A total of seven countries.

9. For GNP to exceed XGS by 900% or more:

$$\frac{GNP}{XGS} \geq 10 \Rightarrow \frac{PVD \text{ as \% of } XGS}{PVD \text{ as \% of } GND} \geq 10.$$

This is true for only Argentina, Russia and Korea.

10. Assume the expenses on rent in 2014 to be `100. The corresponding values in 2013, 2014 and 2015 would be 110, 121 and 133, respectively. As 27.2% of total = 100, the total expenses in 2012 would be $\dfrac{100}{27.2} \times 100$ = 368 cr

Similarly, total expenses in 2015 would be $\dfrac{133}{27.9} \times 100$ = 477 cr

Education expenses in 2012 = $\dfrac{22.7}{100} \times 368 = 83.5$

That in 2015 = $\dfrac{24.2}{100} \times 477 = 115.4$

The percentage increase = $\dfrac{32}{83.5} \times 100 = 38\%$

11. Assume that total expenses in 2012 to be 100. The expenses on entertainment = 5.3

\ Expense on entertainment is 2015 = 5.3 × 1.5 = 7.95

7.95 = $\dfrac{5.8}{100}$ × x, when x is the total expenses in 2015.

\ $x = 137$

Expenses on food in 2015 = $\dfrac{15.6}{100}$ × 137 = 21.5

Expenses on food in 2012 = 14.3

\ Required value = $\dfrac{21.5}{14.3}$ × 100 = 150%

Alternate solution:
As the percentage share of both food and entertainment increased by approximately the same percentage from 2012 to 2015, their corresponding increase also would be the same.

12. The percentage increase in the share of food and entertainment can be readily observed to be the highest.

Increase in share of food = $\dfrac{1.3}{14.3}$ × 100 = 9.1%

Increase in share of entertainment = $\dfrac{0.50}{5.3}$ × 100 = 9.45%

As the percentage increase in the share of entertainment is the highest from 2012 to 2015, the expenses under that head would have showed the highest percentage increase.

13. Assume that the total expenses in 2014 to be Rs. 100.

\ Expenses on travel = Rs. 6
As expenses on travel in 2015 is at most Rs. 6, if the total expense that year is X.

$\dfrac{1.7}{100}$ × X = 6

\ X = 105.25%

14. The maximum distance is from PP_2 to GD_5 and then from GD_5 to D_6.
\ The maximum cost is (920 + 1216) 250 = `5.34 lakhs

15. The maximum cost is from PP_4 to GD_2 and then from GD_2 to D_5, i.e., (968 + 847) 250 = 1815 × 250
The minimum cost is from PP_4 to GD_5 and then from GD_5 to D_5, i.e., (225 + 737) 250 = 962 × 250.
\ Required difference is 210 (1815 – 962) $\cong$ `2.15 lakhs.

16. Material can be transported from Printing Presses PP_1 or PP_3 to any godown and from any godown to D_7 in 2 × 6 = 12 ways.

17. The least distance between a printing press and godown is 225 km (PD_4 to GD_5). The least distance between a godown and the destination is 339 (GD_5 to D_2)
\ The least distance between a printing press and destination is 225 + 339 = 564

18. The number of distinct ways is 4 × 6 × 8 = 192.

19. Number of banks with a profit of more than `400 crore = 58
Number of banks with a profit of more than `700 crore = 23
Number of banks with more than 400 branches = 53
Of these 53 banks, every bank has a profit of more than `200 crore but only 30 have not more than `700 crore.

20. Number of banks with more than 500 branches = 36
Number of banks with NPAs of not more than 4%
$$= 100 - 71 = 29$$
Number of banks with more than 500 branches and NPAs of not more than 4% = Lesser of 29 and 36 = 29.

21. Number of banks with a profit of not more than `100 crore = 9
Number of banks with not more than 250 branches = 11
Banks with both the above attributes = 9
All these banks have more than 1% NPAs.
Hence, 9 banks satisfy the given conditions.

22. 82 banks have a profit of not more than `800 crore and also NPAs of more than 2%.
Of these 16 have NPAs not more than 8%.
Hence, 66 banks satisfy the given conditions.

23. Number of banks with NPA's not more than 5% = 100 − 49 = 51
Number of banks with a profit more than `700 crore = 23.
∴ 23 banks satisfy the given condition.

Solution for questions 24 to 27: As it is said that in reasoning none of the other three persons scored more than Chetan, Chetan is either A or C. From the second condition we can conclude that Balu and Anand is one among A or D in any order or one among B or C in any order.

24. If Deepak scored the lowest marks in the reasoning section, Deepak is student B which means Balu and Anand are one of A and D in any order and so statement 2 would be false.

25. If Balu's lowest score is in the reasoning section, Balu is student B and Anand is student C and the statement that Anand's lowest score is in the quantitative section is true.

26. If Anand gets the highest score in the verbal section, he is student B and Balu is student C.
∴ Both statements cannot be simultaneously true. Anand and Balu can also be A or D in any order in which case both statements would be false.
∴ At most one of the statements is true.

27. If Deepak gets his lowest score in the verbal section, he is student D in which case Chetan is student A.

28. The maximum number of students in section A who passed in all the four subjects is 26.

29. In section C, 14 students have failed in Maths, 6 students in Physics, 9 students in Chemistry and 11 students in Biology. If all these students are distinct, 14 + 6 + 9 + 11 = 40 students would have failed in one subject each and so no student passed in all the four subjects.

30. For having the maximum number of students passing in exactly one subject, you should have the maximum number of students passing in all the four.
If x is the number of students in section B who passed in exactly one subject and y is the number of students who passed in exactly four subjects, then
$x + y = 40$ and $x + 3y = 136$
$x = 8$ and $y = 32$.

31. The maximum number of students who passed in both Physics and Chemistry in the different sections are A-31, B-32 and C-31, i.e., 31 + 32 + 31 = 94.

32. The female population of country B = $\frac{44}{100} \times 280$
$$= 123.2 \text{ lakhs}$$

33. Let the population in each country be 100.
Literates in country A = 48
Female literates = $\frac{35}{100} \times 46 = 16.1$
Required ratio = $\frac{16.1}{48} = \frac{1}{3}$
Literates in country B = 54
Female literates = $\frac{42}{100} \times 44 = 18.48$
Required ratio = $\frac{18.48}{54} = \frac{1}{3}$
Literates in country C = 60
Female literates = $\frac{32}{100} \times 50 = 16$
Required ratio = $\frac{16}{60} = \frac{1}{4}$
Literates on country E = 50
Female literates = $\frac{36}{100} \times 45 = 162$
Required ratio = $\frac{16.2}{50} = \frac{1}{3}$
It is lowest in country C.

34. Number of literates in country C = $\frac{60}{100} \times 740$ = 444 lakhs.

35. In countries A, C, D and E, the number of illiterates is more than two crores.

36. If January 3rd falls on a Sunday, there will be five Sundays or five weekends in the month. Family A has gone to a resort during a weekend. They cannot club any other

activity with this. There are 7 more activities, which require four weekends. A has taken up at least one activity on every weekend. Analysing in this way we can find that B, C and D may not have taken up any activity during at least one weekend.

37. Families A, C, D and E have made at least one visit to a temple. Of these D and E are not staying in a rented house. D's average income per member per year is less than `70,000.

38. Families B, C, D and E have at least `3 lakhs income per working person per annum. Among these C and E go to a resort at least once in a month. But only C goes to films at the most twice a month. There is only one such family. E can go to a film on up to three weekends.

39. If January 30th falls on a Sunday, there will be five weekends during the month. For family A, one weekend is spent towards resorts. Barring 'Resorts' activity and hotel activity, the remaining 6 activities can be taken up during the remaining three weekends. In this way all the five families can go to a hotel without clubbing with any other activity.

40. Activity A_4 can be completed in either 2 or 3 or 4 or 5 hours. If Amitabh is more efficient than Mukesh, then he would take lesser time as compared to Mukesh. Possibilities for the time taken

Amitabh	Mukesh	Value of x
2	3	50
2	4	100
2	5	150
3	4	33⅓
3	5	66⅔
4	5	25

So, Amitabh cannot be 60% more efficient than Mukesh.

41. The following persons cannot complete all the activities in exactly 4 hours. Biplab, Menon, Amitabh, Priya. (These persons are engaged in more than 2 activities) This implies exactly 6 persons can complete the activities assigned to them in 4 hours.

42. For the activities to be completed in the least time, by two persons where one person should work on two activities and the other person should work on the other two activities, i.e., (for example) Menon can work on activities A_1, A_2, while simultaneously Priya can work on A_3 and A_4. To complete A_1 and A_2, Menon will take 3 hours. While Priya completes A_3 and A_4 in 4 hours.

\ A total of 4 hours is required to complete all the four activities.

43. No group of three persons can complete the work in 2 hours as to complete the activities A_2, A_3 and A_4 only, the group takes 2 hours and one of them takes one more hour to complete the work.

44. Manoj has to complete the activity A while Mukesh has to complete A_4. Since Manoj should not take a time of 5 hours and Mukesh should not take a time of 1 hour, therefore, Manoj cannot do the work in 1 hour or 5 hours.

Solution for questions 45 to 48: Since no two candidates got the same rank in a single parameter and the rank of a candidate in no two parameters were the same, we can fill in the vacant ranks in the table given.

	Person					
Parameters	**Vani**	**Pallavi**	**Rajiv**	**Martin**	**Asma**	**Scarlet**
Educational Qualification (E)	3(5)	6(1)	2(8)	1(12)	4(3)	5(2)
Analytical Ability (A)	2(8)	3(5)	6(1)	5(2)	1(12)	4(3)
Logical Ability (L)	1(12)	2(8)	3(5)	4(3)	5(2)	6(1)
Communication Skills (V)	5(2)	1(12)	4(3)	6(1)	2(8)	3(5)
Teaching Skills (T)	6(1)	4(3)	5(2)	2(8)	3(5)	1(12)
Creativity (C)	4(3)	5(2)	1(12)	3(5)	6(1)	2(8)

The scores obtained by the candidates in different parameters are given within parenthesis.

(The ranks can be filled in the table with the fact that each of the 6 ranks will be present in each row and each column only once)

45. If only the parameters A, C, V and T are considered, the scores of the candidates will be as follows.

Candidate	Vani	Pallavi	Rajiv	Martin	Asma	Scarlet
Score	14	22	18	16	26	28

The candidate with fourth highest total score is Rajiv.

46. If only E, A, L and T are considered the candidates, then their scores will be as follows.

Candidate	Vani	Pallavi	Rajiv	Martin	Asma	Scarlet
Score	26	17	16	25	22	18

The candidate with the 2nd highest score is Martin.

47. If the parameters other than L and T are considered the candidates, then their respective scores will be as follows.

Candidate	Vani	Pallavi	Rajiv	Martin	Asma	Scarlet
Score	18	20	24	20	24	18

The difference between the highest score and the least score is 24 – 18 = 6.

48. With only parameters E, A and V being considered for selection the candidates and their total scores will be as follows.

Candidate	Vani	Pallavi	Rajiv	Martin	Asma	Scarlet
Score	1	18	12	15	23	10

Now candidates with the lowest scores will not be selected. The candidates with the lowest scores are Rajiv and Scarlet.

49. The literacy rate in India is

$$= \frac{7 \times 64.8 + 3 \times 54.7 + 1 \times 47.1}{7 + 3 + 1}$$

$$= \frac{453.6 + 164.1 + 47.1}{11} = 60.4\%.$$

50. For 1961 and 1971, the number of literates would definitely be less than one-third. While for 1991 and 2001 it would definitely be more than one-third.

\ We must check only for 1981.

Considering the best case, the literacy rate in India would be only

$$= \frac{43.57 \times 50 + 21.38 \times 25 + 16.35 \times 25}{50 + 25 + 25}$$

$$= \frac{2178.5 + 534.5 + 408.75}{100} = \frac{3121.75}{100}$$

$$= \frac{3121.75}{100} = 31 \times 22\%, \text{ which is less than one-third.}$$

\ It is at least one-third for only two years.

EXERCISE-3

1. To get calls from all colleges, he has to clear the cut off of all colleges and also clear the aggregate cut off (162).
\ He has to score at least 41 marks in section A, 41 in section B, 42 in section C and 39 in section D.
The minimum aggregate score = 41 + 41 + 42 + 39 = 163.

2. If he scores 50, 50, 39 and 50 marks each in sections A, B, C and D, he would miss calls from colleges 2, 3 and 6.
\ The maximum marks for three calls are 189.

3. To get calls from two colleges, she has to score at least 156 marks. If she scores 50, 50, 6 and 50 marks each in section A, B, C and D, respectively, then she would get calls from colleges 1 and 4.

4. If Ramesh scored 50, 50, 39 and 34 marks in sections A, B, C, and D, respectively, he would miss calls from all the six colleges.
The marks would be 50 + 50 + 39 + 34 = 173.

5. Minimum marks of a student who got one call is 151.
Maximum marks for a student with only one call is 50 + 50 + 39 + 36 = 175 marks.
The maximum difference is 175 – 151 = 24 marks.

Solution for questions 6 to 10: As the company started its operations in 2008, for solar power generators manufactured in 2008, the company will provide panels free of cost in 2009 and 2010. 70% of the people would take panels from third party vendors in 2011. The 2011 value is 70% of the sum of total production in 2008, 2009 and the total productions in 2010. In a similar way, we can determine the production in other years.

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sales	X	Y	1100	800	900	1200	1500	1400	
Company replacement		X	X + Y	0.3X + Y + 1100	360 + 1100 + 800 = 2260	360 + 330 + 800 + 900 = 2390	3030	3900	4460
Third party replacement			0	0.7X	840	1610	2170	2800	2640

As 0.7 ($x + y$) = 840
X + Y = 1200
As the company replacement of 2014 is $\frac{30}{100}$ (1200 + 1100 + 800) + 900 + 1200 and the company replacement in 2015 is $\frac{30}{100}$ (1200 + 1100 + 800 + 900) + 1200 + 2014 production (X) = $\frac{30}{100}$ (4000) + 1200 + X = 3900
X = 3900 – 2400 = 1500.
Similarly, production in 2015 = 1400.

6. 1200 solar power generators were sold in 2013.

7. 2300 solar power generators were sold from 2008 to 2010.

8. In 2012, the company sold or replaced 2260 panels.

9. 1100 solar power generators were sold in 2010.

10. The company sold 1400 solar power generators in 2015.

11. Among those with 1-year experience, all 6 managers have 15 or more points.

Among those with 2 years' experience, no one has 15 or more points.

Among those with 3 years' experience, at most 2 engineers an have 15 or more (because the 3rd engineer has 12 points) points.

Among those with 4 years' experience, at most 4 engineers can have 15 or more points.

\ At most 6 + 0 + 2 + 4 = 12 employees can have a performance appraisal of 15 or more points.

12. The average appraisal of each group varies within a range; therefore, nothing can be uniquely stated without knowing all the values.

13. The average performance appraisal of engineers with 3 and 4 years' experience lies in the range of 11.375

$$\left(\frac{2(12)+16+4(9)+15}{8}\right) \text{to } 14.125$$

$$\left(\frac{12+2(16)+9+4(15)}{8}\right).$$

Similarly, the average performance appraisal of engineers with 3 years and 4 years work experience lies in the range 10.33 to 12.

Maximum possible difference = 14.125 – 10.33 = 3.79.

14. The minimum average appraisal score of the managers would be

$$\left(\begin{array}{c}5 \times 15 + 1 \times 17 + 5 \times 12 + 1 \times 14 + 9 \times 10 \\ + 1 \times 12 + 4 \times 10 + 1 \times 13\end{array}\right)$$
$$\overline{27}$$

$$= \frac{75 + 17 + 60 + 14 + 90 + 12 + 40 + 13}{27}$$

$$= \frac{321}{27} = 11.89$$

15.

Company	2011	2016	Change
A	27	38	+11
B	46	39	−7
C	50	60	+10
D	74	82	+8
E	110	110	0

16. A maximum of 50 people would have crossed the age of 50 years between 2011 and 2016.

This implies that 60 people must have entered the age group.

17. Least possible number of employees
= 11 + 10 + 8 = 29.

18. Average selling price (S) = (1 + profit margin) × Average cost price (C)

Given that the average cost price increased by 20% every year. Let C in 2000 = 100

⇒ S in 2000 = 1.27 × 100 = 127

S in 2001 = 1.3 × 120 = 156

S in 2002 = 1.24 × 144 ≅ 179

S in every other year will be more than that in 2002. Hence, S is lowest in the year 2000.

19. The ratio $\dfrac{\text{Exports}}{\text{Demand}}$ cannot be determined independent

of the ratio $\dfrac{\text{Imports}}{\text{Supply}}$.

Therefore, in 2002, we can find that $\dfrac{\text{Supply}}{\text{Demand}} \times \dfrac{\text{Exports}}{\text{Imports}}$

as $\dfrac{0.72}{0.9}$. But we cannot find only $\dfrac{\text{Exports}}{\text{Demand}}$.

Hence, the question cannot be answered.

20. Given that the value of widgets imported in 2003 = `200 crore
= Average import price per widget × Volume of imports
= Average cost price per widget × Volume of imports
Now, value of widgets exported = Average selling price per widget × Volume of exports.

Hence, $\dfrac{\text{Average cost price} \times \text{Volume of imports}}{\text{Average selling price} \times \text{Volume of exports}}$

$$= \frac{1}{(1+0.3)} \times \frac{1}{0.5}$$

⇒ Value of exports = 0.65 × 200 = `130 crore.

21. Since the imports increased by a steady (i.e., equal) percentage every year, to find the year in which the exports increased by the highest percentage, we need to only consider the EXIM ratios. By observation, it is the highest from 2003 to 2004.

22. We can say that a company definitely had less market capitalization on 1st April 2016, when compared with company K, if both the following points are true.

(i) Market capitalization as on 1st April 2017 of the company is less than that of K, i.e., numerically higher rank in market capitalization happened for C, D, F, H, I, L, M, O, P and R.

(ii) Percentage growth in market capitalization of the company from 1st April 2016 to 1st April 2017 is more than that of company K, i.e., numerically lower rank in percentage growth in market capitalization happened for A, C, E, G, H, I, J, N, P and S. Both happened for C, H, I and P, i.e., a total of four companies.

23. Profitability of any company is definitely more than that of company M, if
   (i) Net profit of the company is definitely more than that of company M, i.e., numerically lower rank compared to company M.
   (ii) Sales of the company are definitely less than that of company M, i.e., numerically higher rank in sales compared to company M.

All companies (excluding M) except A, I, J and R satisfy. Hence, a total of 15 companies.

24. Looking at companies ranked lower than E in sales in 2016–17, it is possible that the difference in sales between E and the company just below it was very high in 2015–16 such that the companies which grew sales faster or slower than E was ranked below E. Now among companies which are ranked better than E in 2016–17, all companies which had a higher growth than E were ranked below E in 2015-16 and got ahead of E in 2016–17, i.e., companies C, F, J, P and S. So, E could have been ranked as high as 8th in 2015–16.

25. Company S had the highest gross profit while in terms of net profit, it was ranked 15th. So, it would have definitely paid more tax then all companies ranked from 1 to 14 in terms of net profit. Similarly, company R would have paid a higher tax than E and M. A also can be the company which paid the highest tax. Only one of these three companies could have paid the highest tax.

2 Bar Graphs

Chapter

❏ BAR

This is a type of graph which is widely used to depict data in a discrete way. They are accurate and the comparison of variables is very convenient.

☑ 300 ltr Model   ☐ 165 ltr Model   ☐ Double Door Model
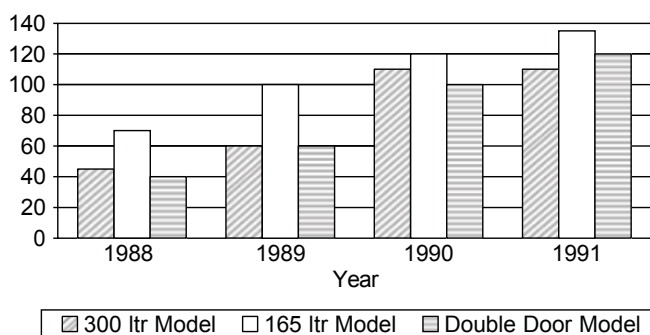
Fig. 2.1 Refrigerator sales of company abc (000's of units)

Figure 2.1 shows the model wise sales of refrigerators during four years. From this graph we can obtain the following:

- Percentage contribution of each model to the company's total sales for four years.
- Relative increase or decrease in the share of each model.
- Sales trend of various models.

Using this bar chart one can carry out a detailed performance evaluation of the company with respect to the sales of the four-year period from 1988 to 1991 for any given model. These bar charts can also be depicted horizontally. Another variation could be showing each product at one place (rather than each year at one place).

Directions for questions 2.01 to 2.05: These questions are based on the information given below.

Exports and Imports of a country (in ₹ 000' crore)
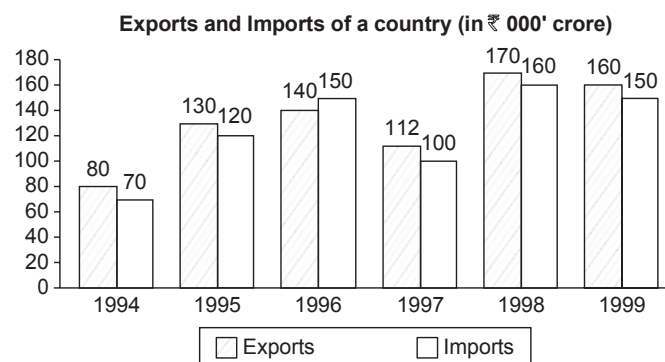
2.01: In how many of the given years were the exports at least 10% more than the imports?
(A) 0 (B) 1
(C) 2 (D) 3

Sol: In 1994, exports = $80 > 70 + \dfrac{10}{100}(70) = 77$

In 1995, exports = $130 < 120 + \dfrac{10}{100}(120) = 132$

In 1996, exports < imports
\ We need not consider this year.

In 1997, exports = $112 > 100 + \dfrac{10}{100}(100) = 110$

In 1998, exports = $170 < 160 + \dfrac{10}{100}(160) = 176$

In 1999, exports = $160 < 150 + \dfrac{10}{100}(150) = 165$

\ The given condition was satisfied in two years.

2.02: What was the average exports for the given period (in '000 crore)?
(A) 145 (B) 132
(C) 126 (D) 119

Sol: Average exports

$= \dfrac{80 + 130 + 140 + 112 + 170 + 160}{6} = 132$

2.03: From 1995 to 1999, in which year was the percentage growth in exports, when compared to the previous year, the highest?
(A) 1995 (B) 1996
(C) 1997 (D) 1998

Sol: Exports in a year exceeded that in the previous year in 1995, 1996 and 1998. Percentages by which exports in 1995, 1996 and 1998 exceed the exports in the previous year were

$\dfrac{50}{80}(100)\%, \dfrac{10}{130}(100)\%$ and $\dfrac{58}{112}(100)\%$, respectively.

The growth rate was the highest in 1995.

2.04: What is the simple average annual growth rate in the imports from 1994 to 1999?
(A) 15 (B) 18
(C) 19 (D) 23

Sol: Imports in 1994 (in '000 crore) = 70
Imports in 1999 (in '000 crore) = 150

Percentage growth = $\dfrac{150 - 70}{70} \times 100 = 115\%$

Average annual growth = $\dfrac{115}{5} = 23$

2.05: Among the years in which the imports as well as exports exceeded those in the previous years, in how many years was the percentage increase in imports less than the percentage increase in exports?
(A) 0 (B) 1
(C) 2 (D) 3

Sol: The imports as well as exports exceeded those in the previous years in 1995, 1996 and 1998.
\ In none of the years was the given condition satisfied.

EXERCISE-1

Directions for questions 1 to 5: Answer these questions based on the information given below.

The value of exports/imports of a country (₹ in 000' crore)
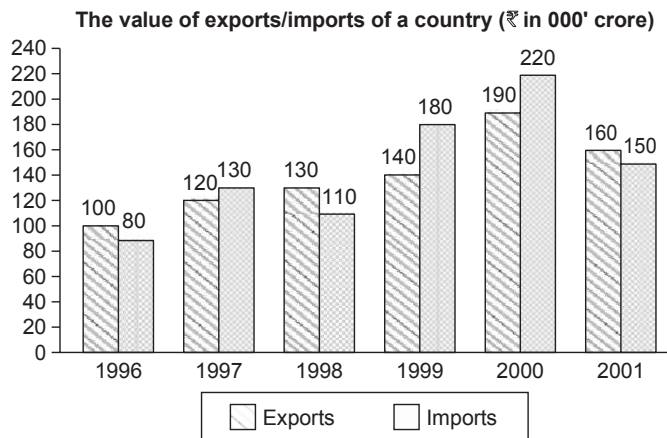
Trade surplus = Exports – Imports.
Trade deficit = Imports – Exports.

1. For the period 1996 to 2001, what percentage of average exports is the cumulative trade deficit?
   (A) 28.6%   (B) 31.6%
   (C) 27.3%   (D) 32.3%

2. During the year 1999, the average cost of exports is `7000 per ton and that of imports is `6000 per ton. By what per cent is the total tonnage of exports less than the total tonnage of imports in that year?
   (A) $66\frac{2}{3}$%   (B) 50%
   (C) 25%   (D) $33\frac{1}{3}$%

3. The percentage decrease of trade surplus from 2001 to 2002 is same as that from 1998 to 2001. Imports in 2002 increased by 20%. What is the value of exports in 2002 in thousands of crore?
   (A) 180   (B) 185
   (C) 190   (D) 195

4. It is decided to increase the exports by 10% every year over its previous year for the next three years from 2001 and also decrease the imports by 10% in the same way. What will be the value of total trade after three years, approximately in thousands of crore of rupees?
   (A) 322   (B) 316
   (C) 414   (D) 450

5. What was the approximate compounded annual growth rate of the exports from 1996 to 2001?
   (A) 8%   (B) 10%
   (C) 12%   (D) 14%

Directions for questions 6 to 10: Answer these questions based on the information given below.

Sales turnover of four companies in different quarters of the year 2001
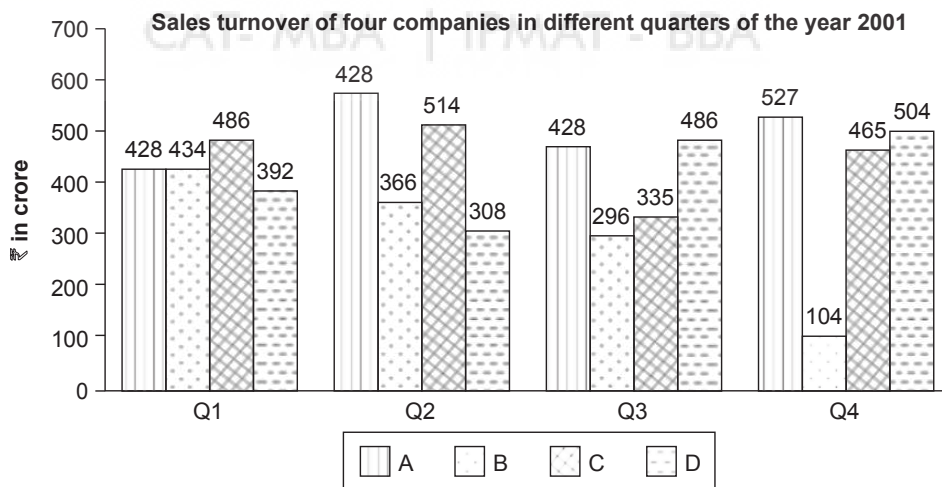
6. Which company has the greatest sales turnover in the year 2001?

7. During the second quarter, the profits of A, B, C and D are in the ratio 8 : 7 : 6 : 5, respectively. For which of the four given companies, is profit as a percentage of sales turnover, the highest?

8. For how many quarters is the sales turnover of company A more than 25% of the total sales turnover of all the four given companies for that particular quarter?

9. What is the approximate percentage decrease in the total sales turnover of all the given companies from the second quarter to the third quarter?

60

10. For how many companies is the sales turnover consistently increasing or decreasing?

Directions for questions 11 to 15: The following questions are based on the stacked bar graph, which represents the overall record of matches played by football playing countries in the year 1998.

- No. of matches played
- No. of matches won
- No. of matches drawn
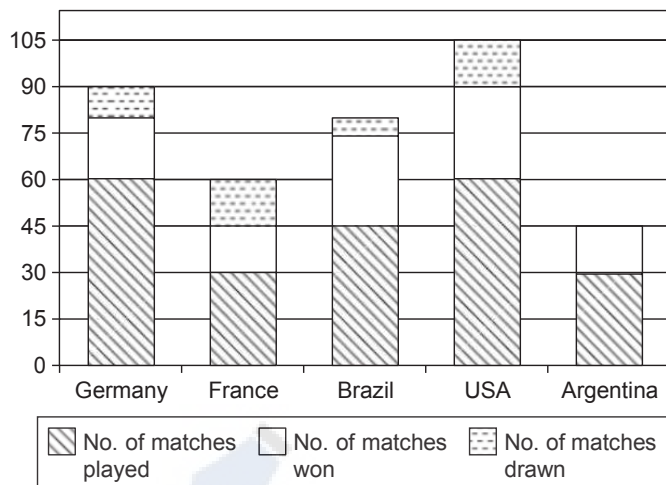
11. Among the given countries, which country lost maximum number of matches?
(A) Germany   (B) USA
(C) Brazil   (D) Argentina

12. If the number of matches played by Germany, Brazil and USA are doubled and the ratio of number of matches drawn and lost to total matches, respectively remains the same, then which of these teams have the highest success rate?
(A) Germany   (B) Brazil
(C) USA   (D) France

13. If the matches lost by Argentina to the other teams, namely to Germany, France, Brazil and USA are in the ratio 3 : 5 : 4 : 3, respectively then which of the following teams had the highest success rate against Argentina?
(A) France   (B) Brazil
(C) Germany   (D) Cannot be determined

14. What is the ratio of matches lost by Germany to those lost by Brazil?
(A) 2 : 1   (B) 3 : 1
(C) 3 : 2   (D) 1 : 1

15. How many more matches were won by the three teams, which had the same success rate (matches won as a percentage of matches played) than the other two teams?
(A) 5   (B) 15
(C) 10   (D) 20

Directions for questions 16 to 20: Answer these questions based on the information given below.

Sales of metals in India (in million tonnes)
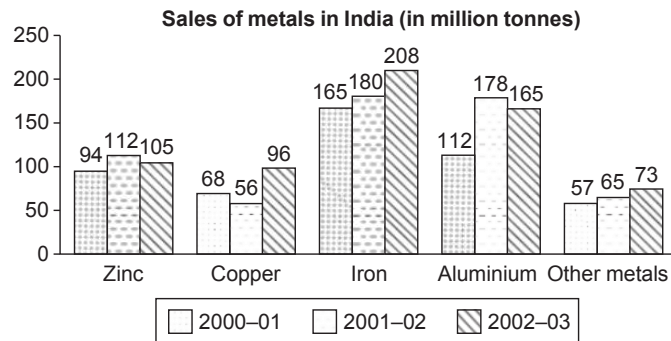
16. The sales target for the sales of metals in the year 2002–2003 was 20% more than that of the actual sales in the year 2000–2001. What is the approximate percentage deficit or surplus achieved in the actual sales in the year 2002–2003?
(A) 8% deficit
(B) 9% surplus
(C) 30% surplus
(D) 120% deficit

17. The sales of Tin in 2000–2001 were 41.32% of the total sales of that of 'Other metals' and they increased by 10% every subsequent year. In 2002–2003, what percentage of the total sales were the sale of Tin?
(A) 3.8%
(B) 4.4%
(C) 7.7%
(D) Cannot be determined

18. If, for every year, the total sales of all metals are 80% of their quantity available and the total sales in the year 2003–2004 for every metal was 25% more than that in the year 2002–2003, then what was the quantity of copper available in the year 2003–2004 (in million tons)?
(A) 120   (B) 150
(C) 1480   (D) 164

19. What is the average annual percentage increase in the sales of all the metals from the year 2000–2001 to the year 2002–2003?
(A) 10.2%   (B) 11.2%
(C) 30.6%   (D) 15.2%

20. What is the approximate ratio between the sales of Gold, which is 25% of that of 'Other metals', in 2002–2003 to the sales of silver, which is 20% of that of 'Other metals' in 2000–2001?
(A) 0.625   (B) 0.976
(C) 1.6   (D) 1.976

Directions for questions 21 to 25: These questions are based on the following bar graph.

Production details of all the products manufactured by XYZ Ltd.
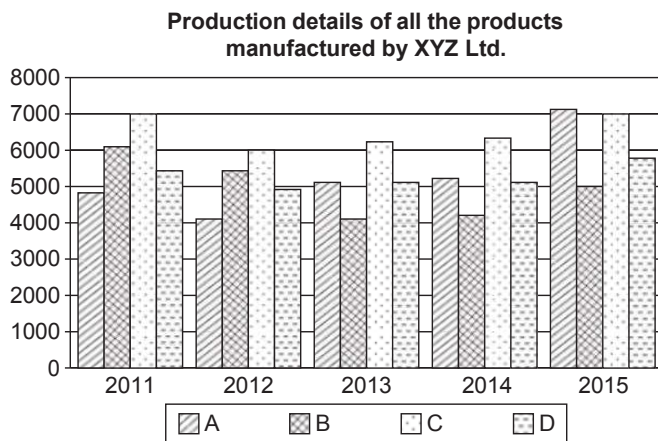
21. In how many of the given years was the production of D, as a percentage of that of B, more than 80% but less than 120%?

(A) 1   (B) 3

(C) 4   (D) 5

22. In which of the following years was the absolute change in the total production of XYZ Ltd. over that of the previous year, the highest?

(A) 2012   (B) 2013

(C) 2014   (D) 2015

23. In the year 2014, 37.5% of the production of D was exported. If the ratio of the total units exported of D to that of A was 5 : 6, then what percentage of the production of A was exported?

(A) 40%   (B) 45%

(C) 50%   (D) 60%

24. From 2015 to 2016, the production of B decreased by 40% and the production of every other product increased by 35%. In 2016, the production of B as a percentage of total production of all the four products is

(A) 10%   (B) 15%

(C) 20%   (D) 25%

25. Which of the following statement/s is/are definitely true?

  I. From 2011–2014, the production of only one of the products decreased and increased in alternate years.

  II. For all the years put together, the production of the product D was the highest when compared to other products.

  III. The percentage share of the production of D increased by about 1.7 percentage points from 2013–2015.

(A) Only II

(B) Only I

(C) Both I and II

(D) Both II and III

Directions for questions 26 to 30: These questions are based on the following stack bar.

Percentage breakup of expenses
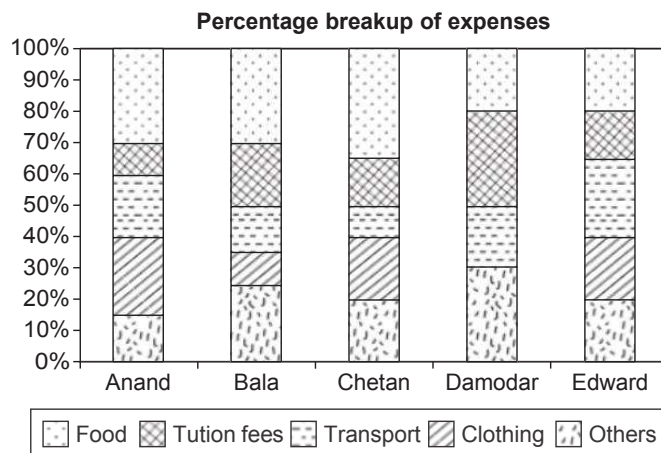
26. If Bala's expenses on clothing are `3700, then how much did he spend on food and tuition fees together?

(A) `6250      (B) `6475

(C) `7200      (D) `7400

27. If Anand's expenses on food was `1620, then what was his expenses on the other four items together?

(A) `11400

(B) `10,800

(C) `9180

(D) None of these

28. If the total expenses of Bala and Chetan are in the ratio of 3 : 5, then what is the ratio of their 'other' expenses?

(A) 18 : 35   (B) 14 : 19

(C) 3 : 5   (D) 7 : 11

29. If Damodar spends 15% more on transport than Edward on clothing, then the total expenses of Damodar is what percentage more / less than that of Edward?

(A) 16.25% more

(B) 13.75% more

(C) 16.75% less

(D) 13.75% less

30. If Anand's expenses under each of the five heads is not less than that of Chetan's, then the total expenses of Anand is at least how many times that of Chetan's?

(A) 1.2   (B) 1.5

(C) 1.8   (D) 2.0

Directions for questions 31 to 35: These questions are based on the following graph.

The country wise break up of exports/imports of country 'XYZ' in 1996
(in ₹ thousand crore)
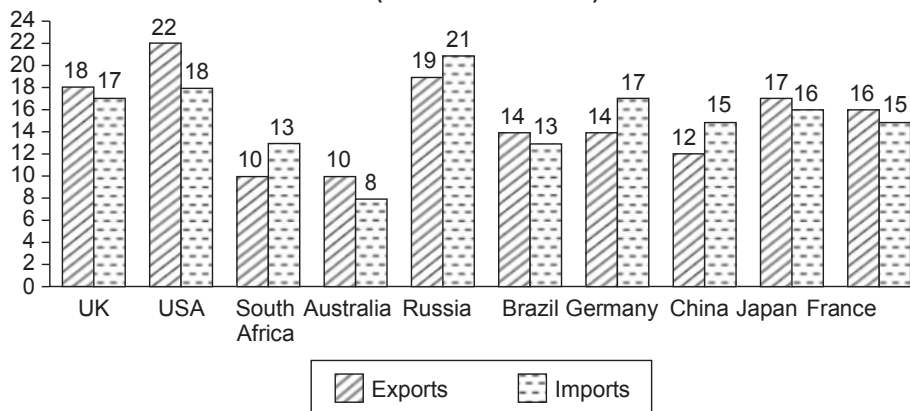
Trade Surplus = Exports – Imports; Trade Deficit = Imports – Exports

31. The cumulative trade deficit of country XYZ is approximately what per cent of its average imports from each of the above-mentioned countries?
(A) 65%   (B) 9%
(C) 6.5%   (D) 0.6%

32. If the average cost of exports is ₹2000 per ton and that of imports is ₹3000 per ton, then by what per cent is the total tonnage of exports more/less than the total tonnage of imports?
(A) 33.3% more   (B) 49% less
(C) 32.8% more/less   (D) 49% more

33. By what percentage are the imports from the country to which the exports are the highest more than the exports to the country from which the imports are the least?
(A) 175%   (B) 80%
(C) 55.55%   (D) 125%

34. Which of the following statements is true?
(A) Country XYZ has a cumulative trade surplus of ₹1 crore.
(B) The cumulative trade deficit of country XYZ is approximately one-fifteenth of its total imports.
(C) The trade deficit of country XYZ considering its trade with China alone is 300% more than its cumulative trade deficit/surplus.
(D) The difference between the highest exports to any country and the lowest imports from any country is equal to the average of the exports to Brazil and Germany.

35. What is the ratio of the total imports from Brazil, Japan, South Africa, Russia and China, to the total exports to the other five countries?
(A) 0.975   (B) 1.026
(C) 0.96   (D) None of these

Directions for questions 36 to 40: These questions are based on the bar graph and the table given below.

Literacy rate of several states in the year 2000
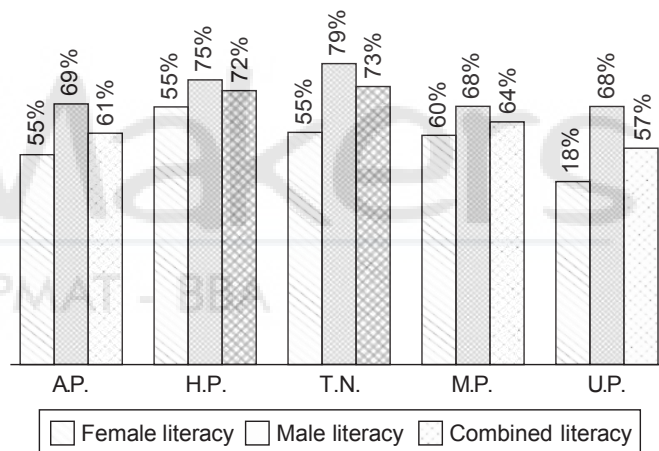
Literacy rate = $\dfrac{\text{Number of literates}}{\text{Total population}}$

Population (in crore) of the given states in the year 2000 is as follows:

A.P.	H.P.	T.N.	M.P.	U.P.
7	6.3	6.5	6	16

36. What is the ratio of number of females to the number of males in the state of T.N.?

37. By what percentage is the population of U.P. less than the total population of the other four states?

38. What is the total number of literate males and literate females in the state of U.P.?

39. In which of the following states is the number of literate males, the highest?

40. What is the number of males in the state of H.P.?

Directions for questions 41 to 44: Answer these questions based on the information given below.

Production and export of sugar (in million kg) from country X

Production and export of sugar (in million kg) from country X

Per capita consumption (in kg) of sugar in country X

Per capita consumption (in kg) of sugar in country X
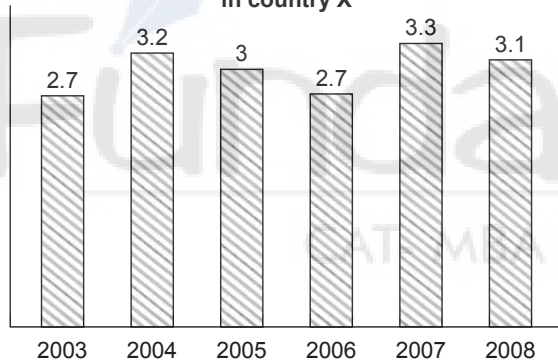
Note: The country did not import sugar in any of the given years

41. In which of the given years was the population of country X, the lowest?
(A) 2003   (B) 2004
(C) 2005   (D) 2006

42. In which year was the percentage increase in the population of country X, the highest?
(A) 2004   (B) 2008
(C) 2006   (D) 2007

43. If the government had planned to increase the exports by 10% each year from 2003 to 2008, what should have been the production (in million kg) in 2008 if the consumption was as given?
(A) 612   (B) 646
(C) 688   (D) 731

44. Which of the following has shown their greatest percentage increase from 2003 to 2008?

(A) Per capita consumption
(B) Production
(C) Population
(D) Consumption

Directions for questions 45 to 47: These questions are based on the information given below.
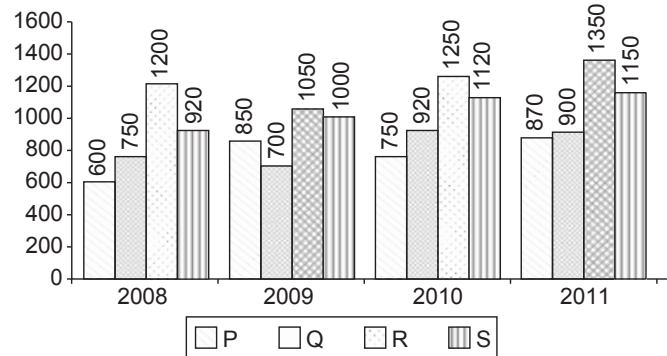
ABC Ltd produces four commodities, namely P, Q, R and S. The prices of P, Q, R and S, respectively in 2008 were `12, `15, `10 and `20 per kg. The price of each commodity goes up by 10% every year. The following bar graph gives the sales (in kg) of each of the four commodities from 2008 to 2011.

45. What was the sales (in `) of the company in 2009?
(A) `57,350       (B) `56,320
(C) `53,860       (D) `51,200

46. What was the percentage increase in the sales (in `) of the company from 2010 to 2011?
(A) 15.23   (B) 16.25
(C) 17.89   (D) 18.68

47. The percentage share of commodity P in the total sales (in `) of the company in 2011 is approximately
(A) 15.2   (B) 15.9
(C) 16.7   (D) 17.3

Directions for questions 48 to 50: Answer these questions based on the information given below.

The following bar graph gives the number of employees in a company, the sales per employee (in ` crore) and the expenses of the company (in ` crore) in four years from 2009 to 2012.
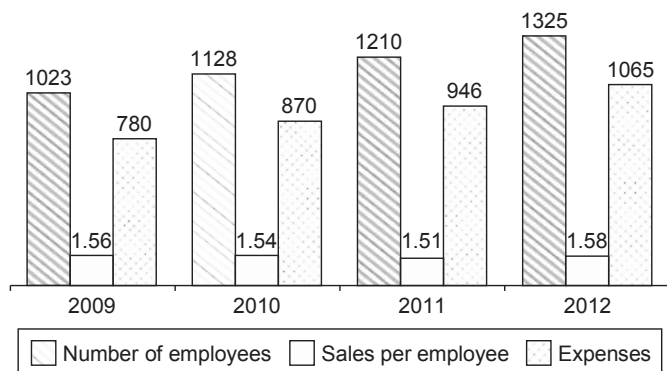
Sales of the company = (Number of employees) ×
(Sales per employee)
Profit = Sales – Expenses.

48. What was the highest percentage increase in sales of the company in any year, when compared to that of the previous year, in the given period?
(A) 8.5%   (B) 10.2%
(C) 14.5%   (D) 17.2%

49. Which of the following had the highest percentage increase in any year, when compared to that of the previous year, in the given period?
(A) Sales   (B) Number of employees
(C) Expenses   (D) Profits

50. If profitability is defined as the ratio of profits to expenses, then in which year was the profitability, the least?
(A) 2009   (B) 2010
(C) 2011   (D) 2012

EXERCISE-2

Directions for questions 1 to 5: Answer these questions based on the information given below.
   The graphs give the results of the market survey regarding various e-mail package used.
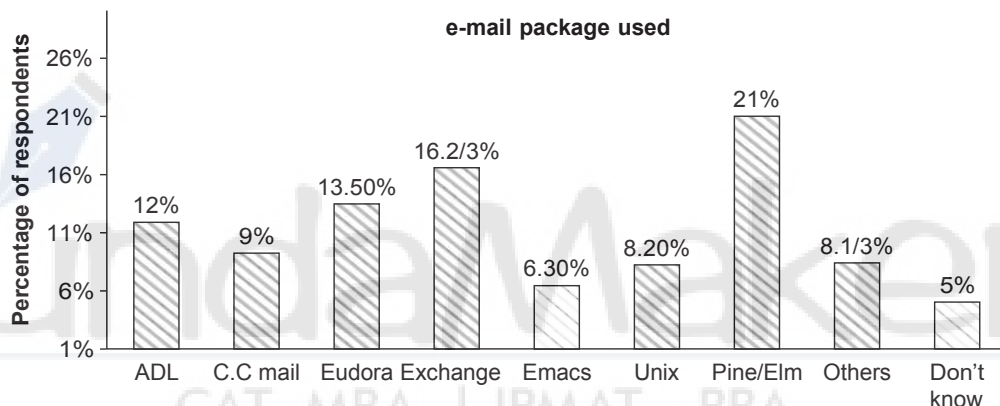
e-mail package used

Note: No respondent uses more than one e-mail package.

Reasons for using an e-mail package
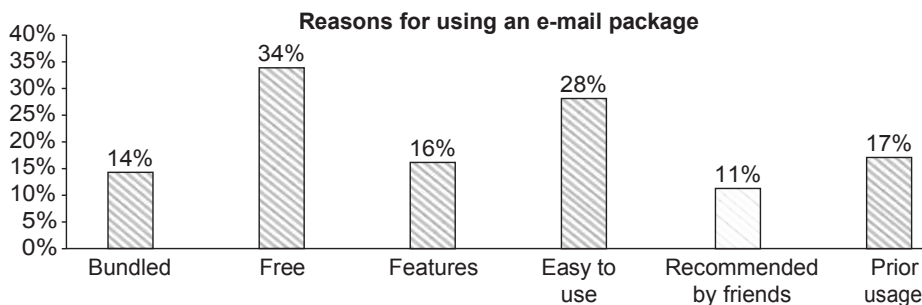
Note: Each respondent claimed one or more than one of the above reasons.
   Total number of respondents = 25500

1. If half of the number of users whose response was 'Don't know', use either AOL or Eudora, then what is the total number of respondents who use AOL or Eudora?
(A) 6120   (B) 7140
(C) 650   (D) 7850

2. Among the respondents, if the users who claim their reason for usage to be 'features' or due to 'prior usage', use only Pile/Elm, then how many Pine/Elm users could have claimed both the reasons?

(A) 3060   (B) 2550
(C) 5355   (D) 5510

3. If the users of C.C. mail shift to Eudora because Eudora is 'Easy to use', then what is the percentage increase in the number of users claiming the reason 'Easy to use'?
(A) 32%
(B) 66 2/3%
(C) 48.2%
(D) Cannot be determined

4. If all the respondents except the users of C.C. mail claim only one reason and the group of respondents who said 'don't know', were excluded from the survey of reasons for using an e-mail package, then what is the average number of reasons claimed by C.C. mail users?

(A) 43   (B) 3.8   (C) 1.2   (D) 10.6

5. Exactly 15% of the respondents claimed the combination of at least two reasons. A maximum of how many UNIX or AOL respondents claimed at most one reason?

(A) 5100   (B) 3825
(C) 5151   (D) None of these

Directions for questions 6 to 9: Answer these questions based on the information given below.

The following bar graph gives the total sales (in `crore) of watches sold by all the companies and the average selling price (in `) per watch sold by company ABC.
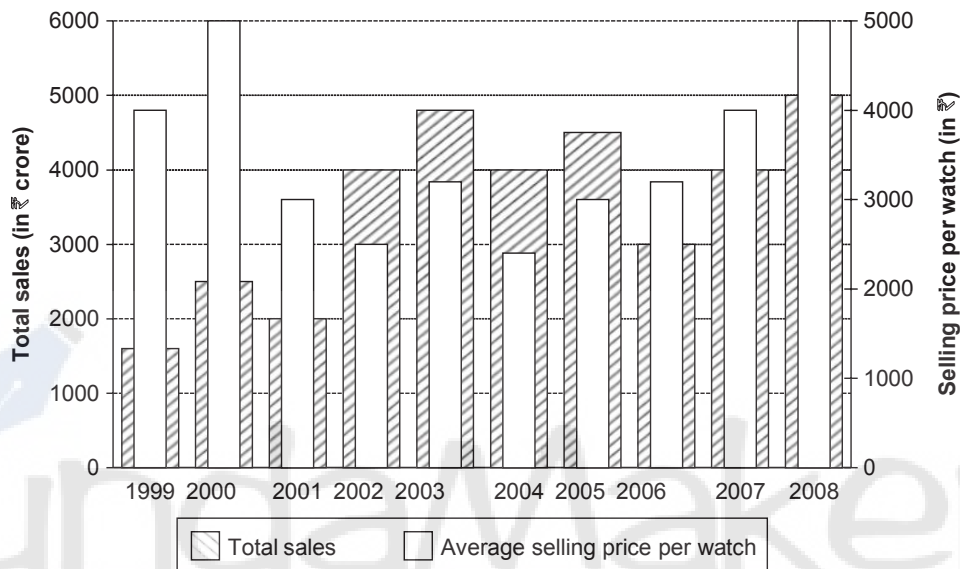
The following table indicates the percentage market share of company ABC and the profit as a percentage of its sales for the different years.

Year	Market share (by value)	Profit as a percentage of sales
1999	50%	12%
2000	40%	15%
2001	60%	10%
2002	37½%	20%
2003	33⅓%	15%
2004	45%	20%
2005	40%	16⅔%
2006	66⅔%	11%
2007	60%	16%
2008	50%	16%

6. If in the year 2005, the sales of watches of company ABC form 25% by volume of the total sales of watches, then what is the average selling price per watch of all the other companies in that year?

(A) `200           (B) `2000
(C) `1500           (D) `150

7. In how many years from 2000 to 2008, did the value of the sales of company ABC increase while its profit decreased over the previous year?

(A) 4   (B) 5   (C) 3   (D) 6

8. The ratio of the profits earned by company ABC in the year 2004 to that in 2008 is

(A) 5 : 4   (B) 7 : 6
(C) 8 : 9   (D) 9 : 10

9. If in each of the given years, the average selling price per watch of all the companies in the market was less than that of the average selling price per watch of company ABC, then in at least how many of the given years was the market share (by volume) of company ABC less than 50%?

(A) 4   (B) 5   (C) 6   (D) 7

Directions for questions 10 to 13: Answer these questions based on the information given below.

There are four departments, such as Marketing, Finance, HR and Operations of company XYZ had 5, 3, 4 and 6 employees as on 1 April 2012. In the next four years, the company recruited one employee in each of the four departments.

All the new employees who joined the company joined on 1 April and were 25 years of age at that point of time. During these four years, two employees who were aged 60 years and 64 years retired from two departments of the company. The following graph gives the average age of the employees in the departments as on 1 April 2012, 2013, 2014 and 2015.

Legend: 2012 | 2013 | 2014 | 2015

Marketing: 48, 49, 43, 44
Finance: 37.33, 35, 36, 37
HR: 42.75, 43.75, 35, 36
Operations: 45, 43, 44, 45
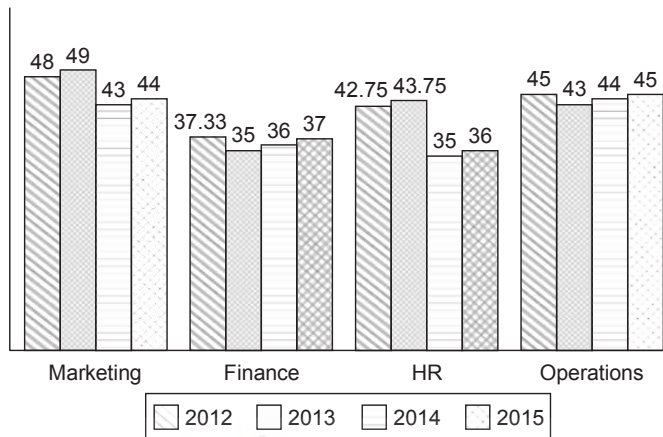
10. From which department did the employee aged 64 years retire?
(A) Marketing
(B) Finance
(C) HR
(D) Operations

11. In which year did the new employee join the HR department?
(A) 2015
(B) 2014
(C) 2013
(D) 2012

12. From which department did the employee aged 60 years retire?
(A) Marketing
(B) Finance
(C) HR
(D) Operations

13. As on 1 April 2015 the age of the new employee who joined the operations department is _____ years.
(A) 28
(B) 26
(C) 25
(D) 27

Directions for questions 14 to 17: Answer these questions based on the information given below.

The following bar graph gives the number of students in all the classes at Champion school in the year 2015 and 2016, respectively. Government regulations ensure that not more than 25% students fail in a class and the school management has a policy of failing at least 10% students in each class. Students join the school only in Class VI and do not leave until they pass out of Class X.

Legend: 2015 | 2016

VI: 90, 85
VII: 80, 91
VIII: 70, 76
IX: 100, 88
X: 120, 80
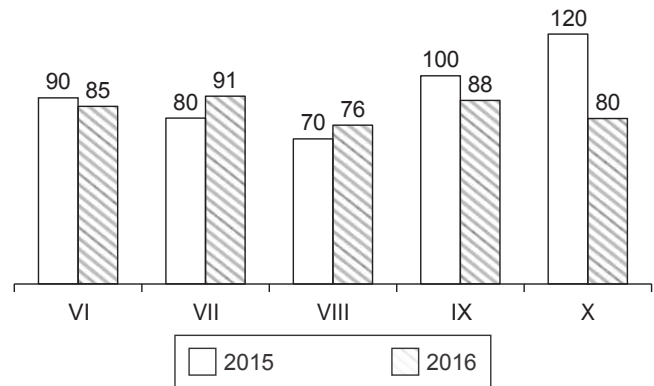
14. Which class had the highest pass percentage in the year 2015?

15. What is the number of students who joined the school in 2016?

16. What is the total number in students of the school who failed in the year 2015?

17. In the year 2015, in which class did the maximum number of students fail?

Directions for questions 18 to 21: Answer these questions based on the information given below.

The chart given below gives the land revenue collections (in crore of rupees) of the given states from 2000 to 2004. The values given at the top of each bar represents the total land revenue collections in the corresponding year.

State	1999–2000	2000–01	2001–02	2002–03	2003–04
UP (Uttar Pradesh)	6124	6321	7548	8106	8564
TN (Tamil Nadu)	3167	3384	3921	4163	4931
MP (Madhya Pradesh)	3246	3561	3628	3821	4376
KA (Karnataka)	2825	3426	3568	3943	4631
Guj (Gujarat)	3951	4427	4903	5436	5521
Bihar	5964	6331	6435	7345	7684
AP (Andhra Pradesh)	4123	4318	5625	5836	6231
Total	29,400	31,768	35,628	38,650	41,938
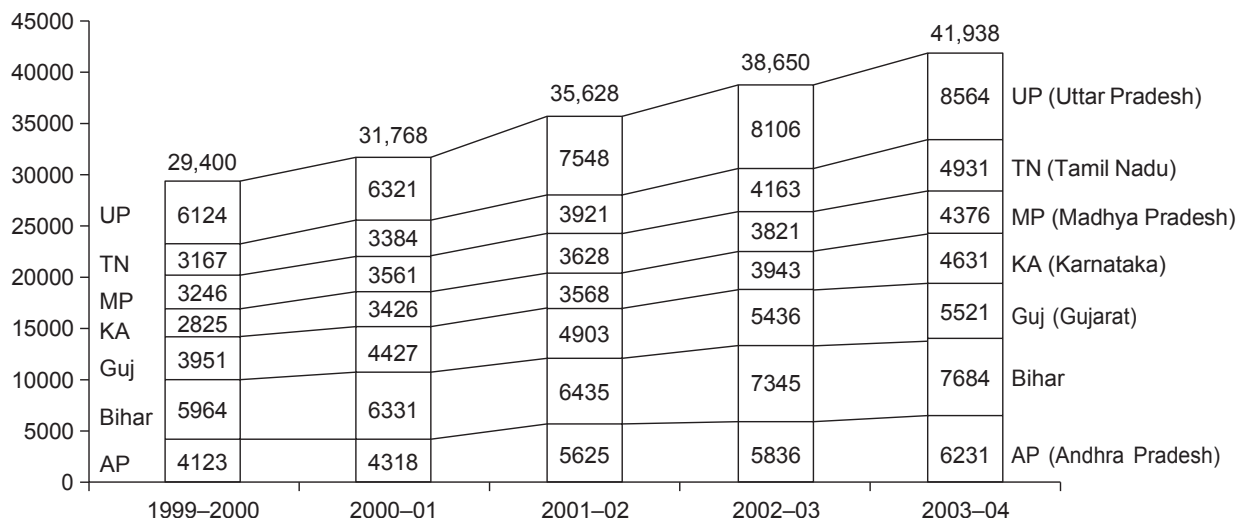
18. If for each year, the states are ranked in terms of the descending order of land revenue collection, then how many states have got the same rank in four of the five given years?
(A) 2
(B) 3
(C) 4
(D) 5

19. The percentage share of land revenue collection of which state has increased by the maximum percentage points from 1999–2000 to 2000–01?
(A) Uttar Pradesh
(B) Karnataka
(C) Bihar
(D) Andhra Pradesh

20. Which pair of successive years shows the maximum growth rate of land revenue collection in Tamil Nadu?
(A) 2000 to 2001
(B) 2001 to 2002
(C) 2000 to 2003
(D) 2003 to 2004

21. For which state has the land revenue increased by the same amount in two successive pairs of years?
(A) Andhra Pradesh
(B) Karnataka
(C) Gujarat
(D) Tamil Nadu

Directions for questions 22 to 25: Answer these questions based on the information given below.

Consumer preferences of major sportswear brands
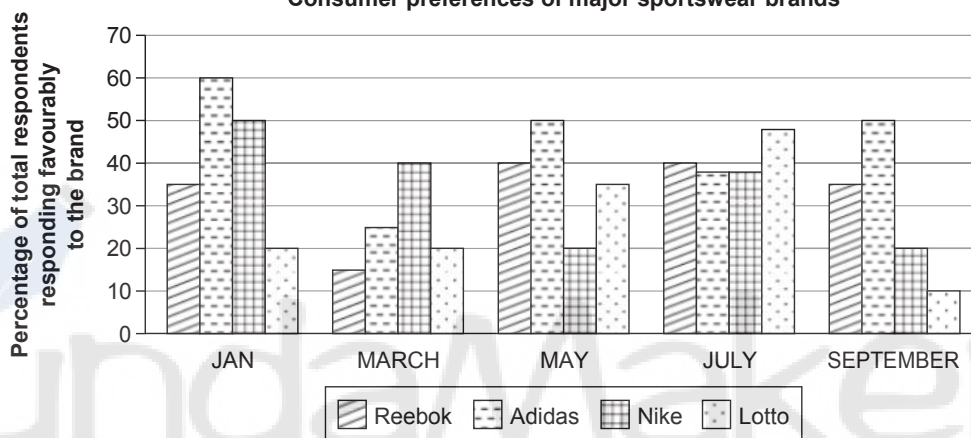
Note: (i) A respondent could give a favourable response for more than one brand.

(ii) The percentage of total respondents responding favourably to a brand represents the consumer liking of that brand.

It is also known that, the sample size (i.e., the total number of respondents in the survey) in March was larger than that in January. The sample size in July was greater than that in March, while the sample size in September is the largest among all the surveys.

22. When the survey results of January and September are considered together, which brand was liked by the maximum number of consumers?
(A) Reebok
(B) Adidas
(C) Nike
(D) Cannot be determined

23. If the sample size in March was 1200, then the number of respondents who did not respond favourably to any of the four brands in that month could be at most
(A) 720
(B) 480
(C) 180
(D) None of these

24. If the number of respondents responding favourably to a brand is represented by N, then which of the following statements is/are false?

(I) The value of N for at least one brand in July was more than that in January.
(II) The value of N for at most one brand in September was less than that in July.
(III) The value of N for exactly one brand in March was the same as that in September.
(A) Only I
(B) Only III
(C) Both II and III
(D) None of the above

25. The sample size in January was 800 and in May it increased by 25%. The number of respondents, who responded favourably in May, to more than one brand (from among the given four brands), must be at least
(A) 100
(B) 150
(C) 250
(D) 400

Directions for questions 26 to 29: Answer these questions based on the information given below.

The bar charts give the statistics regarding the telecommunications industry in a country. There are only three types of services, namely LOCAL, STD, and ISD – offered by the industry, and there are only four companies, such as AIRCOMM, AIRSIM, DATACOM and APPLE in the industry. Sales in this industry are measured in terms of number of call units.

Distribution of the total sales volume of the industry (by type of service)
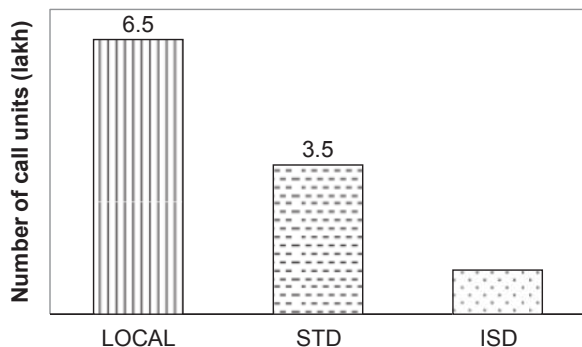
Distribution of the total sales volume of the industry (by company)
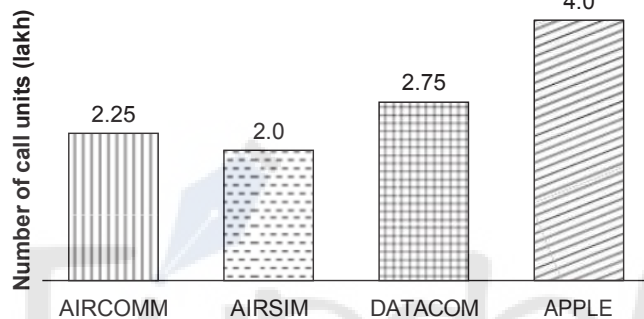
Charges customers pay for the different types of services offered by various companies
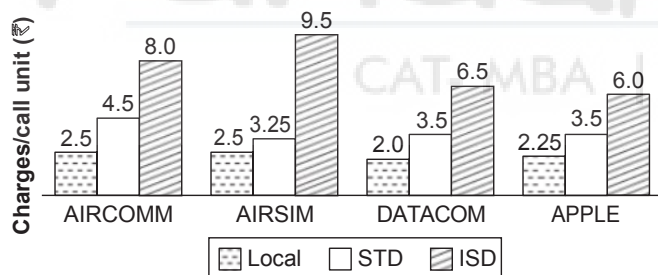
26. Given the above information, what could be the least possible amount spent by all the customers on all the LOCAL and STD calls put together? Assume that a customer can utilize the services of more than one company.

(A) `22 lakh
(B) `26.375 lakh
(C) `26 lakh
(D) `27.75 lakh

27. What would be the answer to the above question if the term STD is replaced with ISD?

(A) `18.875 lakh
(B) `20.125 lakh
(C) `22.175 lakh
(D) `22.875 lakh

Additional Data for questions 28 and 29:
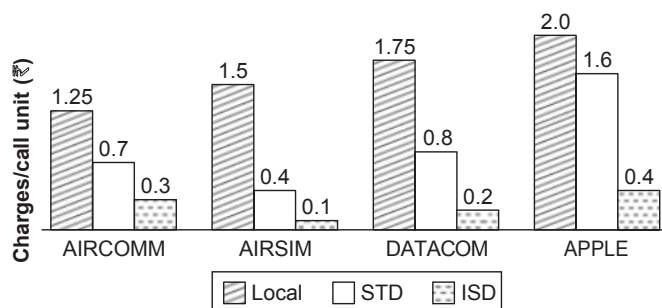
Distribution of the total sales volume of the industry (by type of service)
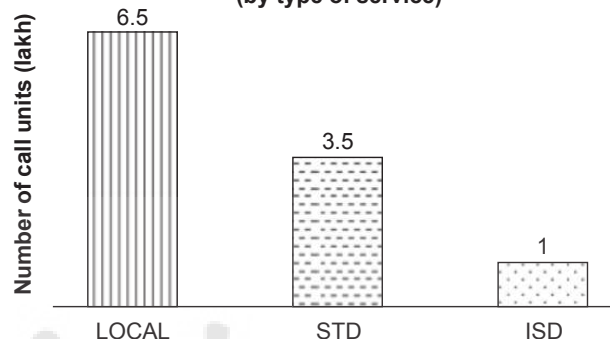
28. If each company reduced its STD charges per call unit by `1, but to exactly compensate for the subsequent revenue loss, it simultaneously increased its ISD charges proportionately, then which company offers the second cheapest service for ISD calls? Assume that the total number as well as the distribution of call units remain the same.

(A) AIRCOMM   (B) AIRSIM
(C) DATACOM   (D) APPLE

29. The company whose total sales revenue is the highest is

(A) AIRCOMM   (B) AIRSIM
(C) DATACOM   (D) APPLE

Directions for questions 30 to 33: These questions are based on the following table and bar graph.

Distribution of the total number of students enrolled in the top 10 Management Institutes based on their educational background.

Stream	Number of students
Commerce	1100
Science	2200
Engineering	3000
Medicine	1500
Arts	500
Others	400

Percentage distribution of the students of various backgrounds on the basis of their work experience (in years)
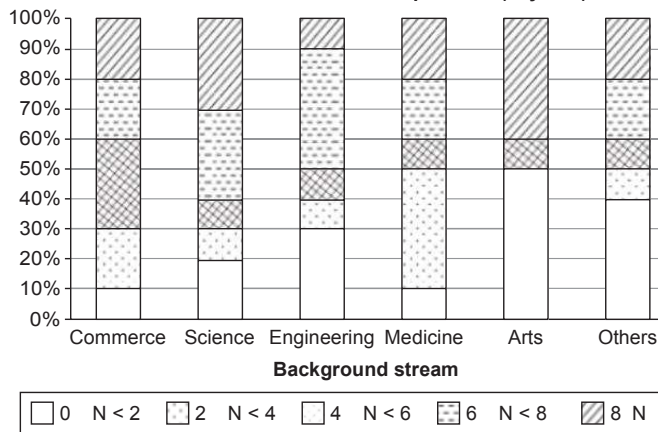
N = Number of years of work experience

30. The least number of students enrolled are from the group with work experience of
   (A) At least four years but less than six years.
   (B) At least six years but less than eight years.
   (C) At least two years but less than four years.
   (D) Less than two years.

31. In which of the following categories is the number of students enrolled the highest?
   (A) Number of Medical students with $2 \leq N < 4$.
   (B) Number of Arts students with $N \geq 8$.
   (C) Number of Science students with $6 \leq N < 8$.
   (D) Number of Engineering students with $4 \leq N < 6$.

32. If the stream wise break-up of the backgrounds of the total number of students was plotted on a pie chart, then the angle subtended by the sector representing the number of students from the Engineering stream would be approximately how many degrees more than that subtended by the sector representing the number of students from the Commerce stream?
   (A) 78.6°   (B) 75°
   (C) 50°   (D) 50.6°

33. Which of the following statements is true?
   (A) The most number of enrolments in the work experience group $N \geq 8$ was from the Arts stream.
   (B) The least number of enrolments in the work experience group $0 \leq N < 2$ was from 'Other' streams.
   (C) At least 30% of the total number of students enrolled in the top 10 management institutes are from the Engineering stream.
   (D) None of the above

Directions for questions 34 to 37: Answer these questions based on the information given below.
   The bar graph gives the details of students studying in classes V to X at Model Public School, for the years 2015 and

2016. Students join the school in Class V and leave the school only after they pass Class X. No student leaves or joins any other class. Students who pass the final examination in any class are promoted to the next higher class in the next year while students who fail have to continue in the same class in the next year also. It was also known that the pass percentage in class V in 2015 was at least 90.
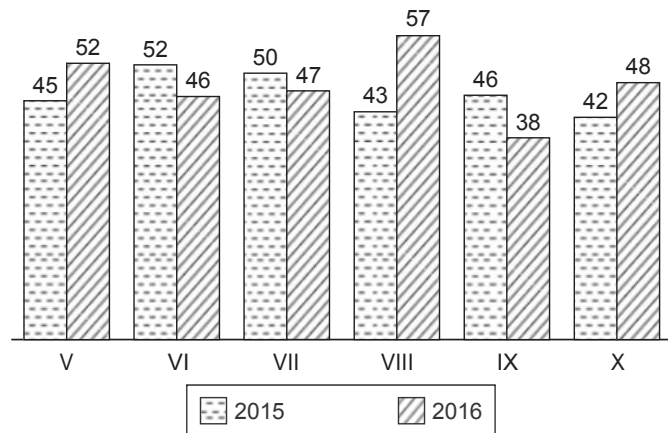
34. How many students joined Class V in the year 2016?

35. In the year 2015, what is the number of students who failed in all the classes from V to X put together?

36. For which class was the pass percentage in the year 2015, the highest?

37. In the year 2015, for how many of the given classes was the pass percentage less than the overall pass percentage of the school?

Directions for questions 38 to 41: Answer these questions based on the information given below.
   A company has four branches B_1, B_2, B_3 and B_4. There are four departments, such as Production (P), Marketing (M), Finance (F) and Research (R) at each of the four branches.
   At each of the branches, every employee has opted for exactly one of the five shifts among Dawn shift, Morning shift, General shift, Evening shift and Night shift. Further, at each of the four branches, in each of the four departments, there was at least one employee working in each of the five shifts.

Departmentwise classification of employees
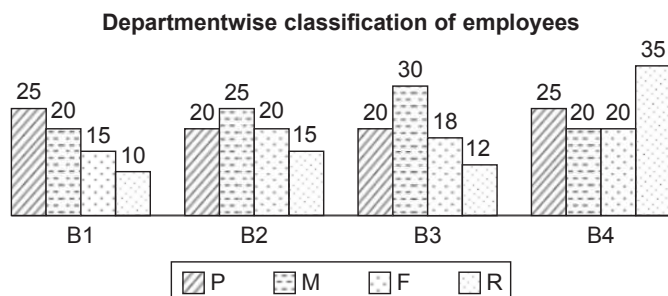
Shiftwise classification of employees
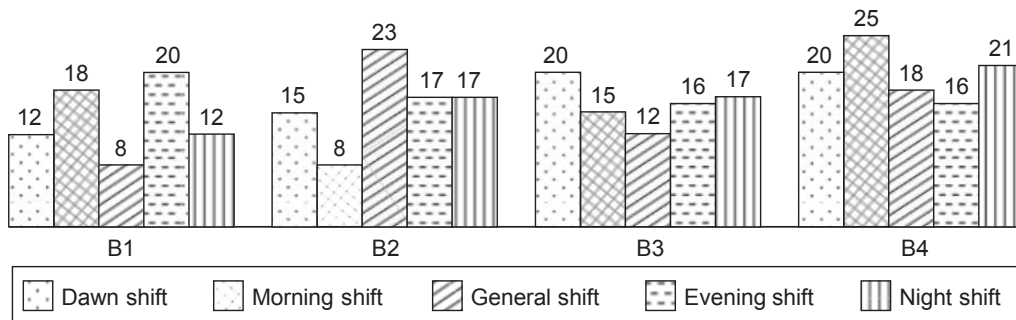
38. Considering all the four branches, the total number of marketing employees who work in the morning shift is at most
(A) 54
(B) 49
(C) 53
(D) 48

39. In Branch B$_3$, the difference between the number of Production employees who work in the morning shift and that of Finance employees who work in the general shift is at most
(A) 10
(B) 11
(C) 12
(D) None of these

40. Considering all the four branches, the number of employees from the Marketing department, who work in either the morning shift or the general shift is at most
(A) 75
(B) 77
(C) 78
(D) 79

41. The company shifted a total of x employees working in the evening shift into the night shift, so that the number of employees working in the night shift is more than those working in the evening shift in each branch. What is the least value of x?
(A) 3
(B) 4
(C) 5
(D) 6

Directions for questions 42 to 46: These questions are based on the following figures.
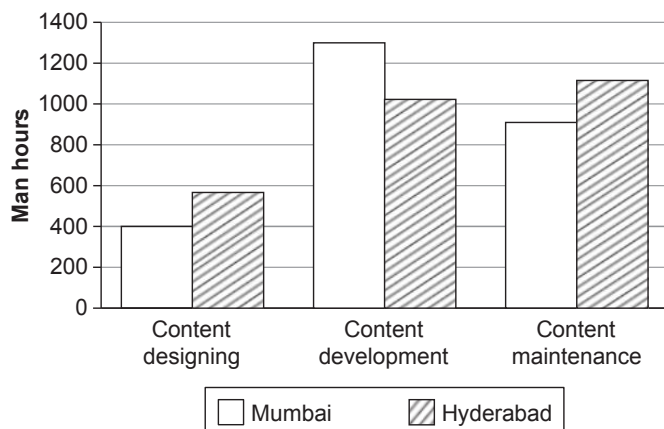
Figure shows the amount of work distribution, in man-hours for a book publishing organization between the activities conducted at two of its offices at Mumbai and Hyderabad.

The activities are content designing, content development and content maintenance.
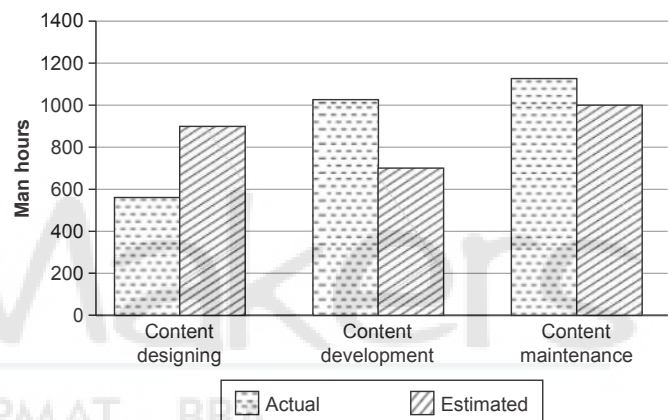
Above figure shows the estimated and actual work involved in the same set of activities in the same organization (at the Hyderabad office) during the same period.

42. If the total working hours (for both offices) were 100, which of the following activities account for approximately 25 hours?
(A) Content development at Mumbai
(B) Content maintenance
(C) Content designing
(D) Content maintenance at Mumbai plus content designing at Hyderabad

43. Which of the work nearly requires as many man-hours as that spent in content development?
(A) Content maintenance and designing (at both the offices).
(B) Content development at Mumbai and content designing (at both the offices).
(C) Content maintenance (at both the offices).
(D) Content designing and maintenance at Hyderabad.

44. Roughly, what percentage of the total work is carried out at Hyderabad?
(A) 41 per cent
(B) 21 per cent
(C) 51 per cent
(D) 31 per cent

45. The total effort (in man-hours) spent at Mumbai is nearest to which of the following?
(A) The total estimated effort for Hyderabad.
(B) Twice the man-hours for the estimated content designing at Hyderabad.
(C) The actual man-hours at Hyderabad.
(D) The sum of the estimated and the actual effort for content development at Hyderabad.

46. If 40% of the work at Mumbai office were to be carried out at Hyderabad, with the distribution of effort between the tasks at Mumbai remaining the same, the percentage of total content maintenance carried out at Mumbai would be nearly
(A) 18
(B) 34
(C) 73
(D) 27

Directions for questions 47 to 50: The data given below is regarding the work pieces machined by two machines A and B. For each of the machines the average number of pieces machined per hour from the start to the end of different hours on a particular day is given.
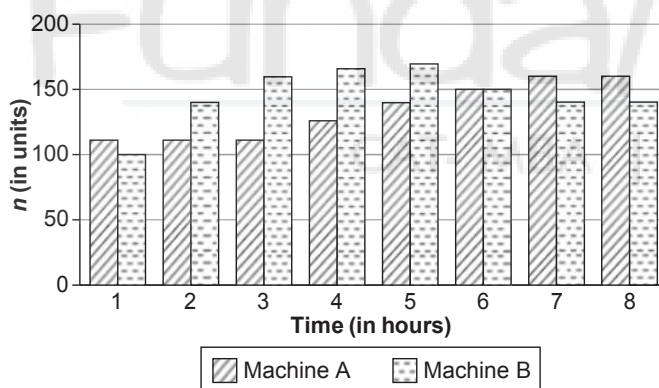
For example, machine A averages 110 units per hour for the first 3 hours of its operation.

47. If machines A and B together take time t (in hours) from the start, to machine 1000 work pieces, which of the following is true of t?
(A) $t = 2$
(B) $2 < t < 3$
(C) $3 < t < 4$
(D) $4 < t < 5$

48. The difference between the total number of pieces machined by any machine by the end of any hour and that by the end of the previous hour is the number of pieces machined by that machine in that hour. During which of the following hours is the number of pieces machined by A the same as that of B?
(A) 1
(B) 2
(C) 3
(D) None of these

49. Considering each of the machines separately, in total, how many instances are there where the number of units machined by the machine is same as that by the machine in the previous hour?
(A) 2
(B) 3
(C) 4
(D) 5

50. Approximately by what per cent is the number of work pieces machined by machine A in the last 3 hours, more/ less than that manufactured by machine B in the same time period?
(A) 11% more
(B) 11% less
(C) 115% more
(D) 115% less

EXERCISE-3

Directions for questions 1 to 4: Answer these questions on the basis of the information given below.

The bar graph gives the sales and net profit (in `cr) of a company across five years.
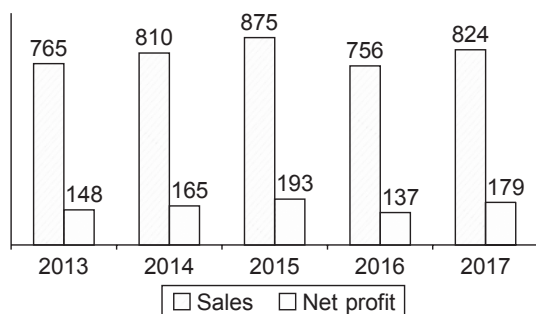
Net profit = Gross profit – Taxes
Gross profit = Sales – Expenses
The tax was 25% of the gross profit in the first two years and 20% in the remaining three years.

1. What were the expenses in 2014?
(A) `680 cr
(B) `645 cr
(C) `590 cr
(D) None of these

2. What was the percentage increase in expenses from 2014 to 2015?
(A) 5.5
(B) 6.5
(C) 7.5
(D) 8.5

3. In which of the given years was the ratio of sales to expenses, the lowest?

(A) 2013   (B) 2014

(C) 2016   (D) 2017

4. If probability is defined as $\dfrac{\text{gross profit}}{\text{sales}} \times 100$, what was the highest value of probability in any of the given years?

(A) 26.5   (B) 26.9

(C) 27.2   (D) 27.6

Directions for questions 5 to 8: Answer these questions on the basis of the information given below.

Percentage distribution of passengers according to station boarded at

E 5%
D 10%
A 25%
C 40%
B 20%
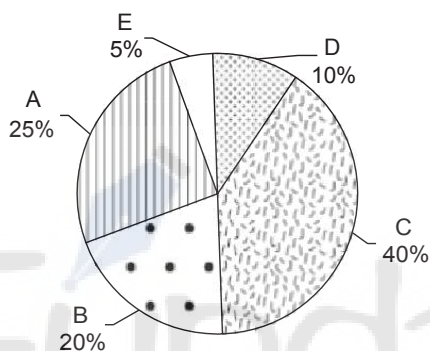
Distribution of passengers according to station got down at

| 300 | 500 | 450 | 150 | 600 |
| B | C | D | E | F |

Station

A — 5 km — B — 10 km — C — 10 km — D — 5 km — E — 15 km — F
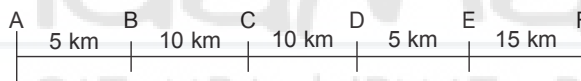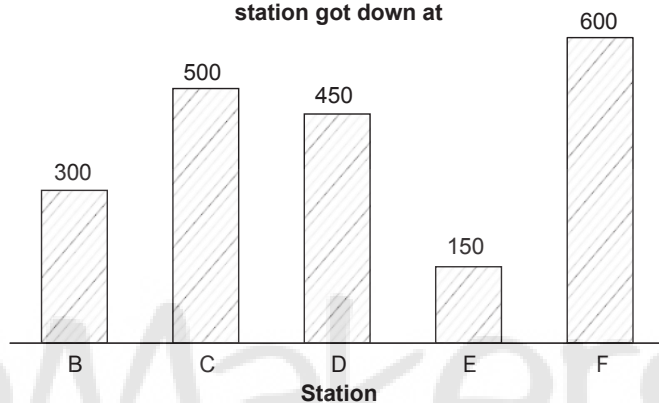
5. A group of villagers boarded the train at one of the stations and all of them got down together at another station. What is the maximum possible number of persons in that group, if the group travelled more than 15 km?

(A) 400   (B) 450

(C) 800   (D) 500

6. What is the maximum possible number of passengers who travelled for not more than 15 km and also had station C as either their boarding or destination station?

(A) 500   (B) 600

(C) 800   (D) 1100

7. What is the maximum possible number of passengers who travelled for at least 30 km in the train?

(A) 100   (B) 300

(C) 150   (D) None of these

8. At 6 p.m. in the evening, the same train returns from station F to station A, with the condition that at each of the stations, the number of passengers who boarded the train in the evening is same as that of those who got down the train in the morning, while the number of passengers

A local train started from station A at 10.00 a.m. in the morning and en route it stopped at exactly four intermediate stations, namely B, C, D and E and finally at station F, which was the destination station. It is known that the total number of passengers who boarded the train at stations A, B, C, D and E put together is 2000.

The pie chart given below shows the percentage distribution of the total number of passengers who boarded the train, according to the station at which they boarded the train. The bar chart shows the number of passengers who got down from the train at different stations. The distance between any two adjacent stations is given in the line diagram.

who got down the train in the evening is same as that of those who boarded the train in the morning. Which of the following statements is/are true?

(A) The number of passengers who travelled in the train between any two stations in the evening is same as that in the morning.

(B) In the evening, the train carried the maximum number of passengers while travelling between stations D and C.

(C) Maximum possible number of passengers who travelled for a distance of at least 30 km in the evening is the same as that in the morning.

(D) All the three

Directions for questions 9 to 12: These questions are based on the following information.

A company was established on 1st January 2015 with a total of 10 members. They were divided into four groups, namely A, B, C and D with each group containing at least two members. Each member had a distinct integral age as on 1 January 2015 with the minimum age being 20 years and the

maximum age being 29 years. These groups were to continue for the whole year.

At the end of every year, reshuffling of these ten members takes place such that a different set of members (no common member) are there in any two years in a particular group. The total number of members in the company remained the same throughout. The following graph gives the average of the integral ages of the members of each group as on 1st January of the three years.
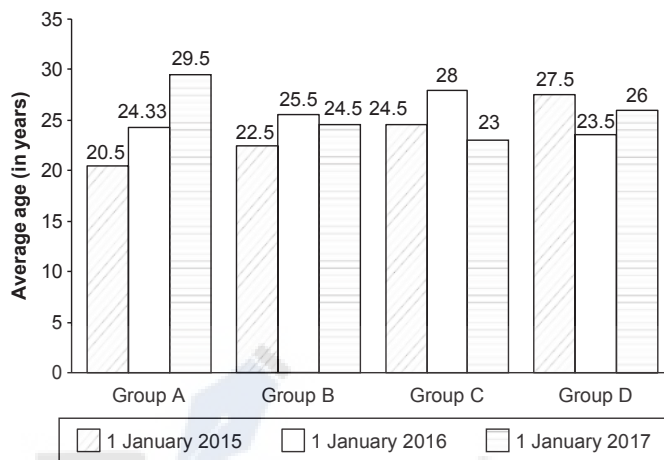

Note: It is known that group A had four members as on 1 January 2017.

9. What was the age of the eldest person in Group B as on 1 January 2017?
   (A) 23 years   (B) 26 years
   (C) 25 years   (D) 27 years

10. How many members are common between Group B for the year 2015 and Group D for the year 2016?
    (A) 0   (B) 1
    (C) 2   (D) 3

11. The total age of which group was the highest in the year 2017?
    (A) A   (B) B
    (C) C   (D) D

12. How many groups showed a consistent increase in the total of the age of all the members put together across the years?
    (A) 0   (B) 2
    (C) 3   (D) 1

Directions for questions 13 to 16: These questions are based on the following data.

The graph shows the details of the room rent (in `) and the occupancy rate (%) at a hotel across the years 2012 to 2017.
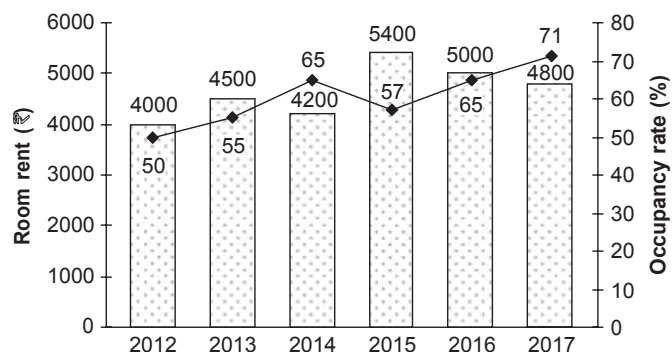
Occupancy rate = Percentage of available rooms occupied

Profitability = $\dfrac{\text{Profit}}{\text{Revenue}} \times 100$

Revenue in a year = Room rent × Number of rooms occupied × 365.

Number of rooms available increased by 10% every year from 2012.

The expenses of the hotel increased by 15% every year from 2012.

The hotel made a profit of `2.79 crore in 2012.

13. In which of the six years was the revenue of the hotel, the highest?

14. In which year was the percentage increase in revenue over the previous year, the highest?

15. In which year was the profit made by the hotel, the highest?

16. In which year was the profitability, the highest?

Directions for questions 17 to 20: Answer these questions on the basis of the information given below.

The following bar graph gives information about the runs scored by eight batsmen in a season. For each batsman, the runs scored relative (difference with respect to) to player B is given. The players are ranked from one to eight, with the player scoring the highest number of runs ranked first, the next one second and so on. It is known that player F was ranked eighth and player D was ranked immediately above player C.
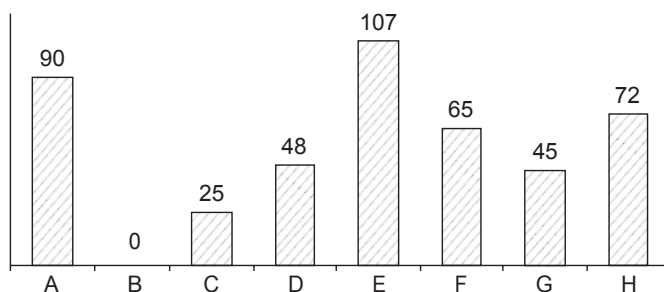
17. What was the rank of player C?
(A) 4 (B) 5
(C) 6 (D) 7

18. How many players scored fewer runs than player H?
(A) 3 (B) 4
(C) 5 (D) 6

19. If the average number of runs scored by the eight players is 435, then how many runs did player C score?

(A) 431 (B) 410
(C) 460 (D) None of these

20. If player G scored 373 runs, how many runs did the eight players together score?
(A) 2966 (B) 3532
(C) 3476 (D) None of these

ANSWER KEYS

Exercise-1

1. (A)	9. 10	17. (B)	25. (B)	33. (B)	40. 3.6	47. (D)
2. (D)	10. 1	18. (B)	26. (B)	34. (D)	41. (A)	48. (C)
3. (B)	11. (A)	19. (D)	27. (C)	35. (A)	42. (B)	49. (D)
4. (A)	12. (B)	20. (C)	28. (A)	36. 1 : 2	43. (C)	50. (C)
5. (B)	13. (D)	21. (B)	29. (D)	37. 38	44. (D)	
6. (A)	14. (B)	22. (D)	30. (B)	38. 10.88	45. (B)	
7. (B)	15. (C)	23. (B)	31. (C)	39. U.P	46. (A)	
8. 3	16. (B)	24. ()	32. (D)			

Exercise-2

1. (B)	9. (D)	17. IX	25. (B)	33. (C)	40. (B)	47. (C)
2. (A)	10. (C)	18. (C)	26. (C)	34. 48	41. (D)	48. (D)
3. (D)	11. (B)	19. (B)	27. (B)	35. 22	42. (A)	49. (B)
4. (B)	12. (A)	20. (D)	28. (A)	36. VII	43. (B)	50. (C)
5. (C)	13. (D)	21. (C)	29. (D)	37. Four	44. (C)	
6. (C)	14. VIII	22. (B)	30. (A)	38. (D)	45. (A)	
7. (C)	15. 75	23. (A)	31. (C)	39. (B)	46. (D)	
8. (D)	16. 67	24. (B)	32. (A)			

Exercise-3

1. (C)	4. (D)	7. (D)	10. (A)	13. 2017	16. 2017	19. (A)
2. (C)	5. (B)	8. (D)	11. (A)	14. 2013	17. (B)	20. (D)
3. (C)	6. (D)	9. (B)	12. (D)	15. 2017	18. (C)	

SOLUTIONS

EXERCISE-1

1. Trade deficit is in 1997, 99 and 2000 = 10 + 40 + 30 = 80
   Trade surplus is in 1996, 98 and 2001 = 10 + 20 + 10 = 40
   Total trade deficit = 80 – 40 = `40 thousand crore
   Average exports = 140 thousand crore.
       30% of 140 = 42
       – 2% of 140 = 2.8

       28% of 140 = 39.2

       +0.5% of 140 = 0.7

   Hence, 28.5% = 39.9

2. In 1999, total tonnage of exports
   $$= \frac{140 \times 10^3 \times 10^7}{7 \times 10^3} = 20 \times 10^7 \text{ tons}$$

   Total tonnage of imports $= \dfrac{180 \times 10^3 \times 10^7}{6 \times 10^3} = 30 \times 10^7$

   10^7 is common. Exports are less than imports by

   $\dfrac{30-20}{30} \times 100 = 33\frac{1}{3}\%$

3. Trade surplus in 1998 = 130 – 110 = 20000 crore.
   Trade surplus in 2001 = 160 – 150 = 10000 crore.

   Percentage decrease $= \dfrac{20-10}{20} \times 100 = 50\%$

   Trade surplus in 2002 = 50% of 10000 = 5000 crore.
   Imports in 2002 = 150 + 20% of 150000 = 180000 crore.
   Exports in 2002 = Imports + Trade surplus
               = 180000 + 5000 = 185000 crore
               = 185 thousand crore.

4. Exports after three years will become
   160(1.1)³ = 212.96 thousand crore.
   Imports after three years will become
   150(0.9)³ = 109.35 thousand crore.
   Total trade = 213 + 109 = 322 thousand crore.

5. The exports increased by 60%.
   For a 10% compounded annual growth rate, 100 be-

   comes $100\left(1+\dfrac{10}{100}\right)^5 = 161$ in 5 years.

   \ The growth is approximately 10%.

6. By keenly observing we can find that the turnover of A is the greatest.

7. Let the profits of the four companies for the second quarter be `8x, `7x, `6x and `5x, respectively.

Profit to sales ratio turnover of A, B, C and D are as follows.

A $= \dfrac{8x}{572} = \dfrac{x}{71}$;   B $= \dfrac{7x}{366} = \dfrac{x}{52}$;

C $= \dfrac{6x}{514} = \dfrac{x}{86}$;   D $= \dfrac{5x}{308} = \dfrac{x}{61}$

x is the common number for each of the fractions. For company B, the denominator is the lowest among all the denominators. Hence, B's profit percentage is the highest.

8. The ratio of A's turnover to that of the total turnover

   in Q1 $= \dfrac{428}{1740} < \dfrac{1}{4}$ in Q2 $= \dfrac{572}{1760} > \dfrac{1}{4}$

   in Q3 $= \dfrac{473}{1590} > \dfrac{1}{4}$ in Q4 $= \dfrac{527}{1600} > \dfrac{1}{4}$

   Alternate method:
   If A's turnover is greater than the average turnover of the other three companies, we can say that A's turnover is more than 25% of the total sales turnover of all the companies. In the first quarter by observation we find that A's turnover is less than the average turnover of the other three companies. And further we find that in II, III and IV quarters, A's turnover is greater than the average turnover of the other companies. Therefore, in three quarters A's turnover is greater than 25% of the total turnover of all the companies in that particular quarter.

9. Percentage decrease in the sales turnover of all the companies from Q2 to Q3

   $= \dfrac{1760-1590}{1760} \times 100 \Rightarrow 9.6\% \cong 10\%$

10. By observation we find that the sales turnover of only company B is consistently decreasing.

11.

Country	Matches played	Matches won	Matches lost	Matches drawn
Germany	60	20	30	10
France	30	15	–	15
Brazil	45	30	10	5
USA	60	30	15	15
Argentina	30	15	?	?

By observation, Germany lost maximum number of matches.

12. Originally, Brazil had the highest success rate. Even after doubling, it will have the highest success rate. (Since the ratio of matches drawn and won to total matches remains the same)

13. As we do not know the number of matches played by each team against Argentina, the success rate cannot be determined.

14. Matches lost by Germany = 30
Matches lost by Brazil = 10
Required ratio = 30 : 10
= 3 : 1

15. By observing the table given in situation 1, we see that France, USA and Argentina had 50% success rate and won 60 matches in all. The other two teams, Germany and Brazil won 50 matches in all.

16. Total sales in 2002-03
= 105 + 96 + 208 + 165 + 73 = 647 →(i)
Total sales in 2000-01 = 94 + 68 + 165 + 112 + 57 = 496
Let $647 \cong 650$ and $496 \cong 500$
Sales target in 2002–02 = $1.2 \times 500 = 600$ m tons
Hence, there is surplus in the sales target.

$\backslash$ Required percentage = $\dfrac{650 - 600}{600} \times 100 \cong 9\%$

17. Sales of Tin in 2000-2001 = $0.4132 \times 57 = 23.55$ million tons
In 2002-2003, Sales of Tin = $23.55 \times 1.1 \times 1.1$
$\cong 28.5$ million tons
Total sales = 105 + 96 + 208 + 165 + 73 = 647 million tons
Required percentage = $\dfrac{28.5}{647} \times 100 = 4.4\%$

18. Sales of copper in 2002–2003 = 96
The sales increased by 25% in the next year, but still remained 80% of the quantity available.

$\backslash$ Quantity of copper available in 2003–04 = $\dfrac{96}{0.8} \times 1.25$
= 150

19. Sales of all metals in 2000–2001 = 496
Sales of all metals in 2002–2003 = 647
Annual percentage increase
= $\dfrac{647 - 496}{496} \times \dfrac{1}{(x-1)} \times 100\%$ [$x = 3$] = 15.2%

20. Sales of Gold in 2002-03 = 25% of 73 = $\dfrac{73}{4}$

Sales of Silver in 2000-01 = 20% of 57 = $\dfrac{57}{5}$

Required ratio = $\dfrac{73}{4} \times \dfrac{5}{57} \cong \dfrac{72}{4} \times \dfrac{5}{55} = \dfrac{18}{11} \cong 1.67$
The nearest value is given in Choice (C) as 1.6

21. We must check whether the production of D as a percentage of B is more than 80% but less than 120% or not, i.e., the difference between the production of D and that of B is less than 20% of B or not.

Year	Difference	20% of B
2011	700	1220
2012	500	1080
2013	1000	820
2014	900	840
2015	800	1000

$\backslash$ It happened for 2011, 2012 and 2015.

22. The total production in
2011 is 23300
2012 is 20400
2013 is 20500
2014 is 20800
2015 is 24900
By observing the above values, the change over the previous year is the highest in the year 2015.

23. In 2014:
Exports of D is $\dfrac{3}{8} \times 5100 = 1912$

Exports of A is $\dfrac{1912 \times 6}{5} = 2295$

$\backslash$ Percentage of exports = $\dfrac{2295}{5200} \approx 45\%$.

24. In 2015, B forms 20% of total production. (5000/24900)
Let the total production be 100; the production of B is 20.
Production of B in 2016 is 60% × 20 = 12
Total production in 2016 is 60% × 20 + 1.35 × 80 = 120.
Production of B as a percentage of total production is 10%. (12/120)

25. From the choices we can observe that II is present in all the four choices.
$\backslash$ By checking II (which is false), the choices (A), (C) and (D) can be eliminated. Now as the only option left is Choice (B) and though it appears that D in 2013 and 2014 is the same, there could be a marginal decrease (For example 5100 and 5090). So the answer is (B) as

it is the only option left. Had the question had 'None of these' as an option, then it would have been the answer.

26. Bala's expenses on clothing = 20% his total expenses
\ Bala's total expenses `18,500
Food and tution fees together constitute 35% of Bala's total expenses which is $\frac{35}{100} \times 18500$ = `6475

27. 15% of Anand's Expenses = `1620
\ the remaining 85% = $\frac{85}{15} \times 1620$ = `9180

28. Let the total expenses of Bala and Chetan be `300 and `500, respectively.

The 'other' expenses are $\frac{30}{100} \times 300$ and

$\frac{35}{100} \times 500$, i.e., 900 and 1750, respectively.

The required ratio = 18 : 35

29. Let Damodar's total expenses be D and that of Edward be E.
Given $\frac{20}{100} \times D = 115\%$ of $\frac{15}{100} \times E$
\ 0.2 D = 0.1725 E
$\frac{D}{E} = \frac{0.1725}{0.2} = \frac{86.25}{100}$
\ D is 13.75% less than E.

30. 10% of Anand's expenses (on clothing) is at least equal to 15% of Chetan's expenses.
\ 10% of A ≥ 15% of C

\ $\frac{A}{C} \geq 1.5$

\ Total expenses of Anand is at least 1.5 times that of Chetan.

31. Total imports = 17 + 18 + 13 + 8 + 21 + 13 + 17 + 15 + 16 + 15 = 153
Total exports = 18 + 22 + 10 + 10 + 19 + 14 + 14 + 12 + 17 + 16 = 152
Trade deficit = 153 – 152 = 1
Average imports = $\frac{153}{10}$ = 15.3
\ Required percentage = $\frac{1}{15.3} \times 100$ = 6.5%

32. Total tonnage of exports = $\frac{152 \times 10^{10}}{2000}$ = 76 × 10⁷

Total tonnage of imports = $\frac{153 \times 10^{10}}{3000}$ = 51 × 10⁷

\ Required percentage $\cong \frac{76 - 51}{51} \times 100 \cong 49\%$ more

33. The highest exports are to USA and the least imports are from Australia.
Imports from USA = 18
Exports to Australia = 10

\ Required percentage = $\frac{18 - 10}{10} \times 100$ = 80%

34. Statement (A): As calculated before, the company's imports are `1 crore more than the company's exports. Therefore, it is a trade deficit (not trade surplus). Hence, this statement is false.
Statement (B): The cumulative trade deficit is `1 crore and the total imports of the company is `153 crore.
1/153 ≠ 1/15, hence this statement is false.
Statement (C): The trade deficit with China is (15 – 12) = 3, which is only 200% more than the cumulative deficit.
Statement (D): The difference between the highest exports and the lowest imports = 22 – 8 = `14 crore.

Average exports to Brazil and Germany $\frac{14 + 14}{2}$

= `14 crore

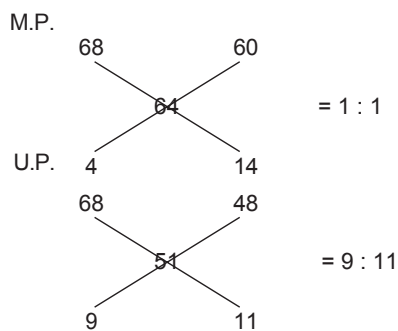As both the figures are equal, hence, the only Statement (D) is true.

35. Total imports from Brazil, Japan, South Africa, Russia and China = 13 + 16 + 13 + 21 + 15 = `78 crore
Total exports to the other five countries = 18 + 22 + 10 + 14 + 16 = 80
Ratio = 78/80 = 0.975

Solutions for questions 36 to 40:

M.P.


```
M.P.
   68        60
        64           = 1 : 1
U.P.  4        14
   68        48
        51           = 9 : 11
    9        11
```
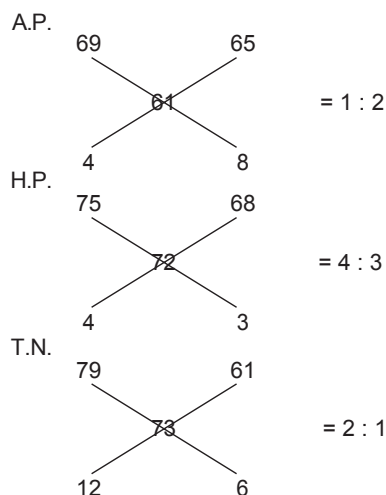
Number of males in A.P. = $\frac{1}{3}$ × 7 = 2.3 crore

Number of males in H.P. = $\frac{4}{7}$ × 6.3 = 3.6 crore

Number of males in T.N. = $\frac{2}{3}$ × 6.5 = 4.3 crore

Number of males in M.P. = $\frac{1}{2}$ × 6 = 3 crore

Number of males in U.P. = $\frac{9}{20}$ × 16 = 7.2 crore

Number of literate males in U.P. = $\frac{68}{100}$ × 7.2 = 4.896 crore

36. Let the number of females and males be x and y respectively.
61% of x + 79% of y = 73% of $(x + y)$

⇒ 61x + 79y = 73x + 73y 6y = 12x $\frac{x}{y}$ = $\frac{1}{2}$ or 1 : 2.

37. The population of other states is 25.8 crore and in U.P. it is 16 crore.

Required percentage = $\frac{25.8 - 16}{25 \cdot 8}$ × 100

= $\frac{9 \cdot 8}{25 \cdot 8}$ × 100 ≅ 38%

38. In U.P. the total number of literate males and literate

females = $\frac{68}{100}$ × 16 crore = 1088,00,000 or 10·88 crore.

39. By alligation rule, the ratio of number of males to that of females in
Number of literate males in U.P. is more than number of males in remaining states so number of literate males in U.P. is the highest.

40. Let the number of females and males in H.P. be x and y.
68% of x + 75% of y = 72% of $(x + y)$ ⇒ $x : y$ = 3 : 4

Number of males = $\frac{4}{7}$ × 6·3 crore = 3·6 crore

Solutions for questions 41 to 44: The values of consumption (in million kg) and the population in the different years is as follows.

In 2003, the consumption is 444 – 212 = 232 million kg.

Population = $\frac{232}{2.7}$ million = 8.6 million

Similarly, the values for other years can also be calculated as given in the table.

Year	2003	2004	2005	2006	2007	2008
Consumption	232	284	288	281	336	347
Population (in Cr.)	8.6	8.8	9.6	10.4	10.2	11.2

41. The population of country X was the lowest in 2003.

42. The percentage increase in the population of country X was the highest in 2008.

43. Had the exports in 2003 been 100 that in 2008 it should have been approximately 1.61.
Therefore, 212 × 1.61 = 341.3
\ The required value of production = 688.3

44. It can be seen that consumption increased by nearly 50% while the percentage increase of all others is much less.

Solutions for questions 45 to 47:

45. The sales of the company in 2009
= (850 × 12 + 700 × 15 + 1050 × 10 + 1000 × 20) 1.1
= (10,200 + 10,500 + 10,500 + 20,000)1.1
= (51,200)1.1 = 56,320

46. As there is a 10% increase in the price of each commodity, we can take the prices of P, Q, R and S in 2010 to be `12, `15, `10 and `20, respectively.
Sales in 2010 = 750 × 12 + 920 × 15 + 1250 × 10 + 1120 × 20 = 57700
Sales in 2011 = 870 × 13.2 + 900 × 16.5 + 1350 × 11 + 1150 × 22 = 66484
The percentage increase = $\frac{8784}{57700}$ × 100 = 15.23%

47. Sales of each commodity in 2011
= 870 × 12 + 900 × 15 + 1350 × 10 + 1150 × 20
= 10440 + 13500 + 13500 + 23000 = 60400
Share of commodity P = $\frac{10440}{60400}$ × 100 = 17.3%

Solutions for questions 48 to 50:
The sales, expenses and the profits of the company in the different years are as follows:

	2009	**2010**	**2011**	**2012**
Sales	1596	1737	1827	2094
Expenses	780	870	946	1065
Profits	816	867	881	1029

48. The highest percentage increase was in 2012.
$$\frac{2094 - 1827}{1827} \times 100 \cong 14.5\%$$

49. The highest percentage increase for each of the items is as follows:
Sales = 14.5%
Expenses = 12.5%
Number of employees = 10.5% and Profit = 17%
The highest percentage increase in any year was in the profits.

50. The profitability was the least in 2011.

EXERCISE-2

1. Number of respondents who said, 'don't know' = 5%
Half of them = 2.5%
Number of AOL users = 12%
Number of Eudora users = 13.5%
Total number of users of either AOL or Eudora
= 12% + 13.5% + 2.5% = 28% [total respondents] = 7140

2. Respondents claiming 'features' = 16%
Respondents claiming 'prior usage' = 17%
But all of these are users of pine/elm = 21%
\ There must be some respondents claiming both reasons.
Let the percentage of such people = x
\ 21% = 16% + 17% − x
\ x = 12% (25500) = 3060

3. We do not know if users of C.C. mail already claimed the reason of 'easy to use' for C.C. mail itself.
They can shift to Eudora claiming the same reason.
Thus, we cannot determine the change in number of respondents claiming 'Easy to use'.

4. Let the total number of users of e-mail packages = $100x$
Out of which user group saying 'don't know' is excluded
= 100 × − 5x = 95x
Now, among these 95x users, except for C.C.-mail users, others claim only one reason each.
Number of package users excluding C.C. mail
= 95 × − 9x = 86x
\ These 86x users account for 86x reasons.
The total number of reasons by respondents
= 14x + 34x + 16x + 28x + 11x + 17x = 120x
\ Number of reasons claimed by C.C. mails users
= 120x − 86x = 34x
The average number of reasons per C.C. mail user
= 34x/9x ≅ 3.8 approx.

5. UNIX + AOL = 12 + 8.20 = 20.20%
As maximum percentage of respondents who claimed at most one reason is greater than 20.2%, the required answer = 20.2% of 25,500 = 5151.

6. Sales of the company ABC in 2005
$$=\frac{40}{100} \times 4500 = 1800 \text{ crore}$$
$$\Rightarrow \text{Number of watches sold} = \frac{1800}{3000} \times 10^7 = 6 \times 10^6$$
The total watches sold in the market = 4 × 6 × 10^6
= 24 × 10^6
Let the average price of watches by all other companies be x.
$$\frac{(4500 - 1800) \times 10^7}{x} = 18 \times 10^6 \Rightarrow x = `1500$$

7.

Year	Sales	Profit
1999	800	96
2000	1000	150
2001	1200	120
2002	1500	300
2003	1600	240
2004	1800	360
2005	1800	300
2006	2000	220
2007	2400	384
2008	2500	400

Over the given period, during 2001, 2003 and 2006 the sales increased while the profits decreased.

8. The ratio of profits in 2004 to 2008 is 360 : 400 = 9 : 10.

9. In the years 1999, 2000, 2002, 2003, 2004, 2005 and 2008 the market share (by volume) of the company is definitely less than 50% as in all these years the market share (by value) is 50% or less. As the average price of watches by all other companies is less than that of company ABC, they would have a higher share by volume than by value.

Solutions for questions 10 to 13: When the average age of any department increases by exactly one, that means no employee of 25 years joined the department and no employee of age 60 or 64 years left the department and the average age went up by one just because the same number of employees aged exactly by 1 year.

When any employee of age 25 years joins a department (where average age is more than 25-which is the case in all the departments in all the years), the average age will fall the next year and similarly when an employee of age 60 or 64 years retires from a department where the average age is much lower than 60 or 64 years the average age will fall the next year. Besides, when a new employee of age 25 years joins and an employee of age 60 or 64 years retires both in same department in the same year, then the average age of the next year will fall the maximum.

The number of employees in different departments in the beginning are 5, 3, 4 and 6, respectively.

The total ages of the employees in the marketing department = 5 × 48 = 240

The next year it becomes 240 + 5 = 245

Had a 25 years old person joined next year, the total age would become 245 + 5 + 25 = 275.

\ Average age = $\frac{275}{6}$ = 45.8

Had only a single person retired next year, the total age of people would become 245 + 5 – (60 or 64) = 190 or 186

and average age would become $\frac{190}{4}$ or $\frac{186}{4}$ = 47.5 or 46.5.

As it is said that it became 43, the only possibility is that a 25-year-old person joined and a 60-year-old person retired.

Using the same logic, we can find when employees retired or joined other departments.

Solutions for questions 14 to 17: It is given that new students join the school only in Class VI and students leave the school only after they pass out of Class X. Also, the pass percentage in any class was from 75% to 90%.

In cases like this when the number of students who passed out from any class in the year 2015 is not given, we have to find the minimum and maximum number of students in each class in the year 2016.

	Students promoted from lower class		Students failed in 2015		Students in 2016	
Class	Min	Max	Min	Max	Min	Max
VII	68	81	8	20	76	101
VIII	60	72	7	17	67	89
IX	52	63	10	25	62	88

As the number of students in Class IX in the year 2016 is 88, which is the maximum possible, we say that 25 students failed in Class IX or the number of students who passed from Class VIII is 63 and 7 Students failed in Class VIII.

\ 69 students passed from Class VII or 11 students failed in class VII. It means that 80 students passed from Class VI or 10 students failed in Class VI and 75 new students joined. In Class X, 14 students (89 – 75) failed and 106 students passed out of the school in 2015.

14. Class VIII had the highest (90%) pass percentage in the year 2015.

15. 75 students joined the school in 2016.

16. The total number of students who failed was 10 + 11 + 7 + 25 + 14 = 67

17. The maximum number of students failed in Class IX.

18. The states are ranked in the descending order of land revenue collections as tabulated below.

Rank	1999–00	2000–01	2001–02	2002–03	2003–04
1	U.P.	Bihar	U.P.	U.P.	U.P.
2	Bihar	UP	Bihar	Bihar	Bihar
3	A.P.	Gujarat	A.P.	A.P.	A.P.
4	Gujarat	AP	Gujarat	Gujarat	Gujarat
5	M.P.	M.P.	T.N.	T.N.	T.N.
6	T.N.	K.A.	M.P.	K.A.	K.A.
7	K.A.	T.N.	K.A.	M.P.	M.P.

Four states U.P., Bihar, A.P. and Gujarat have the same ranks in four of the five given years.

19. The percentage share of land revenue collection for the different states in the given periods are as follows:

State	1999–2000	2000–2001
U.P.	$\frac{161}{294} > 20\%$	$\frac{63}{317} < 20\%$
Karnataka	$\frac{28}{294} < 10\%$	$\frac{34}{317} > 10\%$
Bihar	$\frac{59}{294} > 20\%$	$\frac{63}{317} < 20\%$
A.P.	$\frac{41}{294} < 20\% = 13.9\%$	$\frac{43}{317} = 13.5\%$

The percentage has increased the maximum for Karnataka.

20. The percentage increased for Tamil Nadu from

2000 to 2001 = $\frac{3384 - 3167}{3167} \times 100\% = 7\%$

2001 to 2002 = $\frac{3921 - 3384}{3384} \times 100\% = 16\%$

2002 to 2003 = $\frac{4163 - 3921}{3921} \times 100\% = 6\%$

2003 to 2004 = $\frac{4931 - 4163}{4163} \times 100\% = 18\%$

21. From the year 2000 to 2001, and 2001 to 2002, the increase in the land revenue collection amount for the state of Gujarat was constant.
4427 – 3951 = 476
4903 – 4427 = 476

22. In both the months mentioned, Adidas is the most preferred. \ It has to be the most preferred when both months are considered together.

23. It is possible that the respondents who responded favourably to Nike (40%) in March were the same respondents who responded favourably to all other brands. Hence, (100 – 40) % = 60% is the maximum possible number of respondents who did not respond favourably to any of the brands.
\ 60% of 1200 = 720

24. Let the total number of respondents in the months given be a, b, c, d, e, respectively.
Given

$b > a$ (1)
$d > b$ (2)
$e >$ each of a, b, c, d (3)

Considering Statement I:
Since from (1) and (2) above, $d > a$.

The N for two brands, i.e., Reebok and Lotto, definitely increased. Hence, Statement I is true.
Considering Statement II:
Since $e > d$, it is possible that the N for no brand or all the brands other than Adidas decreased. Hence, Statement II is not definitely false.
Considering Statement III:
Since $e > b$, and we need to compare the following four pairs of qualities:
15% of b vs 35% of e
50% of b vs 50% of e
25% of b vs 20% of e
20% of b vs 10% of e
We can observe that the first two pairs can never be equal while the second two pairs will always be either equal or unequal together, i.e., if 40% of b = 20% of e, then 20% of b = 10% of e and vice versa. Hence, the N for either zero brands or exactly two brands was the same in March and September.
Hence, Statement III is false.

25. Considering the sum of the percentage values of the given brands:
40% + 50% + 20% + 35% = 145%
Now, imagine that there are 145 'favourable responses' (henceforth referred to as 'votes'). These must be distributed among a total of 100 respondents or say voters. It is allowed for any voter to have more than one vote and up to a maximum of four votes. But these 145 votes must be distributed in such a way that the least possible number of respondents get more than one vote each. Hence, the extra 45 votes (left after first giving one vote to each voter) should be distributed among the least possible number of voters. This can be done by distributing away as many votes as possible to each voter. But, since the maximum possible votes allowed is only four, three more votes can be given to any voter. Hence, 45 votes can be distributed among at the least 15 voters. Hence, we can have only 15 voters who have more than one vote. Thus, our required percentage is 15%.
Therefore, 15% of 125% of 800 = 15% of 1000 = 150.
Hence, at least 150 respondents must have responded favourably to more than one of the given brands.

26. According to the question, all the LOCAL and STD calls have to be made such that the amount paid should be minimum. If customers have the choice from all the four companies, then they will go for the service which is cheapest.
For LOCAL calls, DATACOM is the cheapest but from DATACOM only 2.75 lakh calls can be made.
Similarly, the cheapest STD charges are when using AIRSIM and 2.0 lakh calls can be made from AIRSIM and the rest 1.5 lakh calls should be made using the second cheapest service (APPLE).

So, the total amount spent on STD calls is
2 × 3.25 + 1.5 × 3.5 = `11.75 lakh.
Total amount spent on local calls is

$$\underset{\text{DATACOM}}{\frac{2.0 \times 2.75}{}} + \underset{\text{APPLE}}{\frac{2.25 \times 2.5}{}} + \underset{\text{AIRCOMM}}{\frac{2.5 \times 1.25}{}} = 5.5 + 2.5(3.5)$$

$$= 5.5 + 8.75 = 14.25$$

Therefore, total amount spent = 11.75 + 14.25 = `26 lakh.

27. When the charges of the companies are compared, the difference between the ISD charges is more when compared to the difference in the LOCAL charges. Therefore, ISD calls should be made first from the cheapest service.
1 lakh ISD calls should be from APPLE
Amount for ISD charges = 1 × 6 = 6 lakh
For local calls, 2.75 lakh calls can be made from DATACOM at the rate of 2 rupees. 3 lakh calls can be made from APPLE at the rate of 2.25 rupees. The remaining 0.75 lakh calls can be made from either of AIRSIM or AIRCOMM at the rate of 2.5 rupees.
Total charges for LOCAL calls
= 2 × 2.75 + 3 × 2.25 + 0.75 × 2.5 ≅ 14.13 lakh
Total (LOCAL+ ISD) charges = (14.13 + 6) lakh
= 20.13 lakh

28. Revenue loss due to reduction in STD changes
for AIRCOMM = 0.7 × (4.5 − 3.5) = 0.7 lakh
for AIRSIM = 0.4 × (3.25 − 2.25) = 0.4 lakh
for DATACOM = 0.8 × (3.5 − 2.5) = 0.8 lakh
for APPLE = 1.6 × (3.5 − 2.5) = 1.6 lakh
To compensate the revenue loss, increment in ISD charges per minute

$$= \frac{\text{Revenue loss for a company}}{\text{Number of ISD calls made from company}}$$

Increment in ISD charges

for AIRTEL = $\frac{0.7}{0.3}$ = 2.33

for AIRSIM = $\frac{0.4}{0.1}$ = 4

for DATACOM = $\frac{0.8}{0.2}$ = 4

for APPLE = $\frac{1.6}{0.4}$ = 4

New ISD charges per unit call for various companies:
AIRCOMM = 10.33, AIRSIM = 13.5, DATACOM = 10.5, APPLE = 10
The second cheapest ISD charges are for AIRCOMM

29. Revenue of AIRCOMM = 2.5 × 1.25 + 4.5 × 0.7 + 8.0 × 0.3
= 8.68 lakh
Revenue of AIRSIM = 2.5 × 1.5 + 3.25 × 0.4 + 9.5 × 0.1
= 6 lakh
Revenue of DATACOM = 2.0 × 1.75 + 3.5 × 0.8 + 6.5 × 0.2
= 7.6 lakh

Revenue of APPLE = 2.25 × 2.0 + 3.5 × 1.6 + 6.0 × 0.4
= 12.5 lakh
The company with the highest sales revenue is APPLE.

30. By observation, N must belong to one of the following two categories.
(i) 4 ≤ N < 6
(ii) 2 ≤ N < 4
Number of students enrolled for 4 ≤ N < 6
= (30 × 11) + (10 × 22) + (10 × 30)
+ (10 × 15) + 10(5) + 10(4) = 1090
Number of students enrolled for 2 ≤ N < 4
= (20) (11) + (10) (22) + (10) (30)
+ (40) (15) + (10) (4)
= 220 + 220 + 300 + 600 + 40 = 1380

31. By observation, the number of students enrolled is the highest for Science with 6 ≤ N < 8.

32. Total number of students = 8700
Required number of degrees

$$= \frac{(360)(3000) - (360)(1100)}{8700} = \left(\frac{360}{8700}\right)(1900)$$

$$= \frac{(360)(19)}{(87)} \cong 78.6°$$

33. For N ≥ 8,
Most number of enrolments is not from the Arts stream.
Least number of enrolments (0 ≤ N < 2) is not form others but from the Commerce stream.
Percentage of enrolments from Engineering

$$= \frac{3000}{8700} \times 100 > 30\%$$

Solutions for questions 34 to 37: It is known that the pass percentage in Class V in the year 2015 was at least 90%.
\ At least 41 of the 45 students in Class V would have passed in 2015. From the given graph, there are a total 52 students in Class VI in 2015 and 47 students in Class VII in 2016. Hence, at least 5 students of Class VI of 2015 must have failed and they must continue in Class VI in 2016 also. By this we can say that 41 students of Class V of 2015 are promoted to Class VI. This can be represented as follows.

Standard	Passed	Failed	Promoted/Joined
V	41	4	52 – 4 = 48
VI	52 – 5 = 47	46 – 41 = 5	41
VII	50 – 0 = 50	47 – 47 = 0	47
VIII	43 – 7 = 36	57 – 50 = 7	50
IX	46 – 2 = 44	38 – 36 = 2	36
X	42 – 2 = 38	48 – 44 = 4	44

34. 48 students joined Class V in the year 2016.

35. The total number of students who failed
= 4 + 5 + 7 + 2 + 4 = 22

36. The pass percentage was the highest in Class VII, i.e., 100%.

37. The overall pass percentage

$$= \frac{41 + 47 + 50 + 36 + 44 + 38}{45 + 52 + 50 + 43 + 46 + 42} \times 100 = \frac{256}{278} = 92\%$$

In classes V, VI, VIII and X, the pass percentage was less than the overall pass percentage.

38. The number of marketing employees working in the morning shift must be the maximum possible.

In B_1, 20 persons are working in the Marketing department and 18 persons are working in the morning shift. Given, there must be at least one person from each department in each of the shifts.

From the Marketing department, at least one person has to work in each of Dawn, General, Evening and Night shifts. \ At most 20 – 4 = 16 persons of the Marketing department can be working in the morning shift.

Among the 18 persons working in the morning shift, at least one must be from each of Production, Finance and Research departments and hence, at most (18 – 3) = 15 persons can be working in the Marketing department. Similarly, if we calculate for other branches.

\ Only 15 employees of the Marketing department can be working in the morning shift.

B_1: Minimum of ((20 – 4), (18 – 3)) = 15
B_2: Minimum of ((25 – 4), (8 – 3)) = 5
B_3: Minimum of ((30 – 4) (15 – 3)) = 12
B_4: Minimum of ((20 – 4) (25 – 3) = 16
\ The required answer is 15 + 5 + 12 + 16, i.e., 48.

39. In the branch B_3, the maximum possible number of Production employees working in the morning shift is 15 – 3, i.e., 12. The minimum number of Finance employees working in the general shift is only one.
\ The required difference is 12 – 1 = 11.

40. Minimum of ((20 – 3), (26 – 6)) = 17
Minimum of ((25 – 3), (31 – 6) = 22
Minimum of ((30 – 3), (27 – 6) = 21
Minimum of ((20 – 3), (43 – 6)) = 17,
i.e., 17 + 22 + 21 + 17 = 77

41. From the evening shift to the night shift, minimum change can be done in the following way:
Shift 5 employees in B_1.
Shift 1 employee in B_2.
For B_3 and B_4, there is no need of a change.
\ The required answer is 5 + 1 = 6.

42. Total man hours spent for both the offices
= (400 + 560) + (1300 + 1020) + (900 + 1120) = 5300

For every 100 hours, the activity should account for 25 hours.
For every 5300 hours then

$$\left(\frac{25}{100}\right) (5300) = 1325 \cong 1300 \text{ hours.}$$

Thus, the activity which accounts for 25 hours for a total of 100 hours spent is content development at Mumbai.

43. Total man hours spent in content development
= 1300 + 1020 = 2320.
From Choices
Choice (A) Man hours for content maintenance and designing = (900 + 1020) + (400 + 560) = 2980
Choice (A) is not true.
Choice (B) Content development (at Mumbai) and content designing (at both offices)
= 1300 + (400 + 560) = 2360

44. Required percentage

$$= \frac{560 + 1020 + 1120}{(1000) + (2300) + (2000)} = \frac{2700}{5300} \times 100 \cong 51$$

45. Total effort (in man hours) at Mumbai
= 400 + 1300 + 900 = 2600.
From Choices
Choice (A)
Total estimated efforts for Hyderabad
= 900 + 700 + 1000 = 2600.

46. If 40% of content maintenance (at Mumbai) have been transferred to Hyderabad, then the
percentage of total content maintenance work carried out at Mumbai

$$= \frac{(100\% - 40\%)(900)}{2020} = \left(\frac{60}{100}\right)\frac{(900)}{2020} (100) \cong 27.$$

Solutions for questions 47 to 50:

	(Pieces/hour) at the end of t hours		Total pieces machined after t hour		Number of pieces machined in the tth hour	
	A	**B**	**A**	**B**	**A**	**B**
$t = 1$	110	100	110	100	110	100
$t = 2$	110	140	220	280	110	180
$t = 3$	110	160	330	480	110	200
$t = 4$	125	165	500	660	170	180
$t = 5$	140	170	700	850	200	190
$t = 6$	150	150	900	900	200	50
$t = 7$	160	140	1120	980	220	80
$t = 8$	160	140	1280	1120	160	140

47. The total number of pieces machined by A and B together at

$t = 1$ is 110 + 100 = 210;

$t = 2$ is 220 + 280 = 500;

$t = 3 = 330 + 480 = 810$

$t = 4$ is 500 + 660 = 1160

\ The time they will take lies between $t = 3$ and $t = 4$.

48. The number of pieces machined by A in any hour is not same as that of B.

49. It happened in three instances, i.e., at $t = 2$; $t = 3$; $t = 6$ for machine A but it never happened for machine B.

50. Number of pieces machined in the last three hours by machine A = 200 + 220 + 160 = 580; machine B = 50 + 80 + 140 = 270.

Required % = $\dfrac{580 - 270}{270} \times 100 = \dfrac{3100}{270} \times 100$

$\cong$ 115% more

EXERCISE-3

Solutions for questions 1 to 4: The sales, net profit, gross profit and expenses in each of the given years is as follows:

Year	2013	2014	2015	2016	2017
Sales	765	810	875	756	824
Gross profit	197	220	241	171	224
Net profit	148	165	193	137	179
Expenses	568	590	634	619	645

1. The expenses in the year 2014 was `590 cr.

2. The percentage increase in expenses from 2014 to 2015 is $\dfrac{44}{590} \times 100 = 7.46\%$

3. The ratios of sales to expenses in the given years are

2013 – $\dfrac{765}{568}$, 2014 – $\dfrac{810}{590}$,

2016 – $\dfrac{756}{619}$ and 2017 – $\dfrac{824}{645}$

It was lowest in 2016.

4. The probability in the different year are as follows.

2013 – $\dfrac{197}{765} = 25.8$, 2014 – $\dfrac{220}{810} = 27.2$,

2015 – $\dfrac{241}{875} = 27.6$, 2017 – $\dfrac{224}{824} = 27.2$.

Solutions for questions 5 to 8: From the pie chart, the number of passengers who boarded the train at different stations can be found. The total number of passengers travelling in the train between any two stations can also be found once we know the number of passengers who boarded the train and those who got down from the train at different stations.

Boarding

500   400   800   200   100

A   B   C   D   E   F

   500   600   900   650   600

300   500   450   150   600
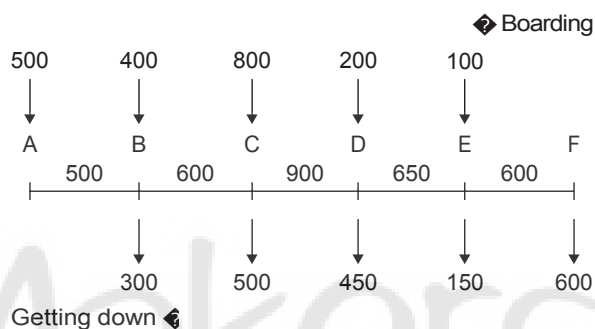
Getting down

5. Maximum number of passengers boarded the train at station C. It can be observed that the difference in the number of passengers on board C to D and the number of passengers getting down at d is 900 – 450 = 450, which is the highest among the other such possible differences. Hence, it is possible that the maximum possible number of passengers satisfying the requirement may have boarded at C. Maximum number of passengers who boarded the train at C and got down at station F will travel a distance 30 km which is more than 15 km and these many passengers would satisfy the condition given in the questions. Therefore, maximum number of passengers in the group of villagers will be the number of passengers boarded at C and got down at F.

From C to D we have 900 passengers, out of which 800 were from C and 100 were from other stations. Number of passengers got down at D is 450 in which 100 passengers could be those who boarded at other stations (before C) and 350 will be those who boarded at C. So, the number of passengers travelling from D to E who boarded at C is (800 – 350), i.e., 450. At station E, 150 passengers got down, all of who could be from 200 passengers who boarded at D.

So, a maximum of 450 passengers who boarded at C can get down at F.

85

6. Maximum number of passengers who got down at C and travelled not more than 15 km are the passengers boarded at stations A and B.

So, maximum number of passengers boarded at A or B and got down at C = 500.

Maximum number of passengers who boarded at C and travelled not more than 15 km are passengers who got down at stations D and E which is equal to 600.

So, total such passengers = 1100.

7. If the passengers who boarded the train at A get down at E or F, then they travelled at least 30 km. Similarly, if the passengers boarded at B get down at F then they travelled at least 30 km.

Maximum number of passengers who boarded at either A or B who can travel till E or F is 100. If the passengers boarded at C gets down at F, then they travelled at least 30 km. The maximum number of such passengers is 350. So, the total passengers satisfying the condition is at most 450. Choice (D)

8. The line diagram for return journey is as given below.

Boarding

Getting down
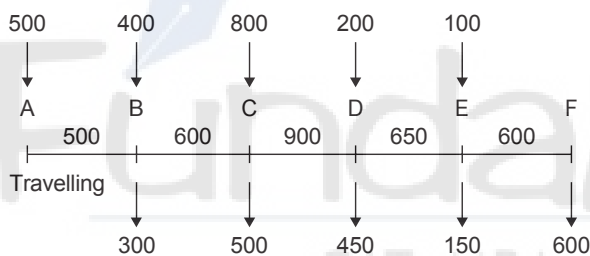
Clearly, choice (A) is true, as number of passengers between any two stations in the evening is same as that in the morning.

Choice (B) is also true.

Choice (C) is true as the number of passengers who boarded at F and get down at C which is 30 km from F is 450. In the morning journey also, this number was 450, therefore this is also a true statement.

Solutions for questions 9 to 12: Let n = number of members in a group

$$10 = 2 + 2 + 2 + 4$$
$$10 = 2 + 2 + 3 + 3$$

Year 2015

Group	n	Total age
A	2	41
B	2	45
C	2	49
D	4	110
		245

Year 2016

Group	n	Total age
A	3	73
B	2	51
C	3	84
D	2	47
		255

Note: As the average age of group A is 24.33, the number of members cannot be 2 or 4. Hence, it must be 3.

Year 2017

Group	n	Total age
A	4	118
B	2	49
C	2	46
D	2	52
		265

Year	Sum of all the ages
2015	245
2016	255
2017	265

Year 2015:
Individual age of the members of the group can be evaluated (unique possibility)

Group	Individual ages
A	20, 21
B	22, 23
C	24, 25
D	26, 27, 28, 29

A different set of members is present in any group for any two years.

Year 2016

Group	Individual ages	Total
A	23, 24, 26	73
B	21, 30	51
C	27, 28, 29	84
D	22, 25	47

Year 2017

Group	Individual ages	Total
A	28, 29, 30, 31	118
B	23, 26	49
C	22, 24	46
D	25, 27	52

Note: Sum of the ages of members of group C (in 2017) must have been 42 as on 1st January, 2015. Which adds to a unique possibility of two members of age 20, 22 years. Similar reasoning is used to establish individual ages in the respective years.

9. Age of the eldest person in Group B as on 1st January 2017 = 26 years.

10. Group D:
Ages = 22, 25 (in 2016)
= 21, 24 (in 2015)

Group B, 2015
22, 23.
No person is common.

11. Group A had the maximum total age in the year 2017.

12. Only group A showed a consistent increase in the total age of all the members across the years.

Solutions for questions 13 to 16:

13. The revenues in the different years are (assuming 100 rooms in 2012) as follows.
2012 – 4000 × 50
2013 – 4500 × 55 × 1.1
2014 – 4200 × 65 × 1.21
2015 – 5400 × 57 × 1.33
2016 – 5000 × 65 × 1.46
2017 – 4800 × 71 × 1.61
It can be seen that the revenue was the highest in 2017.

14. The percentage increase in revenue over the previous year was the highest in 2013, i.e., over 35%.

15. As it is given that the hotel made a profit in 2012, the revenue in that year is more than the expenses. As the expenses increased by 15% each year it can be seen that the growth rate of revenue was more than 15% in each year and so the profit would be the highest in 2017.

16. For any number of rooms, the profit increases at a faster rate than revenue. So, the profitability keeps an increasing and is the highest in 2017.

Solutions for questions 17 to 20: As it is known that player F was ranked eight and that player D was ranked immediately above player C, it can be concluded that both C and D scored more runs than player B, while player G scored fewer than player B. So also, as the difference between the runs scored by player A, E and H and player B is more than that of player F, all the three must have scored more runs than player B.

\ If player B scored 0 'x' runs, the runs scored by the other players are as follows:

A	$x + 90$	Rank – 2
B	x	Rank – 6
C	$x + 25$	Rank – 5
D	$x + 48$	Rank – 4
E	$x + 107$	Rank – 1
F	$x – 65$	Rank – 8
G	$x – 45$	Rank – 7
H	$x + 72$	Rank – 3

17. The rank of player C was 5.

18. Five players scored fewer than player H.

19. The total runs scored by the eight players are
$$= \frac{8x + 232}{8} = x + 29 = 435$$
\ $x = 406$
Player C scored 406 + 25 = 431 runs.

20. $x – 45 = 373$
\ $x = 418$
Total runs = $8x + 232 = 8 × 418 + 232 = 3576$

3

Pie Charts

Chapter

Learning Objectives

In this chapter, you will :

- Understand various types of data presented in the form of pie charts.
- Get familiar with different types of pie charts.
- Get familiar with different types of questions based on pie charts.
- Learn shortcuts to solve questions involving two or more pie charts without finding all the values.
- Compare values (changes) across two or more pie charts using percentage techniques.
- Understand data which involves more than one data type – bar graph and pie chart together, pie chart and table, etc.

❐ PIE-CHARTS

This is probably the simplest of all pictorial forms of data presentation. Here, the total quantity to be shown is distributed over one complete circle or 360 degrees. In pie charts, data is essentially presented with respect to only one parameter (unlike in two and 3-dimensional graphs described later). This form essentially presents the shares of various elements as proportion or percentage of the total quantity. Each element or group in the pie chart is represented in terms of quantity (or value, as the case may be) or as the angle made by the sector representing the elements or as a proportion of the total or as a percentage of the total. Pie charts are also very frequently used in combination with other forms of data or along with other pie charts.

Figure 3.1 depicts the distribution of the population in different geographical zones.
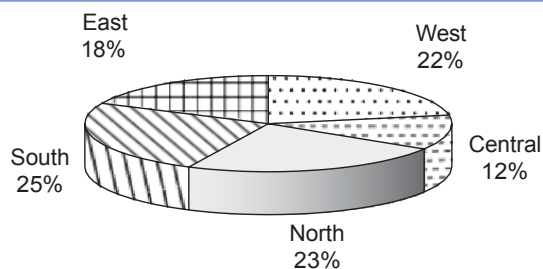
Fig. 3.1 Distribution of population in geographical zones

From the above pie chart, we can calculate the following:

- Population in any zone given the total population
- Population of any zone as a percentage of that of another zone.
- Percentage increase in the total population given the percentage increase in the population of one or more zones.

Solved Examples

Directions for questions 3.01 to 3.05: These questions are based on the information given below.

The following pie chart represents the break-up of Raju's monthly expenses.
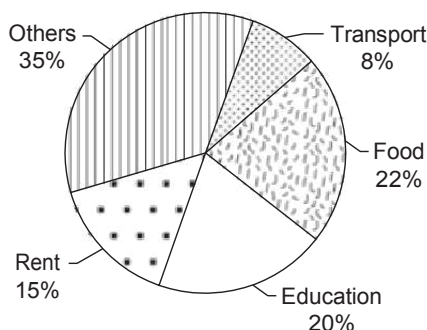
3.01: If Raju spent `4500 more on food and transport together than he spent on rent, then find his monthly expenses (in `).
(A) 15,000   (B) 25,000
(C) 30,000   (D) 35,000

Sol: Percentage of his expenditure spent on rent = 15%
Percentage of his expenditure spent on transport and food = 30%
\ 30% - 15% = 15% = `4500
Monthly expenses = 100%
$$= \frac{100}{15}(4500) = `30,000$$

3.02: If Raju increased his savings, which is currently 10% of his income by 20% and reduced his expenses by 20%, then his savings would be what percentage of his expenses?
(A) 10%   (B) 12.5%
(C) 15%   (D) $16^2/_3$%

Sol: Let his monthly income be `x.

Original savings = ` $\frac{10}{100}x$

New savings = $\frac{10}{100}x + \frac{20}{100}\left(\frac{10}{100}x\right) = `\frac{12}{100}x$

Original expenditure = $x - \frac{10}{100}x = `\frac{90}{100}x$

New expenditure = $\frac{90}{100}x - \frac{20}{100}\left(\frac{90x}{100}\right) = `\frac{72}{100}x$

Required percentage = $\frac{\frac{12}{100}x}{\frac{72}{100}x}(100) = 16\frac{2}{3}$%

3.03: Raju spent 20% of his expenditure on 'others' on entertainment. This amounted to `2100. Find his expenditure on education.
(A) 4500   (B) 5000
(C) 6500   (D) None of these

Sol: Expenditure on entertainment = 20% of 35%
= 7% = 2,100
1% = 300
Expenditure on education = 20% = `6000

3.04: Find the angle made by the expenditure on rent and 'others' put together.
(A) 120°   (B) 160°
(C) 180°   (D) 210°

Sol: Total expenditure on rent and 'others'
= 15% + 35% = 50%
Required angle = $\frac{50}{100}(360°) = 180°$

3.05: As prices dropped, Raju's expenditure on clothes dropped by 10%. As a result of this, his expenditure on 'others' decreased from `10,500 to `10,290. What percentage of his expenditure on 'others' was spent on clothes?
(A) 10%   (B) 12%
(C) 15%   (D) 20%

Sol: Decrease in expenditure on 'others'
= 10,500 - 10,290 = `210
\ Initial expenditure on clothes
$$= 210\left(\frac{100}{10}\right) = `2100$$

Required percentage = $\frac{2100}{10500}(100) = 20\%$

Directions for questions 1 to 5: The pie chart given below shows the import of various commodities to India during 1999–2000.
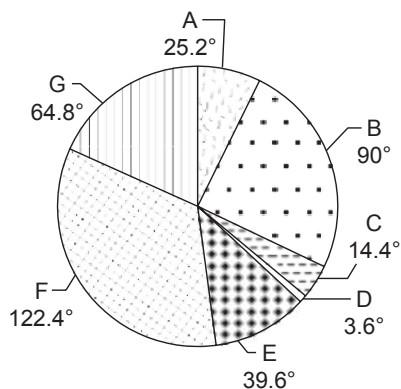
Total = 36 billion dollars

A = Food and allied products
B = Fuel
C = Fertilizers
D = Paper and allied products
E = Capital goods
F = Bulk goods
G = Miscellaneous items

1. If 40% of the miscellaneous items imported are pharmaceutical products and this is one eighth of the total internal production, then the total value of internal pharmaceutical production in billion dollars is
(A) 2.592   (B) 25.92
(C) 20.736   (D) 3.24

2. Find the value of bulk goods, food and allied products imported.
(A) 14.76 billion dollars
(B) 16.74 billion dollars
(C) 11.46 billion dollars
(D) 17.46 billion dollars

3. In 1999–2000, the total exports of India is $24 billion. In this figure, 20% is contributed by the textile industry, whereas 50% of miscellaneous items are for imports of textiles. Find the value of net imports or exports of textile industry.
(A) $2.24 billion net exports
(B) $3.16 billion net imports
(C) $1.84 billion net imports
(D) $1.56 billion net exports

4. On account of the exploring of oil at two sites in Andhra Pradesh, India can save $2 billion on its fuel bill. Find the approximate ratio of imports of new fuel bill and capital goods bill.
(A) 7 : 5   (B) 7 : 4
(C) 3 : 1   (D) 5 : 2

5. The fuel bill in 2000–2001 increases by 40% and the bill for all other commodities remains the same as in 1999–2000. What is the angle made by capital goods sector imports if the pie chart is redrawn for the year 2000–2001?
(A) 36°   (B) 39.6°
(C) 32.4°   (D) 43.2°

Directions for questions 6 to 10: These questions are based on the following pie chart which shows the viewership of different sports channels in the month of February 2003 in India. There is no overlap in viewership of channels.
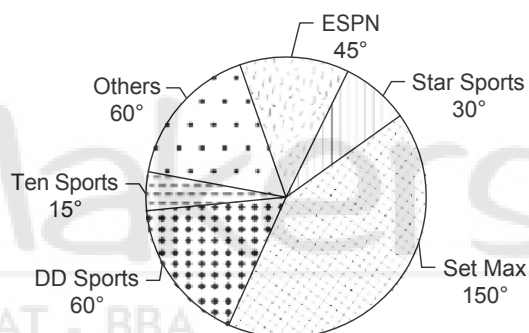
6. If 60,000 people watched Star Sports on an average per day in February 2003, then how many more people watched Set Max than Ten Sports on an average per day for the same period?

7. During the given period for how many sports channels is the viewership more than 20% of the total viewership?

8. If the viewership of DD Sports for the first half of February is half that of the second half of February, then what is the ratio of viewership of DD Sports for the second half of February to that of ESPN for the whole month?

9. By mistake the viewership of DD sports has been under-quoted by 20%. If this mistake is corrected then what is the correct share of viewership of Set Max?

10. If the viewership of ESPN on an average was 90,000 per day, then what was the viewership for all the sports channels on an average per day?
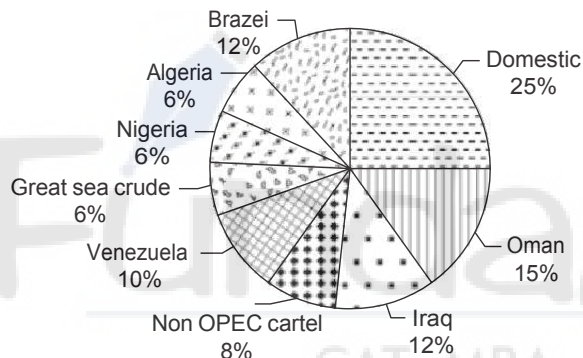
Directions for questions 11 to 15: These questions are based on the pie charts given below.

Break-up of various energy sources consumed by India (by value)

Crude oil 30%
Coal 20%
Kerosene 12%
Electricity 13%
Nuclear 15%
Gas 10%
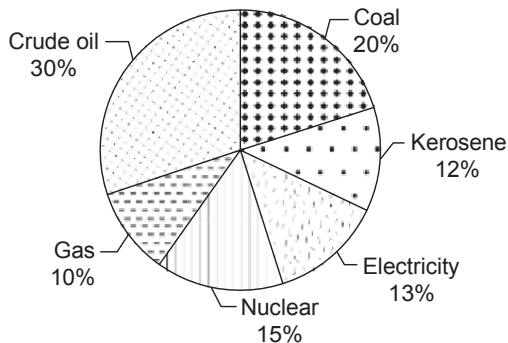
Total value = ₹ 60,000 crore

Break-up of crude oil supply in India (by volume)

Brazei 12%
Algeria 6%
Nigeria 6%
Great sea crude 6%
Venezuela 10%
Non OPEC cartel 8%
Iraq 12%
Oman 15%
Domestic 25%

Total = 250 million barrels

11. What is the value of 1 litre of kerosene given that the total kerosene consumed in India is 150 lakh kilolitres?
(A) `3.2
(B) `4.8
(C) `6.8
(D) Data inadequate

12. If 1000 kilowatts {= 1 gigawatt (1 GW)} of electricity costs `25 lakh, then what is the total amount of electricity generated in India?
(A) 31,200 GW
(B) 25,000 GW
(C) 21,750 GW
(D) Data inadequate

13. What is the domestic crude oil price per barrel in Oman given that Oman sells crude oil to India at a discount of 20% on its domestic price? (Assume that the price of crude oil to India from all the sources is the same)
(A) `900
(B) `750
(C) `720
(D) Data inadequate

14. If the Total Estimated Reserves (TER) of crude oil in India is 4000% more than the Total Recoverable Reserves (TRR) and the current domestic production of crude oil is 16% of the TRR, then what is the approximate TER of crude oil in India? (in million barrels)

(A) 11,500
(B) 13,700
(C) 15,000
(D) 16,000

15. The current domestic price of crude oil is 25% less than the price of crude oil from all other sources (as shown in the pie chart), then what is the price of crude oil imported from Venezuela? (Assuming that prices of crude oil from all sources other than domestic are equal)
(A) `617 per barrel
(B) `768 per barrel
(C) `917 per barrel
(D) Data inadequate

Directions for questions 16 to 19: These questions are based on the following pie charts.

State wise Production of Food Grains in India

In 1999–2000

Karnataka 5%
Rest of India 17%
U.P. 6%
Kerala 8%
Tamil Nadu 4%
A.P. 10%
Maharashtra 10%
West Bengal 15%
Punjab 25%
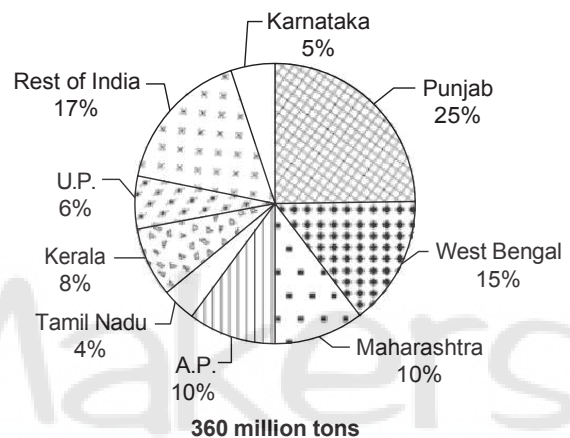
360 million tons

In 2000–2001

Karnataka 8%
Rest of India 15%
U.P. 4%
Kerala 5%
Tamil Nadu 10%
A.P. 16%
Maharashtra 8%
West Bengal 10%
Punjab 24%
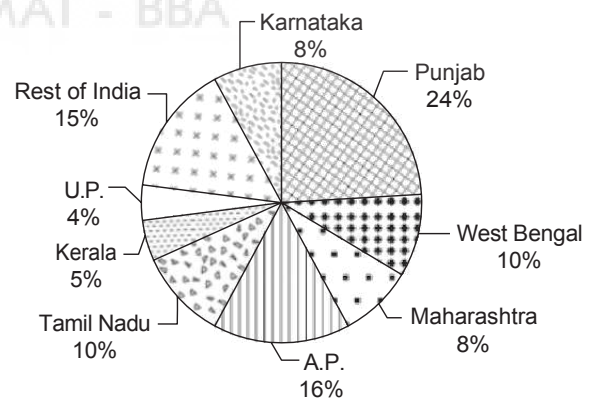
300 million tons

16. From 1999–2000 to 2000–2001, which of the following states showed the maximum percentage increase in the food grain production?
(A) A.P.
(B) Tamil Nadu
(C) Kerala
(D) Karnataka

17. In 1999–2000, rice and wheat form 60% of the total food grain production. In 2000–2001, they form 80% of the total food grain production. What is the percentage change in the production of food grains other than rice

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and wheat in Maharashtra, given that Maharashtra produced 4 million tons of rice and wheat in both the years?
(A) 20% increase
(B) 37.5% decrease
(C) 58.3% increase
(D) 33.3% decrease

18. If the ratio of the average price per kg of rice in 1999–2000 to that in 2000–2001 is 11 : 12, then the percentage of revenue gained/lost on account of rice by West Bengal from 1999–2000 to 2000–2001, given that 50% of its total production is from rice in both the years?
(A) 35% loss   (B) 40% loss
(C) 40% gain   (D) 35% gain

19. If the percentage increase in the production of food grains for A.P. and Karnataka in 2001–02 from the previous year is the same as the percentage increase from 1999–2000 to 2000–2001, then what is the difference in share of production between these two states in the year 2001–02?
(A) 11.11 percentage points
(B) 22.22 percentage points
(C) 33.33 percentage points
(D) Cannot be determined

Directions for questions 20 to 23: The following pie charts represents the demand and supply of blood in a city of different blood groups in a certain period.

Supply (4,000 litres)
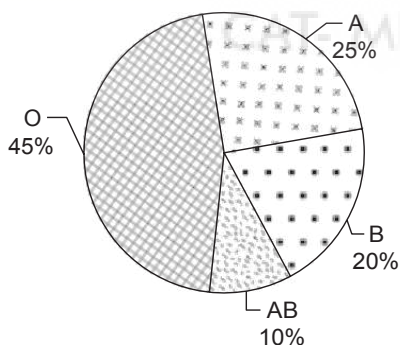
Demand (16,000 litres)
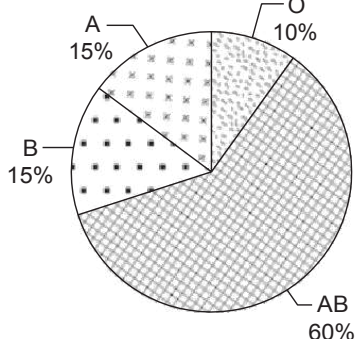
20. If the ratio of supply of positive and negative combinations of the blood groups A, B, O and AB are 3 : 1, 4 : 1, 1 : 1 and 2 : 1, respectively, then the blood group having the least supply of blood is
(A) O^- (B) AB^-
(C) A^- (D) B^-

21. If total demand doubles and the demand percentage of blood group AB remains constant, then which of the following is true?
(A) Supply of blood groups A, B and O will decrease.
(B) Supply of blood groups A, B and O will increase.
(C) Demand of blood groups A, B and O will decrease.
(D) Demand of blood groups A, B and O will increase.

22. If the supply of blood group O^+ and O^- is in the ratio 3 : 2 and the demand of these blood groups is in the ratio 3 : 5, then how much excess supply of blood is there in blood group O^+?
(A) 620 litres
(B) 560 litres
(C) 480 litres
(D) 525 litres

23. If a person having blood group 'O' can donate maximum of up to 2 litres at a time and a person having blood group 'A' can donate maximum 1 litre at a time, then how many people are required to donate the blood for these two groups, so that the demand for these two groups is met. Assume that apart from the blood obtained from the above donors, there is no other supply of these blood groups.
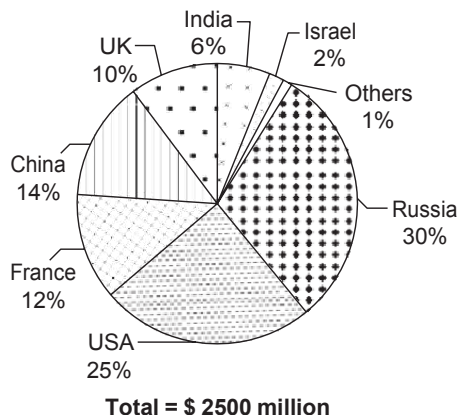(A) 3200   (B) 2900
(C) 2100   (D) 1600

Directions for questions 24 to 28: These questions are based on the pie charts given below.

Distribution of Nuclear Warheads produced among different countries (in the year 2002)

Total = 80,000
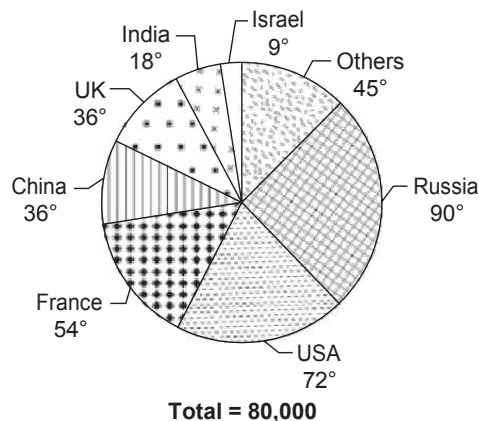
Cost incurred in building and maintaining Nuclear Warheads by various countries (in the year 2002)


Total = $ 2500 million

**Note:** Assume that all the countries had no warheads at the end of the year 2001.

24. What is the ratio of the difference in the number of warheads possessed by Russia and USA and the difference in the number of warheads possessed by India and Israel?
(A) 1
(B) 1.5
(C) 2
(D) 2.5

25. What is the average cost of building and maintaining one nuclear warhead by China in 2002?
(A) $437.50
(B) $43,750
(C) $4375
(D) None of these

26. What is the difference in the average expenditure incurred in building and maintaining one warhead by Russia and that of USA?
(A) $1500
(B) $1562.50
(C) $1671.40
(D) None of these

27. If each warhead of the countries from the category 'Others' weighs 1000 kg, which is half the weight of the other countries given in the graph, then what is the weight of all the nuclear warheads of all countries put together?
(A) 30,0000 tons
(B) 45,000 tons
(C) 1,40,000 tons
(D) 1,50,000 tons

28. If after signing the Nuclear Non-proliferation Treaty (NPT), Russia reduces the number of nuclear warheads with it by 40%, USA by 30%, UK and China by 20% each and all other countries by 10%, then what will be the total number of nuclear warheads in the world after this reduction?
(A) 61,200
(B) 64,000
(C) 72,800
(D) None of these

Directions for questions 29 to 33: These questions are based on the pie charts which provides the statistics of international students pursuing post-graduation in the United States in the year 2000.

Distribution by nationality
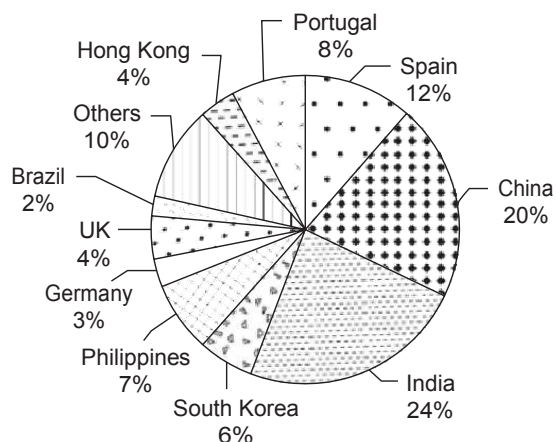
Distribution by graduation
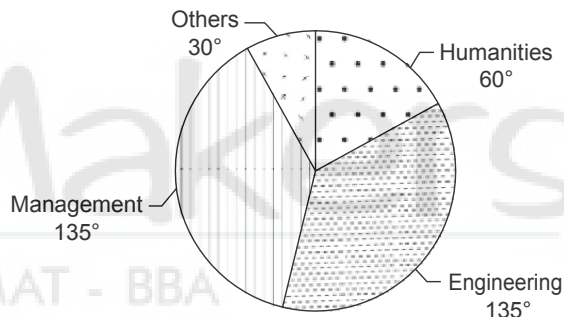
29. The number of students form India and China is what percent of the students form all the other countries (excluding the 'Others' category)?
(A) 96.78%
(B) 95.12%
(C) 95.65%
(D) 92.01%

30. How many students from the country which has the maximum representation in the year 2000 are pursuing a management course? (assuming that the nation wise distribution of the students of each graduation stream is as per the graph of distribution by nationality)
(A) 7200
(B) 9000
(C) 19200
(D) Cannot be determined

31. If the number of students pursuing post-graduation in USA in the year 2000 from Spain and Portugal is 25% of the number of domestic students pursuing MS in USA, then what is the total number of domestic students pursuing MS in USA?
(A) 16000
(B) 36000
(C) 60000
(D) None of these

32. If it is known that a total of 3,60,000 students are pursuing post-graduation in USA in 2000, then approximately what percentage of it is comprised of students from Asian countries (i.e., China, India, South Korea, Philippines and Hong Kong)?
(A) 16.5%   (B) 13.5%
(C) 19%   (D) Cannot be determined

33. What is the number of Indian students pursuing either Engineering or Management as a percentage of the number of Chinese students pursuing any course other than Engineering and Management in USA in the year 2000? (use the data given in question 17)
(A) 120%   (B) 220%
(C) 360%   (D) 440%

Directions for questions 34 to 37: Answer these questions on the basis of the information given below.

The first pie chart gives the breakup of the total students doing graduation in a city according to their area of specialization. The second pie chat gives the breakup of the boys doing graduation according to their area of specialization. The ratio of the number of boys to girls doing graduation is 2 : 5.
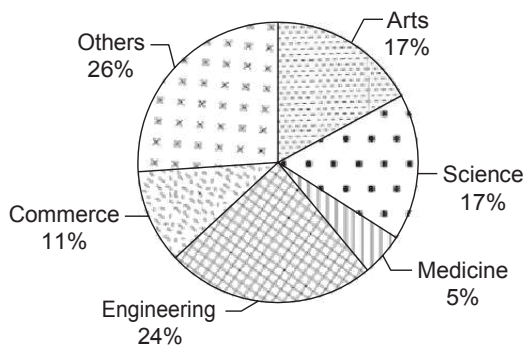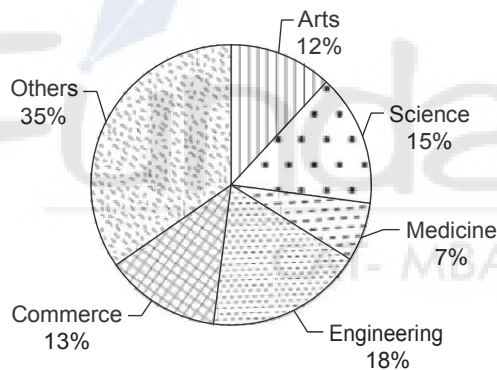
34. If gender ratio = $\dfrac{\text{number of girls}}{\text{number of boys}}$, then what is the gender ratio of students doing Medicine?
(A) 3.9   (B) 4.3
(C) 3.5   (D) Cannot be determined

35. For how many areas of specialization is the number of boys at least half of the number of girls?

(A) 1   (B) 2
(C) 3   (D) 4

36. If the number of girls doing Medicine is 4056, then what is the total number of boys doing graduation?
(A) 12,400   (B) 18,600
(C) 20,800   (D) None of these

37. What is the ratio of the number of girls in the area of specialization for which the number of boys is the second highest and the number of boys in the area of specialization for which the number of girls is the highest?
(A) 2 : 5   (B) 2 : 3
(C) 3 : 2   (D) Cannot be determined

Directions for questions 38 to 41: Answer the following questions based on the information given below.

The following figures represent the export performance of XYZ Ltd in the year 2015–16. The first pie chart represents the product-wise break-up of the exports to Germany, the main market of XYZ Ltd in Europe and the second pie chart represents the product-wise exports to Europe, which is the only region to which the company exports. 'Rest of Europe' refers to all regions in Europe excluding Germany.
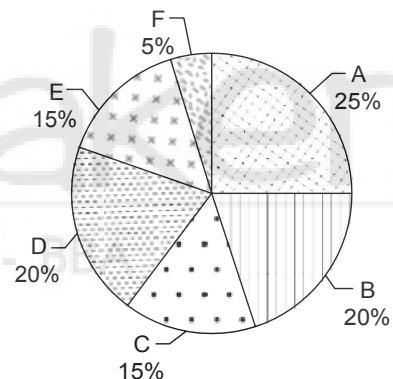
Total = 40 million dollars
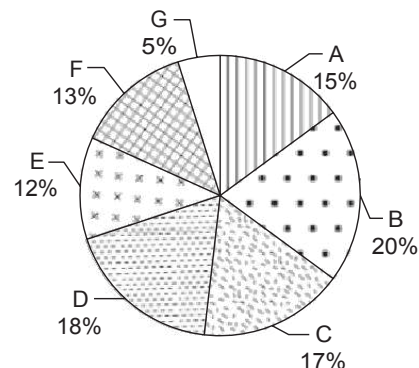
**Total = 110 million dollars**

38. For which of the given products is the percentage share of exports to Germany, out of its total exports to Europe, the highest?
(A) A   (B) B
(C) D   (D) E

94

39. If for product A, the value of exports to France is accounted for 35% of that to 'rest of Europe', then what was its value (in million dollars)?
(A) 1.975
(B) 2.125
(C) 2.275
(D) None of these

40. For how many of the given products was the value of its exports to Germany more than two thirds of that to the 'rest of Europe'?
(A) 4
(B) 3
(C) 2
(D) 1

41. The exports of product B to the 'rest of Europe' is more than the exports of how many products to the whole of Europe?
(A) 0
(B) 1
(C) 2
(D) 3

Directions for questions 42 to 45: Answer these questions on the basis of the information given below.

The pie chart exhibits the break-up of all engineers in a city based on the industry they work for. The bar graph gives the percentage of females, among the engineers for each sector.


Total = 80,500
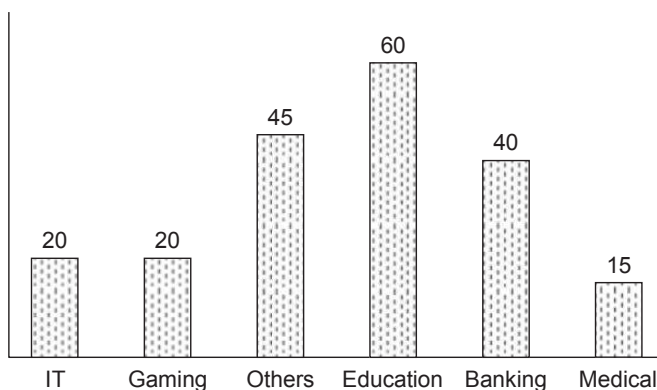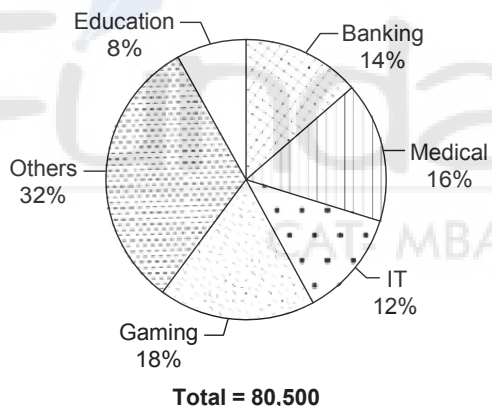
42. What is the average number of female engineers per sector?
(A) 2861
(B) 4273
(C) 4402
(D) 4454

43. The number of male engineers in the banking sector is what percentage more than the number of female engineers in the IT sector?
(A) 350%
(B) 150%
(C) 250%
(D) None of these

44. Had the number of female engineers in the gaming sector been 4628 and the number of male and female engineers in all other sectors remain the same, then what would have been the percentage of females among the total engineers?
(A) 35.5%
(B) 34.6%
(C) 34.2%
(D) 33.5%

45. What is the maximum difference between the number of male and female engineers in any single industry?
(A) 8126
(B) 8694
(C) 9016
(D) None of these

Directions for questions 46 to 50: Answer the questions based on the information given below.

The following pie chart gives the break-up of the costs and the sales value of all the six products, namely A, B, C, D, E and F manufactured and sold by company XYZ.
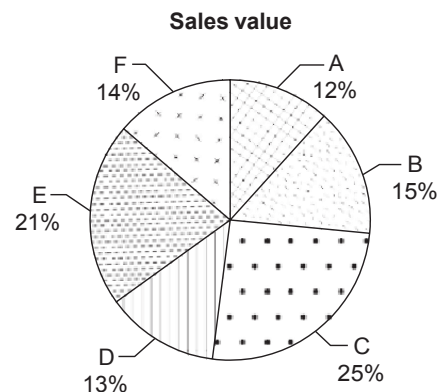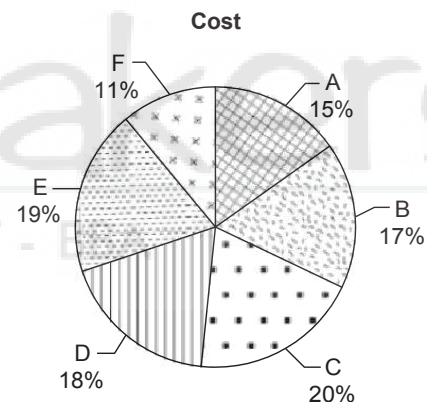

Cost

Sales value

46. If the company made an overall profit of 10%, then for which product was the profit percentage, the highest?
(A) B
(B) C
(C) D
(D) F

47. If the company made an overall loss, then for at most how many products was the sales value more than the costs?

(A) 0   (B) 1

(C) 2   (D) 3

48. If the company made an overall profit, then on at most how many products did it incur a loss?

(A) 4   (B) 3

(C) 2   (D) 1

49. On at least how many products should the company make a profit so as to make an overall profit?

(A) 1   (B) 2

(C) 3   (D) 4

50. If the company made a profit on each of the products, then the overall profit percentage is at least

(A) 32%   (B) 38.5%

(C) 43%   (D) 48%

EXERCISE-2

Directions for questions 1 to 4: These questions are based on the information given below.

The pie charts shows the market share of sales (by volume) of all major car manufactures in a country in two consecutive years. All manufacturers with less than 5% market share are classified under 'others'.
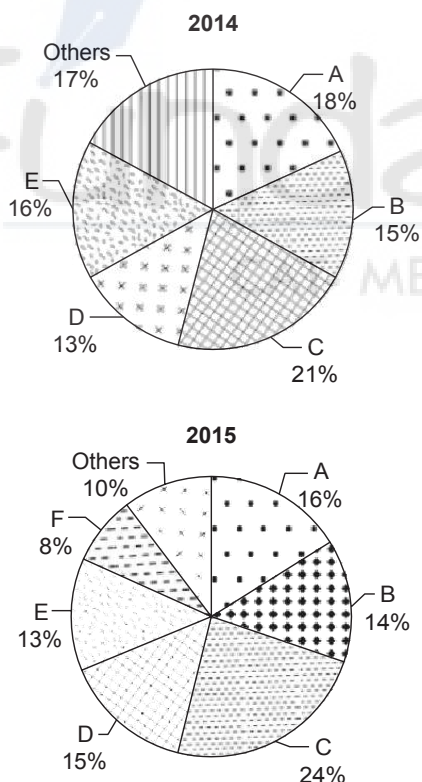

2014

2015

The total sales (by volume) increased by 5% from 2014 to 2015.

1. What was the percentage increase in the sales of company D?

(A) 15.4%   (B) 18.4%

(C) 21.2%   (D) 24.01%

2. If the average selling price of a car sold by company B increased by 8% from 2014 to 2015, then what is the percentage increase in sales (by value) from 2014 to 2015?

(A) 5.85   (B) 5.32

(C) 5.01   (D) 4.86

3. Which company had the highest percentage increase in the sales (by volume) from 2014 to 2015 (ignore companies with less than 5% share in both the years)?

(A) C   (B) D

(C) E   (D) F

4. For how many companies is the growth in sales (by volume) greater than 20% ? (Assume no company among 'others' had a volume growth more than 18%)

(A) 1   (B) 2

(C) 3   (D) 4

Directions for questions 5 to 9: The following charts exhibits the market survey data for various CRM software packages implemented by different companies. The total number of companies surveyed is 1000.

Percentage distribution of the number of companies (as a percentage of the total number of companies surveyed) implementing different CRM packages.
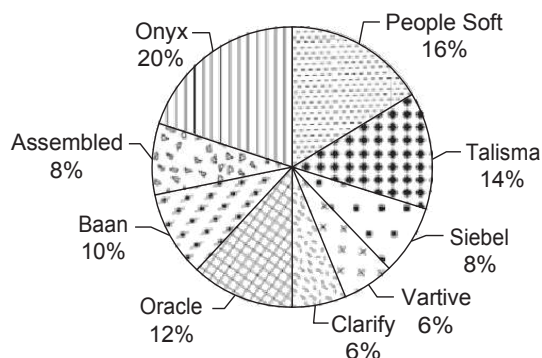
Note: Each company implements exactly one software package.

Percentage distribution of the number of companies (as a percentage of the total number of companies surveyed) quoting different reasons for implementing software CRM packages.


Percentage of companies
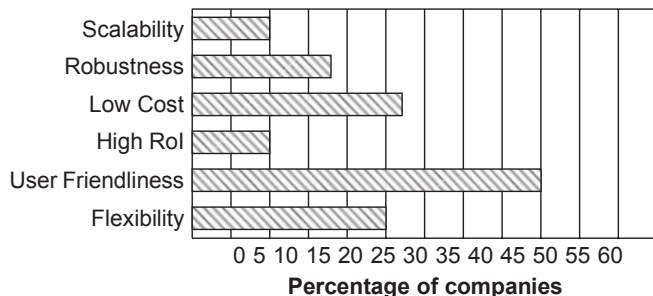
**Note:** Each company surveyed claimed at least one of the above reasons.

5. If $31\frac{1}{8}$% of the companies which implement Oracle, cited Robustness as a reason, then a maximum of how many companies which implemented either Clarify or Baan, could have cited Robustness as a reason?
   (A) 140 (B) 40
   (C) 160 (D) 100

6. Among the companies surveyed, if all the companies which implemented Talisma/People Soft/Onyx quoted either User Friendliness or Flexibility as a reason, then at least how many of these companies quoted both the reasons?
   (A) 500 (B) 450
   (C) 250 (D) 200

7. If all the companies which quoted either Low Cost or Scalability as a reason implement either Onyx or Oracle but not any other package, then at least how many of these companies implemented Oracle?
   (A) 170 (B) 200
   (C) 70   (D) 50

8. If all the companies that implemented either Siebel or Vartive quote the same reason, then which of the following cannot be that reason?
   (A) Scalability (B) High RoI
   (C) Low Cost   (D) Both (A) and (B)

9. At the most how many companies which had implemented 'Assembled' could have quoted all the six reasons for implementation?
   (A) 0   (B) 70
   (C) 80 (D) 100

Directions for questions 10 to 14: These questions are based on the pie charts given below, which give the statistics regarding the total number of students (129600) graduating nation-wide and their respective career details.
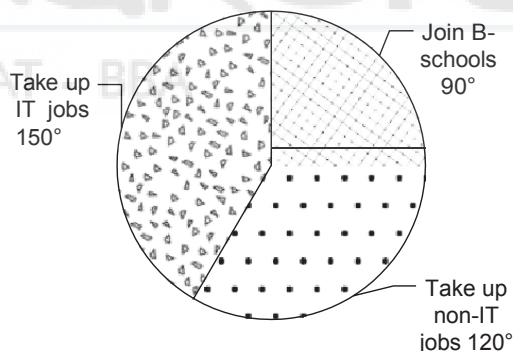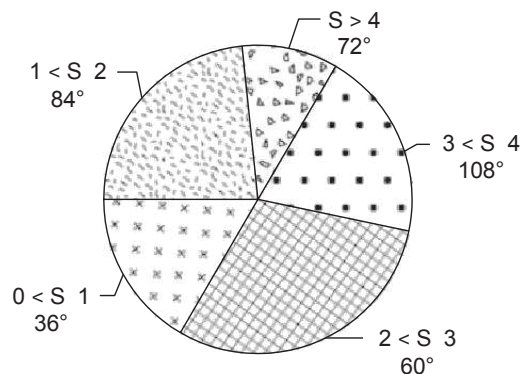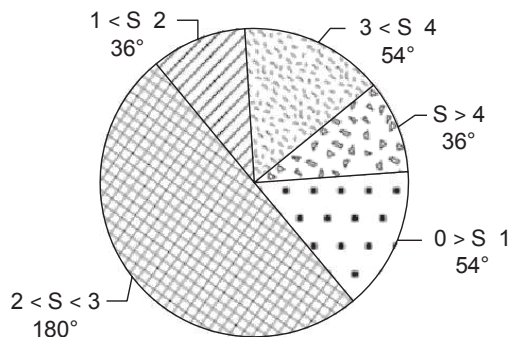
Discipline-wise distribution
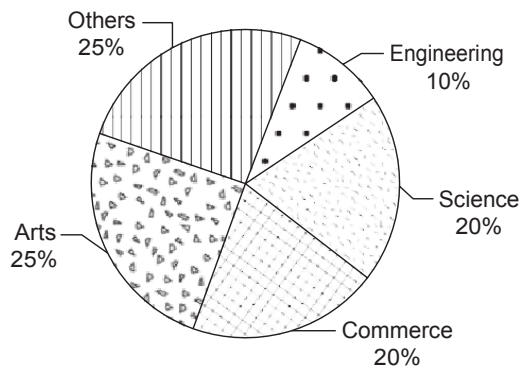
Region-wise distribution
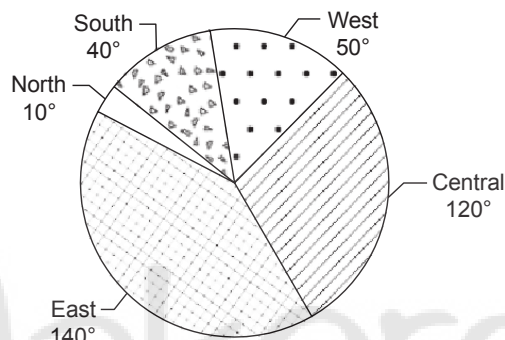
Career-wise distribution

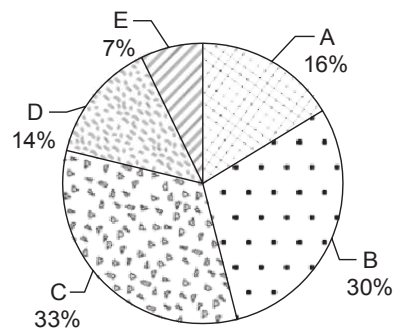**Region-wise distribution of B-Schools Salary-wise distribution of students taking the students join up IT-jobs**

Salary-wise distribution of students taking up non-IT jobs

Total production cost = ₹ 90,000 million

10. The total number of students taking up either type of jobs (IT or non-IT) with a salary of more than `4 lakh per annum forms what percentage of the total number of students who joined a B-school in the Central region?

(A) 58%   (B) 68%

(C) 140%   (D) 168%

11. If a consolidated pie chart is drawn representing the distribution of the number of students taking up either type of jobs (IT or non-IT), then what is the approximate angle formed by the sector representing those with a salary of more than `1 lakh/annum but less than or equal to `2 lakh/annum?

(A) 100°   (B) 120°

(C) 62.5°   (D) 270°

12. How many students from Commerce discipline joined a B-school located in the Western region?

(A) 360

(B) 3600

(C) 36000

(D) Cannot be determined

13. Find the number of students who took up a non-IT job with a salary of more than `2 lakh per annum.

(A) 32400   (B) 38880

(C) 21600   (D) 4320

14. If all students graduating in Commerce discipline join a B-school, then at the least how many students graduating in a discipline other than engineering joined B-schools located in the Central region?

(A) 10,800   (B) 7,200

(C) 4,320   (D) 1,240

Directions for questions 15 to 18: These questions are based on the pie chart and table given below.

There are five companies A, B, C, D and E which produce steel in country X. The following pie chart shows the percentage share of production costs of each company in the total production costs of all the five companies in the year 2007.

The following table shows the ratio of production costs of each company in producing the three different varieties of steel and the corresponding profit % earned, for the year 2007. The five companies produce only those three varieties of steel.

Company	Ratio of production costs Variety I : Variety II : Variety III	Corresponding profit % Variety I	Variety II	Variety III
A	4 : 5 : 7	45%	45%	35%
B	3 : 5 : 2	33%	40%	48%
C	6 : 2 : 3	34%	38%	42%
D	7 : 5 : 2	35%	32%	46%
E	6 : 3 : 5	44%	48%	25%

Note: Profit is calculated on the production cost.

15. Which company has the maximum profit from the sales of variety II?

(A) B   (B) D

(C) A   (D) C

16. What is the overall profit of E (in ` millions)?

(A) 1162.50   (B) 2398.50

(C) 3164.50   (D) 4165.50

17. Production costs of company C are approximately how much percentage more than those of company D?

(A) 136%   (B) 57.6%

(C) 52.3%   (D) 48.6%

18. Which company has incurred the maximum production cost for variety III?

(A) B   (B) D

(C) C   (D) A

Directions for questions 19 to 23: Answer these questions based on the information given below.

Revenues earned by three Airways for the year ending 31.03.2002 Bharat Airways

Total revenue = ₹ 6,000 crore

FUT Airways

Total revenue = ₹ 7,200 crore

Lahiri Airiways

Total revenue = ₹ 3,600 crore
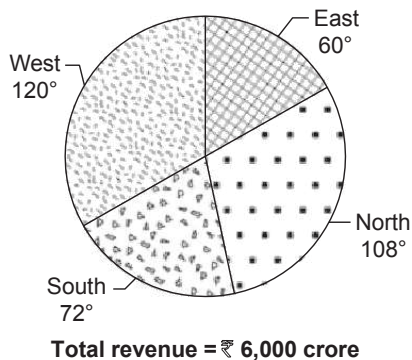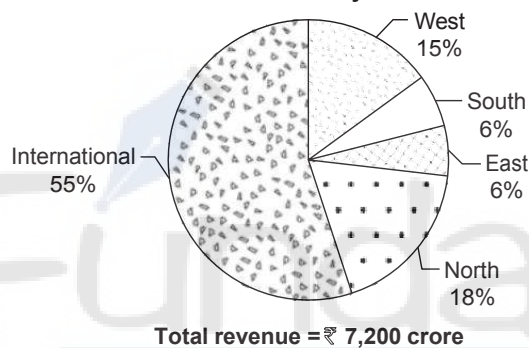
Note: East, West, North and South are the four inland zones of the country.

19. Assuming that there are no other airways operating in the inland market, what is the inland market share of FUT Airways?
 (A) 48.6% (B) 28.5%
 (C) 25.2% (D) 21.8%

20. Considering the revenues generated by the three airways in each of the four inland zones, which of the following is the second highest?

(A) South zone for Bharat Airways
(B) North zone for FUT Airways
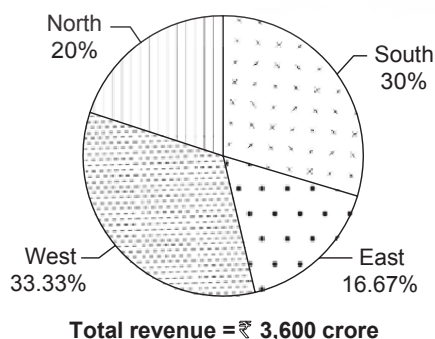(C) West zone for Lahiri Airways
(D) North zone for Bharat Airways

21. If in the next year, the markets in the East, West, North and South zones increased by 10%, 20%, 10% and 30%, respectively and Bharat Airways captures half of the increase in the market in each of the respective zones, then by approximately what percentage does the total revenue of Bharat Airways increased when compared to that of the previous year?
 (A) 15%
 (B) 18%
 (C) 21%
 (D) Cannot be determined

22. Which of the following is not true?
 (A) The revenue generated from the North zone for Bharat Airways is equal to the revenue generated for Lahiri Airways from both North and South zones put together.
 (B) For FUT Airways, the revenue generated from the North zone is 50% more than the revenue generated from the East and South zones together.
 (C) The revenue generated from the South zone for Bharat Airways is 33.3% more than the revenue generated from the North zone for Bharat Airways.
 (D) The revenue generated from the International zone for FUT Airways is more than the total revenue generated by Lahiri Airways.

23. If in the North zone, these three airways form 20% of the total market, then the total market (in ₹ crore) in the North zone is
 (A) 19,080
 (B) 76,920
 (C) 1,908
 (D) 7,69

Directions for questions 24 to 29: These questions are based on the pie charts given below.

Match-I

99

Match-II

4's 5%
3's 20%
6's 5%
2's 30%
1's 40%

Match-III

6's 6%
4's 12%
1's 35%
3's 27%
2's 20%
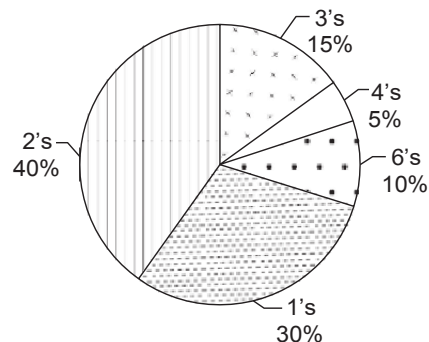
A certain cricket team played three matches. In each match, the team faced a certain total number of balls, the runs scored off each ball being only in 1's, 2's, 3's, 4's or 6's. However, it is possible that the team scored no runs off some of the balls that it faced.

The pie charts given above shows the percentage distribution of the total number of runs scored by the team in the three matches. For example, 20% of the total runs scored by the team in Match-III were scored in 2s.

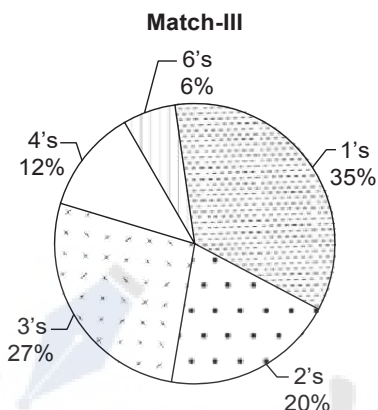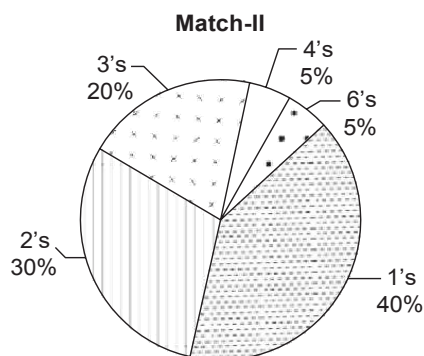Further, the total number of runs scored by the team in each of the three matches are not known exactly, except for the ranges in which each of the totals lie. The following table gives this information.

Match	Total Number of Runs(T)
I	O < T < 300
II	100 < T < 300
III	100 < T < 300

24. Find the number of balls off each of which the team scored 4 runs in Match-I.
(A) 12 (B) 4
(C) 3 (D) 2

25. If every six balls that the team faces comprise an 'over', what is the total number of overs faced by the team in Match-II?
(A) 25½ (B) 37⅔
(C) 45⅓ (D) Cannot be determined

26. What is the total number of runs scored by the team in Match-II?
(A) 248 (B) 256
(C) 280 (D) None of these

27. What is minimum number of runs scored by the team through 1s in any of the three matches?
(A) 72 (B) 70
(C) 144 (D) 140

28. Find the total number of runs scored by the team through 6s in Match-III.
(A) 12 (B) 18
(C) 24 (D) 6

29. If, in each of the three matches the team faced a total of exactly 300 balls, then the number of balls off which no runs were scored by the team was the least for
(A) Match-I (B) Match-II
(C) Match-III (D) Cannot be determined

Directions for questions 30 to 33: These questions are based on the pie charts and table given below. The two pie charts I and II give the distribution of three lakh graduates course-wise and state-wise.

Chart-I

B.Ed 6%
BCA 5%
BA 10%
BBA 9%
B.Com 15%
B.Tech 30%
B.Sc 25%

Chart-II

Rajasthan 6%
Karnataka 10%
Tamil Nadu 11%
Kerala 13%
Maharashtra 12%
A.P. 10%
Gujarat 8%
M.P. 15%
U.P. 7%
Bihar 8%
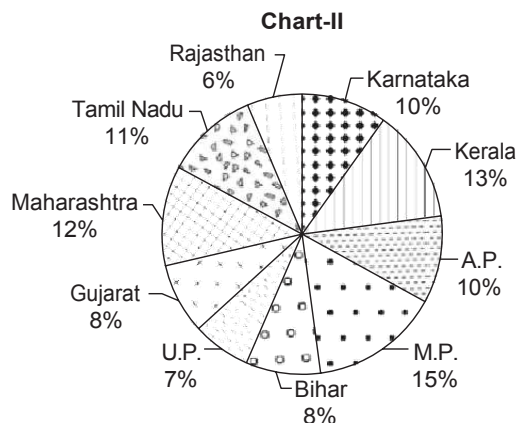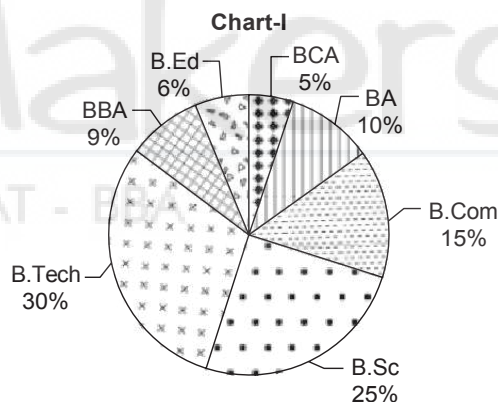
The table below gives the ratio of the number of males and females among the three lakh graduates in the different states.

100

State	Male : Females
A.P.	5 : 7
M.P.	8 : 7
Bihar	5 : 3
U.P.	11 : 10
Gujarat	2 : 3
Maharashtra	11 : 7
Tamil Nadu	13 : 9
Rajasthan	2 : 1
Karnataka	3 : 2
Kerala	6 : 7

30. In which state was the number of male graduates the highest?
(A) M.P. (B) Maharashtra
(C) Tamil Nadu (D) Bihar

31. Find the total number of female graduates in the four states with the highest number of total graduates.
(A) 6950 (B) 69500
(C) 22500 (D) 74500

32. Which of the following statements is true?
(A) The difference in the number of B.Com. and B.Sc. graduates is at least 30,000.
(B) The number of male graduates in U.P. is more than the number of female graduates in M.P.
(C) The number of BBA graduates is more than the number of male graduates from Karnataka and Kerala put together.
(D) More than one of the above.

33. In how many states, is the number of male graduates not more than 5000?
(A) 10 (B) 9
(C) 0 (D) 1

Directions for questions 34 to 37: Answer these questions based on the information given below.

The performance of 6 batsmen, namely A, B, C, D, E and F playing for a team in a recently conducted cricket series is given in the following pie charts. The series consisted of five one-day matches and all the six batsmen played in each one of them. The first pie chart gives the percentage distribution of total runs scored by the team in those five matches whereas the second pie chart gives the percentage distribution of the total runs scored by each batsman in the entire series. It is also known that the sum of the individual scores of the six batsmen in the entire series constitutes 90% of the total runs scored by the team.

Distribution of runs scored in the five matches
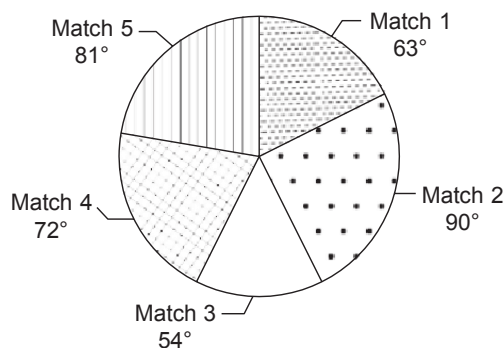
Distribution of individual scores in the five matches together
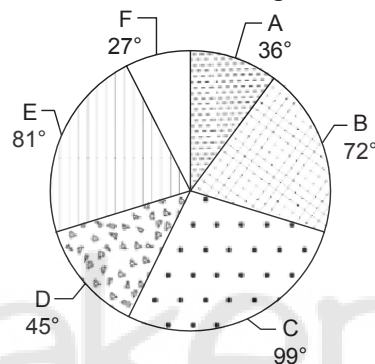
34. If C scored at least 20% of the total runs scored by the team in each of the 5 matches, then the runs scored by C in a match as a percentage of the total runs scored in that match is at most
(A) 43.75% (B) 36.66%
(C) 41.11% (D) 51.66%

35. If the difference between the total runs scored in Match 2 and the total runs scored by C in the entire series is 4, then what is the total runs scored by A and D together, in the series?
(A) 162 runs (B) 243 runs
(C) 324 runs (D) 360 runs

36. If each of the 6 batsmen contributed at least 16% of the total runs scored in Match 2, then the total runs scored by one of the 6 batsmen in Match 2 as a percentage of the total runs scored by that batsmen in the entire series is at most
(A) 44.44% (B) 74.07%
(C) 51.26% (D) 83.33%

37. If the minimum runs scored by the team in any single match in the given series was 180, then what is the total runs scored by B in the entire series?
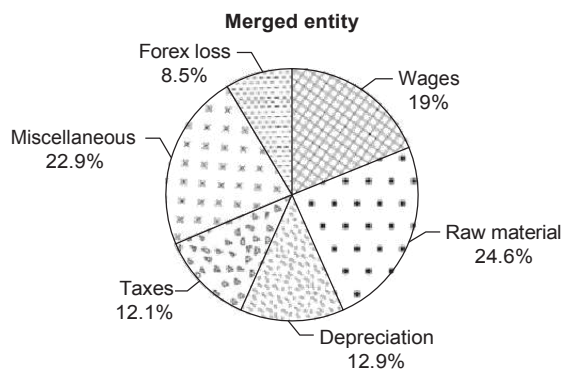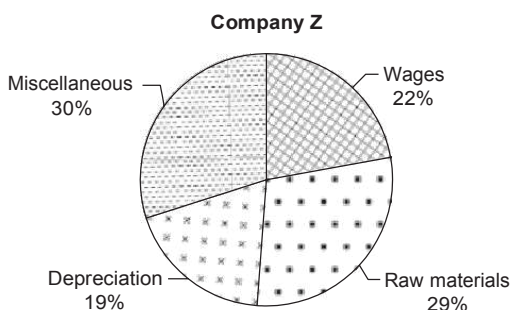(A) 216 runs (B) 144 runs
(C) 288 runs (D) 360 runs

Directions for questions 38 to 41: Answer these questions based on the information given below.

The Agenta group was a diversified business house which had three companies X, Y and Z. As part of restructuring, the group decided to merge all the three companies. The following pie charts give the breakup of expenses of each company and that of the merged entity in the year 2007.

Company X

- Miscellaneous 23%
- Wages 22%
- Taxes 17%
- Raw material 26%
- Depreciation 12%

Company Y

- Miscellaneous 20%
- Wages 16%
- Forex loss 17%
- Raw materials 22%
- Taxes 14%
- Depreciation 11%

Company Z

- Miscellaneous 30%
- Wages 22%
- Depreciation 19%
- Raw materials 29%

Merged entity

- Forex loss 8.5%
- Wages 19%
- Miscellaneous 22.9%
- Raw material 24.6%
- Taxes 12.1%
- Depreciation 12.9%
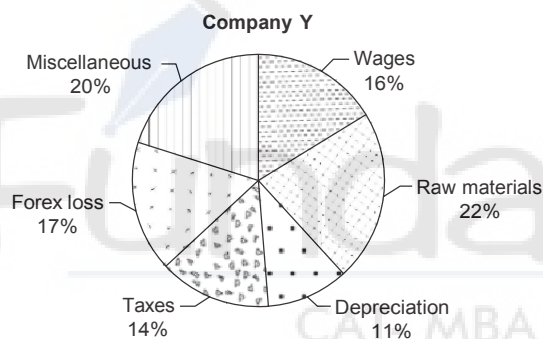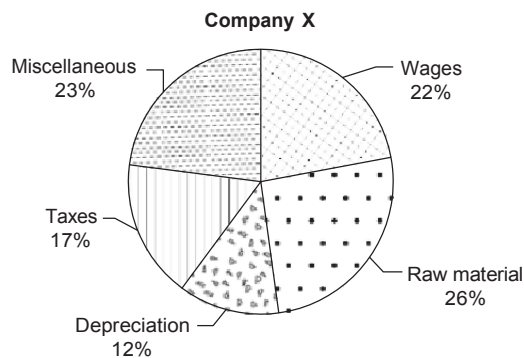
38. What is the ratio of the total expenses of companies X and Y?
- (A) 3 : 2
- (B) 2 : 5
- (C) 3 : 5
- (D) 2 : 3

39. The forex loses of company Y was what percentage of the depreciation expenses of company Z?
- (A) 152%
- (B) 186%
- (C) 205%
- (D) 223%

40. The wage bill of which of the three companies was the highest?
- (A) X
- (B) Y
- (C) Z
- (D) Both X and Y

41. The expenses of company Z was under quoted by 20% because the taxes paid by it was not included in the given diagrams. If this figure is also included, then the taxes paid would account for what percentage of the expenses of the merged entity?
- (A) 23.2%
- (B) 21.5%
- (C) 18.6%
- (D) None of these

Directions for questions 42 to 46: Answer these questions based on the information given below.

A company named XYZ Ltd. which sells five different products, such as A, B, C, D and E gave misleading information to the press regarding some of its sales. The company exaggerated the sales of its product D in the Western region, while stating sales of all other products in all other regions accurately.

Product-wise distribution of total sales of XYZ Ltd.

- A 18.0%
- E 30.0%
- B 12.0%
- D 15.0%
- C 25.0%
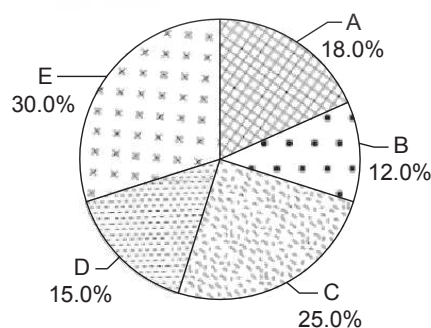
Region-wise distribution of the sales of product D by XYZ Ltd.
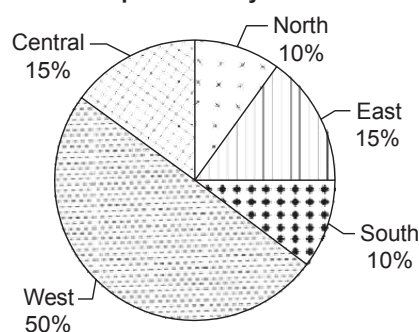
- Central 15%
- North 10%
- East 15%
- South 10%
- West 50%

Region-wise distribution of the total sales of XYZ Ltd.

Central 15%
North 30%
West 25%
East 10%
South 20%

Product-wise distribution of the sales of XYZ Ltd., in the Western region

A 15%
E 20%
B 25%
D 30%
C 10%
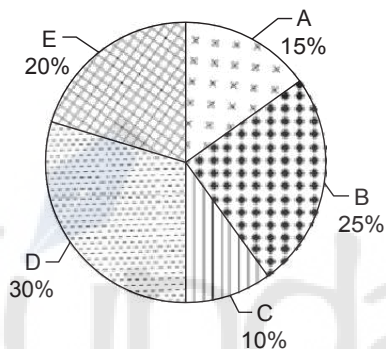
The above pie charts are drawn by Sunil, a business journalist, who is unaware of the above-mentioned discrepancy. Another set of four similar pie charts, (not shown here), representing the distribution of the same quantities mentioned above, are drawn by Anand, an employee of the company XYZ Ltd., who is aware of all the figures accurately and has drawn them accordingly.

42. If it is known that XYZ Ltd., exaggerated the value of the sales of product D in the Western region by 25%, then considering the pie charts drawn by Anand, what is the ratio of the total sales of product C and that of product E?
(A) 5 : 6
(B) 57 : 50
(C) 2 : 3
(D) 3 : 5

43. According to Sunil, what percentage of the total sales in the Northern region are the sales of product D in that region?
(A) 5%
(B) 8⅓%
(C) 12.5%
(D) 15%

44. According to the pie charts drawn by Anand, if the sales of product E in the Western region represent 25% of the total sales in the Western region, then what is the percentage share of the sales in the Northern region, in the total sales of the company?
(A) 28.8%
(B) 30.2%
(C) 34.8%
(D) None of these

45. If the actual total sales of the company is `14,000 crore and the actual sales of product B is `1800 crore, then by how many times are the sales of D in the Western region stated more than the actual?
(A) 7 times
(B) 6 times
(C) 8 times
(D) 9 times

46. If the actual sales of product A in the Western region are known, which of the following additional data (considered independently along with the above information) is necessary and sufficient to find the actual total sales of product D?
 I. The actual sales of product D in the Southern region.
 II. The actual total sales in the Northern region.
 III. The sum of the actual sales of product E and product D in the Western region.
 IV. Difference between the actual total sales in the Northern and the Western regions.
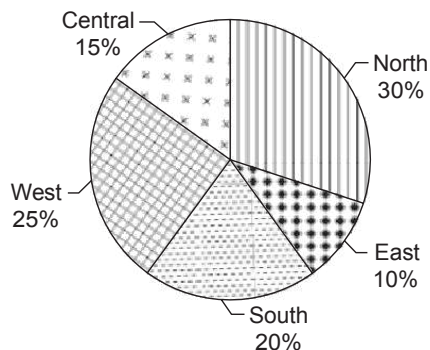(A) Only I
(B) Only I or Only III
(C) Only I or Only IV
(D) Only III or Only IV

Directions for questions 47 to 50: Answer the questions based on the information given below.

Sales (by volume)

F 13%
A 12%
B 15%
E 23%
C 19%
D 18%

Sales (by value)

F 10%
E 23%
A 15%
B 11%
D 23%
C 18%
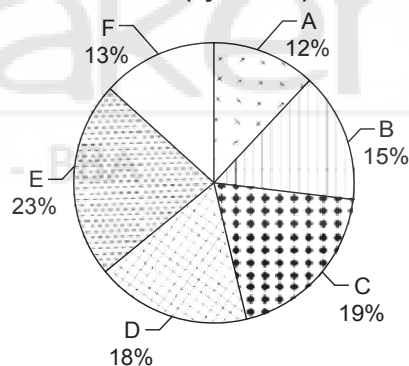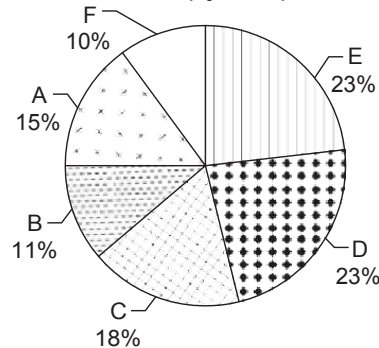
47. For which product is the selling price per unit the highest?
(A) A
(B) B
(C) C
(D) D

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48. For how many of the given products is the selling price per unit more than the average selling price of all the six units?
(A) 1   (B) 2
(C) 3   (D) 4

Directions for questions 49 and 50: The break-up of costs is exactly the same as the breakup of sales (by volume).

49. If the company made an overall profit, then at most how many products did it incur a loss?

(A) 3   (B) 4
(C) 2   (D) 5

50. If the company did not make a loss on any of the six products, then the overall profit percentage is at least _____.

(A) 25%   (B) 33.33%
(C) 40%   (D) None of these

EXERCISE-3

Directions for questions 1 to 4: Answer these questions on the basis of the information given below.

Break-up production cost of six products-P through U

Total cost = ₹ 25 crore
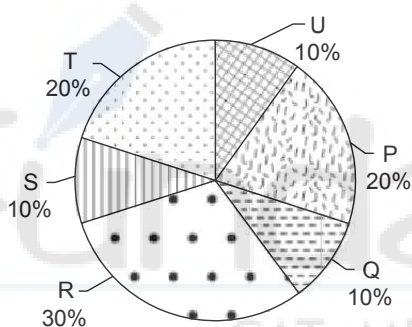
Each of the six products is produced in two qualities, grade A and grade B. The ratio of the units produced for each product and the profit percentages is given in the table below.

	Ratio of production		Profit percentage	
Product	**Grade A**	**Grade B**	**Grade A**	**Grade B**
P	6	5	20	15
Q	1	2	30	15
R	3	4	20	25
S	4	5	15	20
T	2	3	20	25
U	1	1	10	15

Assume that for each item, the cost of production of grade A and grade B items are in the ratio 5 : 4.

1. What is the total profit made on product R (in ₹ lakh)?
(A) 135   (B) 152
(C) 170   (D) 190

2. For which product is the ratio of total profit to total cost, the highest?
(A) R   (B) T
(C) P   (D) S

3. What is the total approximate cost (in ₹ cr) incurred in producing items P, R and S of grade A?
(A) 7.9   (B) 8.6
(C) 9.2   (D) 7.1

4. For how many of the given companies is the profit obtained on items of grade A more than that obtained on items of grade B?
(A) 1   (B) 2
(C) 3   (D) 4

Directions for questions 5 to 8: These questions are based on the following data.

The first pie chart exhibits the breakup of students in various classes of a school and the second pie chart gives the breakup of boys who were selected for a scholarship. The table gives the breakup of students in the school, among those selected for the scholarship, according to the class they study.

Total = 1260

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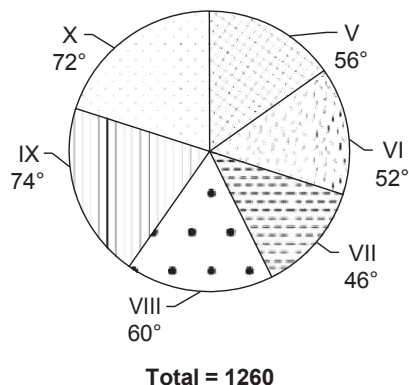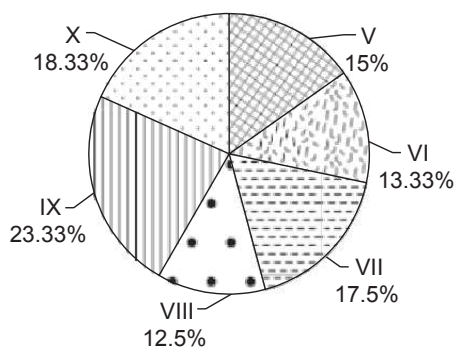
Total = 120

Class	Percentage of Students Selected
V	14.6%
VI	13.2%
VII	15.6%
VIII	19.5%
XI	18.5%
X	18.5%
Total = 205	

5. What is the number of girls in Class VII who were selected for the scholarship?
(A) 14   (B) 12
(C) 11   (D) 10

6. What percentage of students in Class VIII was selected for the scholarship?
(A) 22   (B) 19
(C) 17   (D) 15

7. In which class was the percentage of students selected for the scholarship, the highest?
(A) Class VII
(B) Class VIII
(C) Class V
(D) None of these

8. In how many classes was the number of boys selected for the scholarship at least 50% more than the number of girls selected from the class?
(A) 0   (B) 1
(C) 2   (D) 3

Directions for questions 9 to 12: Answer these questions on the basis of the information given below.

The following pie charts give the break-up of the number of products (in '000) sold by a company across two years 2015 and 2016. The first table show the price/unit of each product in 2015 and the second table show the percentage increase in the price/unit of each product from 2015 to 2016.
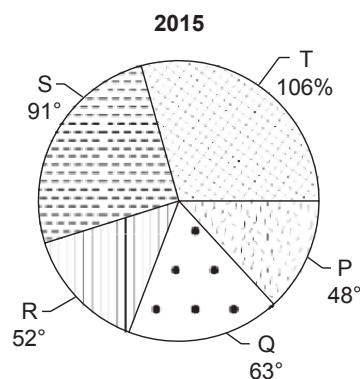
2015

Total = 79200 units
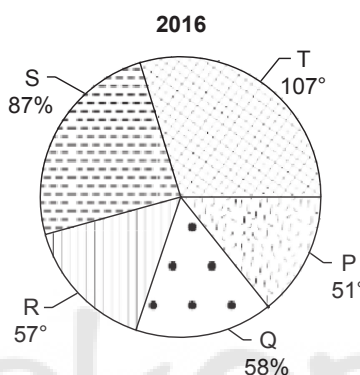
2016

Total = 86400 units

Price/unit in 2015		Percentage increase in 2016	
Product	Price	Product	Percentage increase
P	132	P	8
Q	167	Q	14
R	102	R	2
S	86	S	0
T	235	T	7

9. What was the sales (by value) of P in 2016?

10. What was the sales (by value) of the five products together in 2015 (in `cr)?

11. How many of the given five products had a more than 10% increase in the sales (by value) from 2015 to 2016?

12. What is the approximate increase in the sales (by value) of the five products together from 2015 to 2016?

Directions for questions 13 to 16: Answer these questions on the basis of the information given below.

Ratan Lal, a businessman, decided to divide his assets among his three sons. The following pie charts give the breakup of the assets of Ratan Lal and the breakup of the assets received by the three sons. It is known that Ratan Lal divided his entire assets among the three sons.

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Assets of Ratan Lal

Cash 8%
Automobiles 12%
FDS 6%
Bonds 11%
Gold 14%%
Property 28%
Equity 21%%

Share of first son

FDs 8.33%
Property 20%
Automobiles 10%
Cash 15%
Equity 30%
Bonds 16.67%

Share of second son

FDs 8.33%
Equity 40%
Cash 5%
Automobiles 10%
Property 36.67%

Share of third son

Cash 5%
Bonds 15%
Automobiles 15%
FDs 2.5%
Gold 35%
Property 27.5%
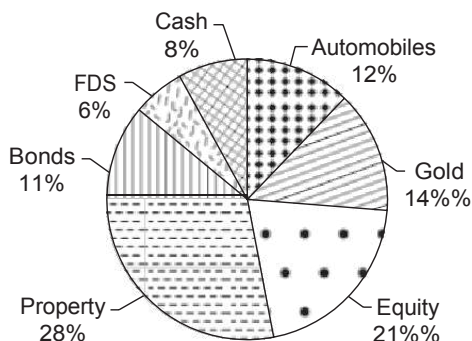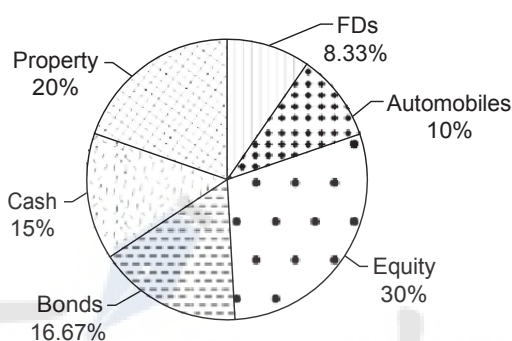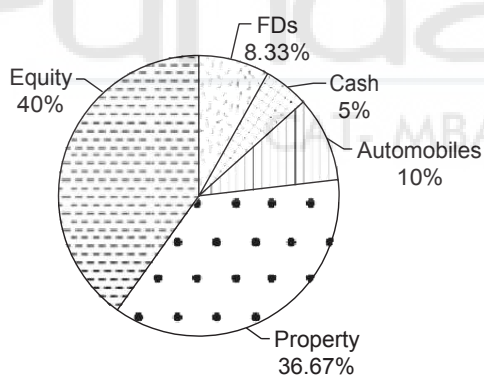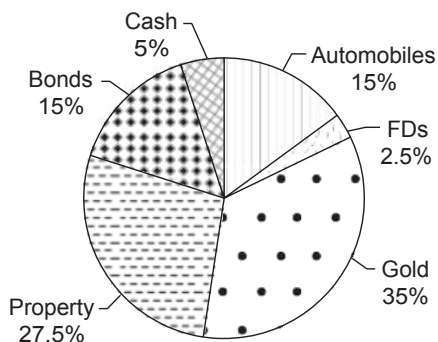
13. What percentage of his assets did Ratan Lal give his second son?

14. If the value of equity given to the first son was `5.25 crore, what was the value of assets (in `cr) given to the second son?

15. If the total assets of Ratan Lal were valued at `48 crore, what was the value of FDs (in `cr) received by the second son?

16. If the cash received by the first and the third sons together was `3.9 crore, what was the value of equity (in `cr) with Ratan Lal?

Directions for questions 17 to 20: Answer these questions on the basis of the information given below.

The ages of six children, namely Prakash, Qureshi, Rahul, Sunil, Thomas and Urvashi was 7, 8, 9, 10, 11 and 12, respectively. One day they went shopping, each carrying their pocket money with them. Before shopping it was found that the money with each of them was in the same ratio as their ages with Prakash having the lowest amount, Qureshi the next highest and so on till Urvashi who had the highest. Each of then spent a different amount while shopping. When they returned it was found that the amount left with Qureshi, Rahul, Sunil, Thomas and Urvashi were in the ratio of 5 : 4 : 3 : 2 : 1.

The following is the breakup of the total amount spent by these five children:

Qureshi 7.33%
Urvashi 32.67%
Rahul 13.67%
Sunil 20%
Thomas 26.33%
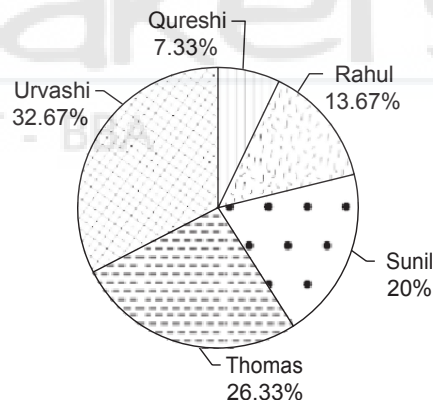
After Prakash came back, it was found that he had double the amount left with Sunil as he had spent only 15 rupees while shopping which was only 5% of what Sunil had spent.

17. What was the total amount spent by the children?

18. What was the maximum difference between the amount with any two children before they went shopping?

19. What percentage of the money with him did Sunil spent on shopping (approximated to the closest integer)?

20. How much more did Thomas spend on shopping than Sunil?

ANSWER KEYS

Exercise-1

1. (C)	10. 7,20,000	19. (D)	28. (A)	37. (C)	46. (D)
2. (A)	11. (B)	20. (B)	29. (C)	38. (A)	47. (D)
3. (D)	12. (D)	21. (D)	30. (A)	39. (C)	48. (B)
4. (B)	13. (A)	22. (C)	31. (D)	40. (B)	49. (C)
5. (A)	14. (D)	23. (A)	32. (B)	41. (C)	50. (B)
6. 2,70,000	15. (B)	24. (C)	33. (C)	42. (D)	
7. 1	16. (B)	25. (B)	34. (A)	43. (C)	
8. 8 : 9	17. (B)	26. (B)	35. (B)	44. (B)	
9. 40	18. (B)	27. (D)	36. (C)	45. (C)	

Exercise-2

1. (C)	10. (C)	19. (C)	28. (A)	37. (A)	46. (D)
2. (A)	11. (C)	20. (D)	29. (B)	38. (C)	47. (D)
3. (D)	12. (D)	21. (D)	30. (A)	39. (D)	48. (B)
4. (C)	13. (A)	22. (C)	31. (B)	40. (B)	49. (A)
5. (A)	14. (C)	23. (A)	32. (A)	41. (D)	50. (D)
6. (D)	15. (A)	24. (C)	33. (C)	42. (A)	
7. (C)	16. (B)	25. (D)	34. (D)	43. (A)	
8. (D)	17. (A)	26. (D)	35. (C)	44. (D)	
9. (B)	18. (C)	27. (B)	36. (B)	45. (C)	

Exercise-3

1. (C)	5. (C)	9. 175	13. 30	17. 1515
2. (B)	6. (B)	10. 1208	14. 17.5 crore	18. 225
3. (A)	7. (A)	11. 4	15. 1.2 crore	19. 67
4. (B)	8. (D)	12. 200	16. 12.6 crore	20. 95

SOLUTIONS

EXERCISE-1

1. Imports of pharmaceutical products = 40% of 64.8°
= 25.92°.
Given 360° ----36 billion dollars
25.92°   ----- ?
? = $\dfrac{25.92 \times 36}{360}$ = 2.592 billion dollars
∴ Total internal production = 8 × 2.592
= 20.736 billion dollars.

2. Angle made by bulk goods, paper and allied products is 147.6°.
360°----- 36 billion dollars
147.6° ------ ?
Clearly 1° ---- 0.1 billion dollars.
∴ 147.6° will be = 147.6 × 0.1 = 14.76 billon dollars.

3. Total value of exports of textile industry is 20% of 24 = 4.8 billion dollars.
Total value of imports of textile industry = ½ × 64.8
= 32.4° = 32.4 × 0.1 = 3.24 billion dollars.
∴ Net exports = 4.8 – 3.24 = 1.56 billion dollars.

4. India's fuel bill = ¼ × 36 = $9 billion.
New fuel bill = $(9 – 2) = $7 billion.
Capital good's bill = $\dfrac{39.6 \times 36}{360}$ = $3.96 billion.
∴ Ratio of imports of new fuel bill to the capital goods bill = 7 : 3.96 ≅ 7 : 4.

5. Fuel bill was 90° in 1999-2000 and has increased by 40%. Hence, the new angle is 90° + 36° = 126°. Since all the other commodities' bills have not changed, the total angle for these remains = 270°, i.e., the total angle is 396°. Angle for capital goods is 39.6°. Hence, for a new pie chart, the angle of capital goods is $\dfrac{39.6 \times 36}{360}$ = 36°.

6. Given angle representing 30° is showing 60,000. Difference between the angles showing viewership of Set Max and Ten Sports is 150° – 15° = 135°
∴The number equidistant to 135° = $\dfrac{135 \times 60,000}{30}$
= 2,70,000

7. Angle showing 20% viewership = $\dfrac{20}{100}$ × 360 = 72°

Only Set Max has shown angle more than 72°.

8. Viewership of DD Sports during second half of February

= 60 × $\dfrac{2}{3}$ = 40°

∴ Required ratio = 40° : 45° = 8 : 9

9. Given, 80% × (Actual value of DD sports) = 60°

∴ Actual value of DD sports = 75°

The total share is 360 + (75 – 60) = 375

% Share of Set Max = $\dfrac{150}{375}$ ×100 = 40%

10. Given 45° = 90,000

360° = ?

? = $\dfrac{360 \times 90{,}000}{45}$ = 7,20,000

11. Total value of kerosene consumed

= 60,000 × $\dfrac{12}{100}$ = 7200 crore

Total kerosene consumed by India (Quantity) = 150 lakh kilolitres.

∴ Value of 1 litre of kerosene = $\dfrac{7{,}200 \times 100 \,(\text{in lakh})}{150 \times 1000}$

Value of 1 litre of kerosene = `4.8

12. The graph here shows the consumption of electricity by India but does not state anything about the production of electricity. Hence, the amount of electricity generated in India cannot be estimated.

13. Price of 1 barrel of crude oil imported by India

= $\dfrac{60{,}000 \times 0.3}{25}$ (250 million = 2500 lacs = 25 crore)

∴ Price of 1 barrel of crude oil imported by India = `720.

Price of 1 barrel of oil that Oman sells to India = `720.

Price of crude oil in Oman (domestic) is 25% more than `720 = 900.

14. Current domestic production of crude oil

= 250 × $\dfrac{25}{100}$ 62.5 million barrels

16% of TRR = 62.5 million barrels

∴ TRR = 62.5 × $\dfrac{100}{16}$ 390.625 million barrels

We know that 100% more implies twice.

Similarly, 200% more implies thrice.

In the scene every 4000% more implies 41 times.

∴ TER are 41 times the TRR.

∴ TER = 41 × 390.655 ᴍ 16000 million barrels.

15. Total value of crude oil consumed in India = 60,000 × 0.3 = 18,000 crore.

Domestic production = 250 × 0.25 = 62.5 million barrels

Crude oil from sources other than domestic = 187.5 million barrels

Assuming 1 barrel from other sources costs ` X, then the price of 1 barrel of domestic crude costs = $\dfrac{3X}{4}$

∴ 187.5 X + 62.5 × $\dfrac{3X}{4}$ = 18000

234.375 X = 18000

X = $\dfrac{18{,}000 \times 100 \,(\text{in lakh})}{234.375 \times 10 \,(\text{in lakh})}$ X = 768

Solutions for questions 16 to 19: The food grains production in the two years are as follows:

State	1999–2000 (Million tons)	2000–2001 (Million tons)
Punjab	90	72
West Bengal	54	30
Maharashtra	36	24
A.P.	36	48
Tamil Nadu	14.4	30
Kerala	28.8	15
U.P.	21.6	12
Rest of India	61.2	45
Karnataka	18	24

16. The percentage increase in the food grain production for A.P. is

$$\dfrac{16\% \text{ of } 300 - 12\% \text{ of } 360}{12\% \text{ of } 360} \times 100$$

$$= \left(\dfrac{16\% \text{ of } 300}{12\% \text{ of } 3600} - 1 \right) \times 100$$

Now, 300/360 will be common for all the states; we need not calculate the entire percentage. It would be sufficient if we observe the percentage increase in the percentages of the respective states.

Therefore, for A.P. 12% to 16% which is <100%,

for T.N. 4% to 10% which is >100%,

for Kerala 8% to 5% which is a decrease and

for Karnataka 5% to 8% which is <100%.

17. Share of Maharashtra in the total production of food grains in 1999–2000 and 2000–01 is 10% of 360, i.e., 36 and 8% of 300, i.e., 24 respectively.

∴ Required percentage = $\dfrac{32 - 20}{30} \times 100$

= 37.5%

18. Rice production in West Bengal in
1999–00 = ½ × 15% of 360 = 27 million tons.
2000–01 = ½ × 10% of 300 = 15 million tons.
\ Revenue from the sale of rice in 1999–2000 and that in 2000–01 is 27 × 11X = 297X and
15 × 12X = 180X.
\ There is a decrease of 120 from 297.

Percentage loss = $\frac{120}{297}$ × 100 ≅ 40%

19. We can find the production of the food grains of A.P. and Karnataka for the year 2001–02 but the total food grain production in 2001–02 cannot be found.

Solutions for questions 20 to 23: The following table gives the supply and demand of blood for different blood groups.

Blood group	Supply (litres)	Demand (litres)
A	1000	2400
B	800	2400
AB	400	9600
O	1800	1600

20. Supply of various blood groups (in '00 litres) is as follows:

A	18.75%	6.25%
B	16%	4%
O	22.5%	22.5%
AB	6.66%	3.34%

\ Blood group AB negative is having the least supply.

21. As demand percentage of AB blood group remained the same, it can be concluded that as the demand doubles, the demand for the other blood groups increases.

22. Supply of blood group O⁺ is

$\frac{3}{5}$ × $\frac{45}{100}$ × 4,000 = 1080 litres and the demand of blood

group O⁺ is $\frac{3}{8}$ × $\frac{10}{100}$ × 16000 = 600 litres.

\ Excess supply of O⁺ blood group is 1080 – 600 = 480 litres.

23. The total demand of O and A blood groups is 10% of 16000 litres, i.e., 1600 litres and 15% of 16000 litres, i.e., 2400 litres.
As a person having blood group O can donate 2 litres,

the number of persons required is $\frac{1,600}{2}$ = 800 and that

of A blood group is $\frac{2,400}{1}$ = 2400.

\ Total persons required are 800 + 2400 = 3200.

24. Difference in the number of warheads possessed by Russia and USA is 90 – 72 = 18° → A

Difference in the number of warheads possessed by India and Israel = 18° − 9° = 9° → B
A is 2 times B.

25. Number of nuclear warheads possessed by China

= $\frac{80,000 × 36}{360}$ = 8000

Cost incurred by China in building and maintaining

these warheads = $\frac{2500 × 14}{100}$ = \$350 million

\ Average cost incurred on one warhead

= $\frac{350}{8000}$ = .04375 Mn

.04375 × 1000,000 = 43,750 \$

26. Number of warheads possessed by Russia

= $\frac{80000 × 90}{360}$ = 20000

Expenditure incurred by Russia = $\frac{2500 × 30}{100}$ = 750

Average cost per warhead for Russia = $\frac{750}{20000}$ × 100000

= 3750 \$

Number of warheads possessed by USA

= $\frac{80000 × 72}{360}$ = 16000

Expenditure incurred by USA = $\frac{2500 × 25}{100}$ = 625 million

Average cost per warhead for USA = $\frac{625 × 100000}{16000}$

= 3906.25\$

\ Difference = 3906.25 − 3750 = \$1562.5

27. Warhead of 'Others' = 1000 kg
Warhead of other countries = 2000 kg

Number of warheads of 'Others' = $\frac{80000 × 45}{360}$ = 10000

\ Total weight = 10000 × 1000 = 10000 tons.
Number of warheads possessed by other countries = 70000.
\ Total weight = 70000 × 2000 = 1,40,000 tons.
Weight of all warheads put together = 1,50,000 tons.

28. Let the total number of warheads with all countries be 360.
The reduction by Russia = 40% of 90 = 36
That by USA = 30% of 72 = 21.6
That by UK and China put together = 20% of (36 + 36)
= 14.4
That by the other countries = 10% of (9 + 18 + 54 + 45)
= 12.6
Total reduction = 84.6

\ The reduced number of warheads = 360 – 84.6 = 275.4

360 → 80,000

275.4 → ?

$= \dfrac{275.4}{360} \times 80{,}000 = 61{,}200$

29. Students from China and India = 20 + 24 = 44% → **(A)**
Students from all countries in the graph except 'others' category = 46% → **(B)**

(A) as a percentage of (B) = $\dfrac{44}{46} \times 100 = 95.65\%$

30. The country with the maximum representation in 2000 is India.

Number of students from India = $\dfrac{80{,}000 \times 24}{100} = 19200$

Students from India taking up Management

$= \dfrac{19200 \times 135}{360} = 7200$

31. Portugal + Spain = 20% = $\dfrac{80000 \times 20}{100} = 16000$

16000 is 25% of domestic students pursuing MS in USA.
\ Domestic students pursuing MS in USA = 64000

32. Students of Asian Countries comprised
$= 24 + 20 + 7 + 6 + 4 = 61\%$

Students of Asian Countries comprised

$= \dfrac{80000 \times 61}{100} = 48{,}800$

\ 48800 as a percentage of 3,60,000 is

$\dfrac{48800}{360000} \times 100 = 13.5\%$

33. Indian students pursuing Engineering or Management

$= 24\% \text{ of } 80{,}000 \times \dfrac{270}{360}$ → **(A)**

Chinese students pursuing other courses

$= 20\% \text{ of } 80{,}000 \times \dfrac{90}{360}$ → **(B)**

(A) as percentage of (B) = 360%

Solutions for questions 34 to 37: As the rate of boys to girls is given as 2 : 5, assume that the number of boys is 200 and the number of girls is 500.
The values can be tabled as follows:

	Boys	**Girls**	**Total**
Arts	334	50	84
Science	34	71	105
Medicine	10	39	49
Engineering	48	78	126
Commerce	22	69	91
Others	52	193	245

34. Gender ratio of girls doing Medicine = $-\dfrac{39}{10} = 3.9$.

35. Only in Arts and Engineering is the number of boys at least half of the number of girls.

36. As the number of girls doing Medicine is $\dfrac{4056}{39} = 104$

times the value calculated in the table, the number of boys would be 104 × 200 = 20,800.

37. The number of boys is the second highest in Engineering. The number of girls in Engineering = 78
The number of girls is the highest in 'other'.
The number of boys in 'other' = 52
The required ratio = 78 : 52 = 3 : 2.

Solutions for questions 38 to 41: The value of exports of each product to Europe, Germany and the rest of Europe is given in the table below.

Europe		Germany		Rest of Europe	
Product	**Export value**	**Product**	**Export value**	**Product**	**Export value**
A	16.5	A	10.0	A	6.5
B	22	B	8.0	B	14.0
C	18.7	C	6.0	C	12.7
D	19.8	D	8.0	D	11.8
E	13.2	E	6.0	E	7.2
F	14.3	F	4.0	F	10.3
G	5.5			G	5.5

38. The percentage share is highest for the product A.

39. Exports of product A to rest of Europe (in million dollars) = $\dfrac{35}{100} \times 6.5 = 2.275$.

40. For products A, D and E, the value of exports to Germany was more than two thirds of that to the 'rest of Europe'.

41. Exports of product B to the rest of Europe = 14.0
It is more than the exports of products E and G to the whole of Europe.

42. The percentage of females in the total is

$12 \times \dfrac{20}{100} + 18 \times \dfrac{20}{100} + 32 \times \dfrac{45}{100} + 8$

$\times \dfrac{60}{100} + 14 \times \dfrac{40}{100} + 16 \times \dfrac{15}{100}$

$= 2.4 + 3.6 + 14.4 + 4.8 + 56 + 2.4 = 33.2$

Average number of female engineers per sector

$= \dfrac{33.2}{100} \times \dfrac{80{,}500}{6} = 4454$

43. Male engineers in the banking sector = $\dfrac{60}{100}$ × 14 = 8.4%

Female engineers in the IT sector = 12 × $\dfrac{20}{100}$ = 2.4%

The required percentage = $\dfrac{8. - 2.4}{2.4}$ × 100 = 250%.

44. The number of female engineers in the gaming sector

currently = 18 × $\dfrac{20}{100}$ = 3.6%

$\dfrac{3.6}{100}$ × 80500 = 2898

As the number of females go up by 4628 – 2898 = 1730

The required percentage = $\dfrac{4454 \times 6 + 1730}{80500 + 1730}$ × 100

= 34.6%.

45. Let the total number of employees be 100.
The difference between the number of male and female engineers would be more in gaming then in IT.
The difference in gaming = 18 × 6 = 10.8
The difference in others = 32 × 1 = 3.2
The difference in education < that in banking.
The difference in banking = 14 × 2 = 2.8
The difference in medical = 16 × 7 = 11.2

The required value = $\dfrac{11.2}{100}$ × 80500 = 9016

46. Since the company has an overall profit of 10%, assume that the cost is `100 and the sales value is `110. The cost and the sales values of the different products are as follows:

Product	Cost	Sales value
A	15	13.2
B	17	16.5
C	20	27.5
D	18	14.3
E	19	23.1
F	11	15.4

We can see that product F had a profit percentage of 40, which is the highest.

47. To find the maximum number of companies, we have to assume that the companies made only a small loss, i.e., both cost and sales value are nearly equal. If we assume both of them to be 100, then

Product	Cost	Sales Value
A	15	12
B	17	15
C	20	25
D	18	13
E	19	21
F	11	14

\ At most three products had a sales value more than the cost.

48. To find the maximum number of products on which there was a loss, we have to assume that the company makes only a small profit. Therefore, on products A, B and D it made a loss.

49. The company has to make a profit on at least products C, E and F to make an overall profit.

50. If the company made a profit on each of the products, then the profit percentage would be the least when the product on which the difference between the percentage share of costs and sales value is the highest, i.e., product D, makes a small profit.
\ If the total cost is `100, then the sales value of product D would be 18 (its cost price) and so the total sales value

would be $\dfrac{18}{13}$ × 100 = 138.5

EXERCISE-2

1. The total sales (by volume) has increased by 5%, so assume that sales in 2014 to be 100 and that in 2015 to be 105.
Sales of D in 2014 = 13% of 100 = 13
Sales of D in 2015 = 15% of 105 = 15.75

\ The required percentage = $\dfrac{2.75}{13}\times100$ = 21.2%. × 100

= 21.2%.

2. Let the total cars sold in 2014 be 100 and those in 2015 be 105, and the selling price of a car sold by B in 2014 be 100 that in 2015 be 108.
Sales (by value) of company B in 2014 = 15 × 100 = 1500
Sales (by value) of company B in 2015 = 14.7 × 108 = 1587.6
\ The required percentage = $\dfrac{87.6}{1500}\times100$ = 5.85% × 100
= 5.85%.

3. Company F would have the maximum percentage increase as it has gone from 5% in 2014 to 8% in 2015 (minimum percentage growth of F would be 68%).

4. Companies C, D and F had a growth in sales by volume greater than 20%.

5. Number of companies which implemented Oracle = 12% of 1000 = 120.
$33^1/_3$% of 120 = 1/3 of 120 = 40
In total, 180 companies cited Robustness as one of the reasons.
\ A maximum of (180 - 40) = 140 companies which implemented either Clarify or Baan could have cited Robustness as a reason.

6. Total number of companies which implemented Talisma/People Soft/Onyx = 140 + 160 + 200 = 500.

User friendliness = 450   Flexibility = 250
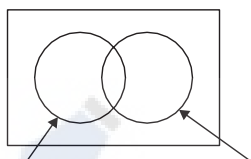
Minimum number of users who could have quoted both the reasons = (450 + 250) – (500) = 200.

7. Minimum number of companies which quoted either low cost or scalability as the reason = 270 = A
Minimum number of companies which implemented Oracle = A – B, where

Low cost = 270   Scability = 100
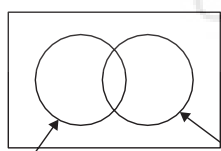
B = Maximum number of companies which implemented Onyx.
Required answer = 270 – 200 = 70.

8. Total number of companies which cited only one reason for implementation = Number of Siebel users + Number of Vartive users = 80 + 60 = 140
Any reason for which the total number of companies < 140, is the required answer.

9. Considering each company quoting one reason as an instance, we have a total of (10% + 18% + 27% + 10% + 45% + 25%) = 135% instance. But there were only 100% of companies. Let, at most x% of the companies quote all the six reasons, that implies (100 – x) of the companies could quote in reasons, where (1 ≤ n < 6). Now, 6x

+ n (100 – x) = 135 (By counting the total number of instances). Now, to maximize x, we must minimize 'n', hence, put n = 1, then 6x + 1 (100 – x) = 135
⇒ 5x = 135 – 100 = 35
⇒ x = 7
\ 7% of 1000, i.e., 70 companies could have quoted six reasons.

10. Total number of students who took up any type of job (with a salary of more than `4 lakh/annum)

$$= \left[\left(\frac{15}{360}\right)\left(\frac{72}{360}\right) + \left(\frac{120}{360}\right)\left(\frac{36}{360}\right)\right](129600)$$

Total number of students who joined a B-school in Central region.

$$= \left(\frac{90}{360}\right)\left(\frac{120}{360}\right)(129600).$$

Required percentage $= \dfrac{(150)(72)+(36)(120)}{(90)(120)}$

$$= \frac{15120}{10800} \times 100 = 140\%.$$

11. Number of students taking up any type of job

$$= \left(\frac{270}{360}\right)(129600)$$

Required angle $= (360)\left\{\dfrac{\left[\left(\frac{84}{360}\right)(150) + \left(\frac{36}{360}\right)(120)\right]}{270}\right\}$

$$= \frac{(84)(150)+(36)(120)}{270}$$
$$= 16° + 46.5° \cong 62.5°.$$

12. Percentage distribution of the candidates (region-wise) for each of the disciplines is not given. Hence, it cannot be determined.

13. Number of students who took up non-IT jobs = $\left(\frac{120}{360}\right)(129600)$

Required number $= \left[\dfrac{(180 + 54 + 36)}{360}\right]\left[\dfrac{120}{360}\right](129600)$

$$= \left(\frac{270}{360}\right)(43200) = 32400.$$

14. 20% of total students graduating nationwide are from Commerce background and all of them join B-schools.
Number of students joining B-schools $= \dfrac{90}{360} = 25\%$ of

total students (T) graduating nationwide.
⇒ At the most 5% of T could be engineers.

⇒ Now students joining B-schools in the Central region

$$= \frac{120}{360} \times \frac{90}{360}(T) = \frac{1}{12} \times (T)$$

Since $\frac{1}{12} \times (T) > 5\%$ of (T)

at least $\left|\left|\frac{1}{12} - 0.05\right|\right| \times (T)$ students are from non-engineering disciplines, i.e., $\frac{1}{30} \times T = 4320$.

Solutions for questions 15 to 18: Let us tabulate the production cost and sales of different companies.

Company	Variety I	Variety II	Variety III	Variety I	Variety II	Variety III
	Production cost			Sales		
A	4 × 900	5 × 900	7 × 900	1.45 × 3600	1.45 × 4500	1.35 × 6300
B	9 × 900	15 × 900	6 × 900	1.33 × 8100	1.4 × 10500	1.48 × 5400
C	6 × 3 × 900	2 × 3 × 900	3 × 3 × 900	1.34 × 16200	1.38 × 5400	1.42 × 8100
D	7 × 900	5 × 900	2 × 900	1.35 × 6300	1.32 × 4500	1.46 × 1800
E	6 × 450	3 × 450	5 × 450	1.44 × 6 × 450	1.48 × 3 × 450	1.25 × 5 × 450

Company A's production cost is 16% of the total cost. Thus, cost of 3 varieties = production cost

4K + 5K + 7K = 16% of 90000. K = 900

Sales = $\left|\left|\frac{100 + 45}{100}\right|\right|$ cost = 1.45 cost(I)

Similarly, we can tabulate for A, B, C, D and E.

15. In variety II profit of companies (Sales − cost):
4500 (0.45) = 2025 → A
10500 (0.4) = 4200 → B
6 × 900 (0.38) = 2052 → C
4500 (0.32) = 1440 → D
1350 (0.48) = 648 → E
Maximum profit is for company B.

16. Profit = Profit (I) + Profit (II) + Profit (III)
Profit earned by E
= 0.44 × 6 × 450 + 0.48 × 3 × 450 + 0.25 × 5 × 450
= 1188 + 648 + 562.50
= `2398.50 million

17. Production cost of company C = `29,700
Production cost of company D = `12,600

= $\frac{297 - 126}{126} \times 100$ = 136%

18. Production cost for variety III:
A → 6300
B → 5400
C → 8100
D → 1800
E → 2250

Solutions for questions 19 to 23: The table gives the revenue earned by the three airlines from the four zones (in ` cr)

Zone	Bharat	FUT	Lahiri
North	1800	1296	720
South	1200	432	1080
East	1000	432	600
West	2000	1080	1200
International	0	3960	0
Total	6000	7200	3600

19. Total inland market = 6000 + 45% of 7200 + 3600
= 12840

\ Inland share of FUT Airways = $\frac{45\% \text{ of } 7200}{12840} \cong 25.2\%$.

20. By observing the pie charts, we can say that the revenue generated from the western region for Bharat Airways is the highest. Revenue generated from the South and the North zones for Bharat Airways is `1200 and `1800 crore, respectively, from the North zone for FUT Airways is 18% × 7200 = `1296 crore and from the West zone for Lahiri Airways is 33% × 3600 = `1188 crore.

21. Since it is not mentioned that there are no other airways operating in the inland market, the question cannot be answered.

22. Statement A: Revenue generated from the North zone for Bharat Airways is `1800 and the revenue generated

for Lahiri Airways from the North and the South zones put together is 50% × 3600 = 1800 crore.

∴ Statement A is true.

Statement B: For FUT Airways the revenue generated from North zone is 18% and the South and the East zones together is 12%, i.e., revenue generated in the North zone is 50% more.

Statement C: Revenue generated in South zone is less than the revenue generated in the North zone.

∴ Statement C is not true.

23. Revenue generated in the North zone by Bharat, FUT and Lahiri Airways is 30% × 6000 + 18% × 7200 + 20% × 3600 = 3816

3816 is 20% of the total revenue generated in the North zone.

∴ Revenue generated in the North zone is 19080.

Solutions for questions 24 to 29: Let the number of balls off which 1s, 2s, 3s, 4s and 6s runs are made be a, b, c, d, e, respectively. Let the total runs in the 1st Match be T_1.

$$\frac{3T_1}{10} = a \qquad \frac{5T_1}{100} = 4d$$

$$\frac{4T_1}{10} = 2b \qquad \frac{10T_1}{100} = 6e$$

$$\frac{15T_1}{100} = 3c$$

$$\Rightarrow a = \frac{3T_1}{10} \qquad d = \frac{T_1}{80}$$

$$b = \frac{T_1}{5} \qquad e = \frac{T_1}{60}$$

$$c = \frac{T_1}{20}$$

T_1 = Common multiple of (80, 60, 20, 10 and 5).

Since $T_1 < 300$,

$T_1 = 240$

Similarly, let total runs in 2nd match be T_2.

$$\frac{4T_2}{10} = a \qquad \frac{5T_2}{100} = 4d$$

$$\frac{3T_2}{10} = 2b \qquad \frac{2T_2}{10} = 3c$$

$$\frac{5T_2}{100} = 6e$$

$$\Rightarrow a = \frac{4T_2}{10}, b = \frac{3T_2}{20}, c = \frac{2T_2}{30}, d = \frac{T_2}{80}, e = \frac{T_2}{120}$$

T_2 = Common multiple of (10, 20, 30, 80, 120) = 240

As $100 < T_2 < 300$

For the 3rd match, using similar logic,

T_3 = common multiple of (20, 10, 100, 25)

Number of runs in the 3rd match = Multiple of 100

Since $100 < T_3 < 300$, $T_3 = 200$

24. To find 'd' for 1st match $d = \frac{T_1}{80} = \frac{240}{80} = 3$.

25. Since it is not mentioned that runs were scored off each ball that the team faced, the total number of balls faced cannot be found out.

26. Total number of runs scored in the 2nd match = 240.

27.

Match	Runs (through 1s)
I	$\frac{(3)(240)}{10} = 72$
II	$\frac{(4)(360)}{10} = 144$
III	$\frac{(35)(200)}{(100)} = 70$

28. Total number of runs scored in the IIIrd match = 200

Number of runs through 6s

$$= \left(\frac{6}{100}\right)(200) = 12.$$

29. In Match-I, the total number of balls off which runs were scored = $a + b + c + d + e$

$$= \frac{3 \times 240}{10} + \frac{240}{5} + \frac{240}{20} + \frac{240}{80} + \frac{240}{60}$$

$$= 72 + 48 + 12 + 3 + 4 = 139$$

Similarly, in Match-II,

we get $= \frac{4 \times 240}{10} + \frac{3 \times 240}{20} + \frac{2 \times 240}{30} + \frac{240}{80} + \frac{240}{120}$

$$= 96 + 36 + 16 + 3 + 2 = 153$$

In Match-III, we get

$70 + 20 + 18 + 6 + 2 = 116$

Comparing number of balls of which no runs were scored:

Match-I = (300 – 139)

Match-II = (300 – 153)

Match-III = (300 – 116)

Thus, it is least for Match-II.

30.

State	Number of male graduates as a fraction total number of graduates
M.P.	$\dfrac{8}{15} \times \dfrac{15}{100} = \dfrac{1}{12.5}$
Bihar	$\dfrac{5}{8} \times \dfrac{8}{100} = \dfrac{1}{20}$
Maharashtra	$\dfrac{11}{18} \times \dfrac{12}{100} = \dfrac{11}{150}$
Tamil Nadu	$\dfrac{13}{22} \times \dfrac{11}{100} = \dfrac{13}{200}$

By comparison, the fraction is maximum for M.P.

31. Top four states (number of graduates wise) are M.P., Kerala, Maharashtra and Tamil Nadu.
Required number of female graduates

$= \left[\left(\dfrac{7}{15} \times \dfrac{15}{100} + \dfrac{7}{13} \times \dfrac{13}{100} + \dfrac{7}{18} \times \dfrac{12}{100} + \dfrac{9}{22} \times \dfrac{11}{100}\right)\left(3 \times 10^5\right)\right]$

$= \left[\dfrac{7 + 7 + \dfrac{14}{3} + 4.5}{100}\right](3 \times 10^5) = \dfrac{69.5}{100} \times 10^5 = 69500$

32. Option (A): Difference = 10% × 3 lakh
= 30,000. This is a true statement.

Option (B): Male graduates in U.P. = $\dfrac{10}{21} \times \dfrac{7}{100} \times 3 \times 10^5$

Female graduates in M.P. = $\dfrac{7}{15} \times \dfrac{15}{100} \times 3 \times 10^5$

Number of male graduates is not more.

Option (C): BBA graduates = $\dfrac{9}{100} \times 3 \times 10^5$

Male graduates from Karnataka and Kerala

$= \left[\left(\dfrac{3}{5} \times \dfrac{10}{100} + \dfrac{6}{13} \times \dfrac{13}{100}\right)\left(3 \times 10^5\right)\right] = \dfrac{12}{100} \times 3 \times 10^5$

Number of BBA graduates is not more.

33. Minimum number of male graduates are in Gujarat

$= \dfrac{4}{125} \times 3 \times 10^5$

$= \dfrac{4}{125} \times 3 \times 10^3 \times 10^2 = 9600$

There is no state in which the male graduates are not more than 5000.

Solutions for questions 34 to 37: The runs scored in the matches are as follows.

Match I = $\dfrac{63}{360} \times 100 = 17.5\%$

Similarly, in
Match 2 = 25%
Match 3 = 15%
Match 4 = 20%
Match 5 = 22.5%
The runs made in the different matches are in the ratio of 7 : 10 : 6 : 8 : 9

Let the total runs scored in Match 1, Match 2, Match 3, Match 4 and Match 5 be 7k, 10k, 6k, 8k and 9k, respectively.

Total = 40k

Similarly, the ratio of the total runs scored by the 6 batsmen are as follows:

A	B	C	D	E	F
10%	20%	27.5%	12.5%	22.5%	7.5%
4	8	11	5	9	3

Let the total runs scored by the 6 batsmen be $4k_2$, $8k_2$, $11k_2$, $5k_2$, $9k_2$ and $3k_2$, respectively.

Total = $\dfrac{90}{100}(40k_1) = 36k_1$

So, depending on the value of k_1 we can have the following scores $k_1 = 10$, $k_1 = 30$, $k_1 = 40$, $k_1 = 50$.

Match 1	70	140	210	280	350
Match 2	100	200	300	400	500
Match 3	60	120	180	240	300
Match 4	80	160	240	320	400
Match 5	90	180	270	360	450

Similarly, we can find the total runs scored by the 6 batsmen.

34. Runs scored by C in the entire series = $11k_2$

$= 11 \times \dfrac{9}{10} k_1 = 9.9k_1$

C scored 20% of the total runs in each of the 5 matches.

So, C scored $\dfrac{20}{100}(40k_1) = 8k_1$

In addition, C scored $9.9k_1 - 8k_1 = 1.9 k_1$
Now runs scored by C in a match as a percentage of the total runs scored in the match will be the highest when the total runs scored in that match is the least, i.e., in Match 3.

Out of a total of $6k_1$, C scored $= \dfrac{20}{100}(6k_1) + 1.9k_1 = 3.1k_1$

Now $\dfrac{3.1k_1}{6k_1} \times 100 = 51.66\%$.

35. Total runs scored in Match 2 = $10k_1$
Total runs scored by C in the entire series = $11k_2$

$= 11 \times \dfrac{9}{10} = 9.9k_1$

Difference = $0.1 k_1$
Now $0.1 k_1 = 4$ or, $k_1 = 40$

Therefore, $k_2 = \dfrac{9}{10}$ (40) = 36

Total runs scored by A = $4k_2 = 4(36) = 144$
Total runs scored by D = $5k_2 = 5(36) = 180$
Thus, total runs scored by A and D in the entire series = (144 + 180) runs = 324 runs.

36. Total runs scored in Match 2 = $10k_1$
Total runs scored by the 6 batsmen in the entire series.

A	B	C	D	E	F
$3.6k_1$	$7.2k_1$	$9.9k_1$	$4.5k_1$	$8.1k_1$	$2.7k_1$

Total runs scored by a batsman in Match 2 as a percentage of the total runs scored by the batsmen in the entire series will be maximum for the batsman who scored the least runs, i.e., F.
Since each batsman scored at least 16% of the total runs in Match 2, the remaining 5 batsmen scored at least (16% of $10k_1$) 5

= 80% of $10k_1 = \dfrac{4}{5}$ $(10k_1) = 8k_1$

Thus, F scored the remaining $2k_1$ runs.

Now, $\dfrac{2k_1}{2.7k_1}$ × 100 = 74%.

37. The minimum runs scored by the team in the entire series was 180.
Minimum runs was scored in Match 3, $6k_1 = 180$
So $k_1 = 30$
So, the total runs scored by B in the entire series was $7.2k_1 = 7.2(30) = 216$.

Solutions for questions 38 to 41: It can be seen that the expenses on account of forex loses is only for company Y. As it is 17% of the total expenses of company Y and 8.5% of the merged entity, the expenses of company Y is 50% of the total expenses of the merged entity. As the expense under taxes are only for companies X and Y, the taxes paid by company Y would account for $\dfrac{14}{2}$ = 7% of the taxes paid by the merged entity while the remaining 5.1% of the taxes paid was due to company X.
  17% of X = 5.1% of $(x + y + z)$
  \ x = 30% of $(x + y + z)$
  \ Ratio of expenses of X, Y and Z = 3 : 5 : 2.

38. Ratio of expenses of companies X and Y = 3 : 5.

39. Forex loses of company Y = 8.5% of total
Depreciation expenses of company Z = 19 × $\dfrac{2}{100}$
= 3.8% of total
Required ratio = $\dfrac{8.5}{3.8}$ × 100 = 223%

40. As the total expenses of the companies are in the ratio 3 : 5 : 2, the wage bill of company Y would be the highest as 16% of 5 > 22% of 3 > 22% of 2.

41. Assume that the expenses of X, Y and Z are `300, `500 and `200, respectively.
\ Taxes paid by company Z = `50
Share of taxes paid = $\dfrac{171}{1050}$ × 100 = 16.3%.

42. The ratio between the value of the sales of C and that of E does not depend on the actual value of the sales of D in the western region.
\ Required ratio = 25 : 30 = 5 : 6

43. Let the exaggerated total sales of product D = D
⇒ Sales of product D in the North = 10% of D

⇒ Total sales of all products = $\dfrac{100}{15}$ of D

⇒ Total sales in the Northern region = 30% of $\dfrac{100}{15}$ of D = 2D

\ Required percentage = $\dfrac{10\% \text{ of } D}{2D}$ = 5%

44. Sales of E is 25% of the total sales in the western region.
\ Total sales in the western region is four times the sales of E in that region.
New, total sales in western region is 80% of what is represented by Sunil.

Hence, West forms only $\dfrac{80}{100}$ × 25 = 20% of the total of 95%.

(The remaining 5% is the exaggerated value)

\ Percentage share of the Northern region in the total

sales = $\dfrac{30}{95}$ × 100 = 31.58% ≅ 31.6%.

45. Sales of B = `1800 crore
\ Total sales after the exaggeration of sales
= $\dfrac{1800}{12}$ × 100 = `15000 crore
Sales of D is exaggerated by `1000 crore.

Exaggerated sales of D = $\dfrac{15}{100}$ × 15000 = `2250 crore

Actual sales of D = `1250 crore
Exaggerated sales value in the Western region
= 50% of 2250 = `1125 crore
Actual sales value in the Western region
= 1125 – 1000 = `.125 crore
\ It is exaggerated by 1000 crore.

Hence, $\dfrac{1000}{125}$ = 8 times.

46. To find the actual total sales of D, we need any relation involving the actual sales of D in the Western region. Hence, either III or IV is sufficient.

47. The selling price per unit would be the highest for the product for which the ratio of $\dfrac{\text{sales (by value)}}{\text{sales (by volume)}}$ is the highest, i.e., for product D.

48. The products for which the share of sales (by value) is more than the share of sales (by volume), the selling price per unit is more than the average selling price of all the units, i.e., for products A and D.

49. If the company made an overall profit, the sales (by value) would be more than the cost and the company could have made a loss on products B, C and F.

50. If the company did not make a loss on any of the six products, then the overall profit has to be at least

$$\frac{15-11}{11} \times 100 = \frac{4}{11} \times 100 = 36.36\%.$$

EXERCISE-3

Solutions for questions 1 to 5: The cost of production and profits on both grades of the six items are as follows:

Item	Total cost	Grade A cost (`cr)	Grade B cost (`cr)	Grade A profit (`lakh)	Grade B profit (`lakh)
P	5 cr	3	2	60	30
Q	2.5 cr	0.96	1.54	29	23
R	7.5 cr	3.63	3.87	72.5	97
S	2.5 cr	1.25	1.25	19	25
T	5 cr	2.27	2.73	45.5	68
U	2.5 cr	1.39	1.11	14.0	17

1. The total profit made on item R is = 72.5 + 97 = 170 lakh.

2. The ratio of total profit to total cost is the highest for product T.

3. The total cost for producing grade A of products P, R and S = `7.88 crore.

4. Only for products P and Q is the profit obtained on grade A products more than that of grade B.

Solutions for questions 5 to 8: The number of students in each class, the number of students selected for the scholarship and the number of boys and girls selected is as follows:

Class	Number of students	Number of students selected	Number of boys selected	Number of girls selected
V	196	30	18	12
VI	182	27	16	11
VII	161	32	21	11
VIII	210	40	15	25
IX	259	38	28	10
X	252	38	22	16

5. The number of girls in class VII who were selected for the scholarship is 11.

6. The required percentage $\dfrac{40}{210} \times 100 = 19\%$

7. The percentage of students selected for the scholarship was the highest in class VII.

8. From the above table it can be seen that in class V, VII and IX the number of boys selected was at least 50% more than that of girls.

Solutions for questions 9 to 12: The number of units of the different products sold are as follows:

Product	2015 (in '000)	Product	2016
P	10560	P	12240
Q	13860	Q	13920
R	11440	R	13680
S	20020	S	20880
T	23320	T	25680

9. Sales of P in 2016 = 12,240 units

Price per unit = $132 \times \dfrac{108}{100}$ = 142.56

Sales (by value) = $12240 \times 142.56 \times 10^3$ ≈ 175 crore

10. Sales (by value) in 2015
= 10560 × 132 + 13860 × 167 + 11440 × 102
    + 20020 × 36 + 23320 × 235
= 140 + 231 + 117+172 + 548
= 1208 crore

11. The total sales increased by slightly more than 9%.
∴ If any product had a 1% or more increase in its share from 2015 to 2016, it would have more than 10% increase. We need to check for T as it is very close to 10%.
Sales of T in 2015 = 23320
10% = $\dfrac{2332}{25652}$

As sales in 2016 are more than this, T also had a more than 10% increase.

12. Sales (by value) in 2016
= 12240 × 142.5 + 13920 × 190.4 + 13680
        × 104 + 20880 × 86 + 25680 × 251.5
M 175.0 + 265 + 142.0 + 180 + 646 = 1408 crore
Difference = 1408 – 1208 = 200 crore

Solutions for questions 13 to 16: It can be seen that gold was only given to the third son. 35% of the total share of the third son equal to 14% of the total assets of Ratan Lal. Therefore, the third son got 40% of the assets of Ratan Lal. Now, bonds were given only to the first and third son and as the third son has got 40% of the share, we can conclude that the first son got 30% and so the second son also has to get 30%.

13. Ratan Lal gave 30% of his assets to his second son

14. As 30% of the share of first son is 5.25 crore, the total share of both the first and second sons would be 17.5 crore.

15. FDs received by the second son is 2.5% of the total assets of Ratan Lal, i.e., $\dfrac{2.5}{100}$ × 48 = 1.2 crore.

16. The value of cash received by the first and the third sons together is 6.5% of his assets. Equity with Ratan Lal is 21% of his assets.

The required value is $\dfrac{21}{6.5}$ × 3.9 = 12.6 crore.

Solutions for questions 17 to 20: As Sunil spent `300, the total amount spent by the five children is `1500. The amount spent by the different children are Prakash = 15, Qureshi = 100, Rahul = 205, Sunil = 300, Thomas = 395 and Urvashi = 490.

Now 7x – 15 = 6y and 8x – 100 = 5y
\ We get x = 45 and y = 50

Hence, the amount with them when they went for shopping was 315, 360, 400, 450, 495 and 540, respectively. The amounts with them when they returned is 300, 250, 200, 150, 100 and 50, respectively.

17. The total amount spent by the children was `1515.

18. The maximum difference in amounts was with Prakash and Urvashi, 540 – 315 = 225

19. Sunil spent $\dfrac{300}{450}$ × 100 = 67%

20. Thomas spent `95 more than Sunil.

4 Line Graphs

Chapter

Learning Objectives

In this chapter, you will:
- Gain an understanding of various types of data presented and different types of line graphs.
- Learn to solve questions and in turn become familiar with area graphs.
- Get familiar with different types of questions based on line graphs.
- Learn how to compare values (changes) across two or more line graphs using percentage techniques.
- Understand how to decipher data which involves more than one data type—bar graph and line graph together, line graph and table, etc.

☐ TWO-DIMENSIONAL
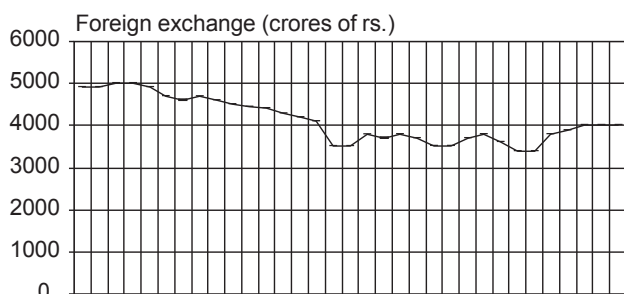
Fig. 4.1 Foreign exchange reserves of India

This is essentially used for continuous data but can also be used for depicting discrete data provided that we understand the limitation. The representation of this data is also known as Cartesian graphs, they represent the variation of one parameter with respect to another parameter each shown on a different axis. These types of graphs are useful in studying the rate of change or understanding the trends through extrapolations.

These graphs can be of various types and a few of them are shown below (Figures 4.1 to 4.3):

The graph in Figure 4.2 shows the changes in the foreign exchange reserves of our country during a period of time. One can find out the trends and the growth rates of foreign exchange reserves.
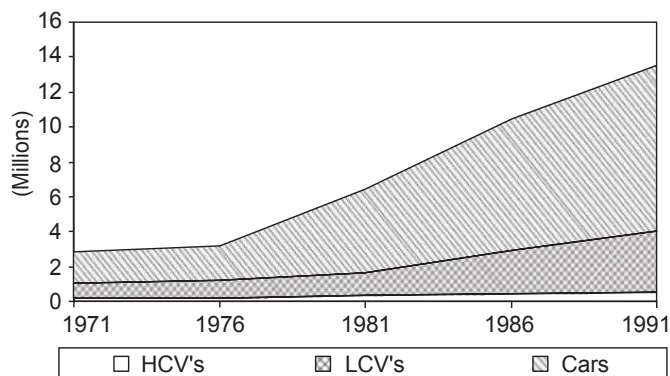
Fig. 4.2 Automobiles in India

Figure 4.2 shows a cumulative type of graph (stacked graph). This figure provides more information than the previous graph that you studied in Figure 4.1.

From the graph given in Figure 4.2, the relative proportion of different varieties of vehicles which constitute the total can be obtained along with the trends and growth rates, percentage variation, actual variations and trends for any period of time can be ascertained.

Figure 4.3 presents another type of 2-dimensional graph which is mostly used to depict scientific data like speed, velocity, vectors, etc. In the graph, the speed trends of three bodies Q1, Q2, Q3 is given.
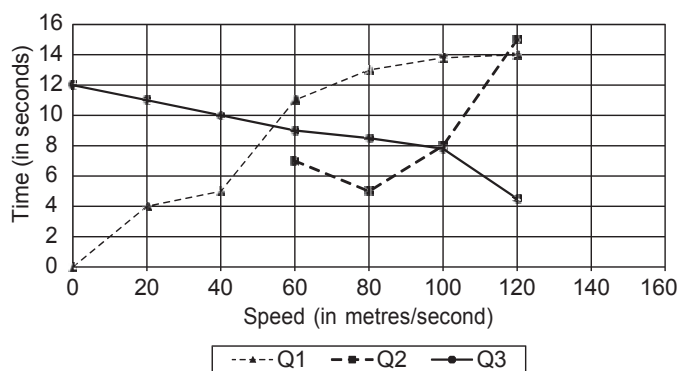
Fig. 4.3 Motion graph of Q1, Q2 and Q3

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Solved Examples

</div>

Directions for questions 4.01 to 4.05: These questions are based on the information given below.

The following line graph represents the population (in millions) of country X in each year from 1980 to 1985.
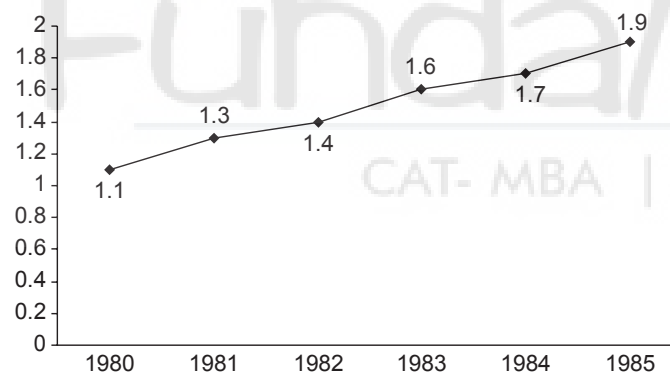
4.01: Find the percentage increase in the population of X from 1980 to 1985.
 (A) 60 (B) 66⅔
 (C) 70% (D) None of these

 Sol: Required percentage
 $$= \frac{1.9 - 1.1}{1.1}(100) = 72\frac{8}{11}\%$$

4.02: If in 1981, 60% of the population of X were men while in 1982 it was only 50%, find the percentage change in the male population from 1981 to 1982.
 (A) 8% (B) 10%
 (C) 12% (D) 13%

Sol: Number of men in 1981
$$= \frac{60}{100}\left(1.3\,\text{million}\right) = 0.78 \text{ million}$$

Number of men in 1982
$$= \frac{50}{100}\left(1.4\,\text{million}\right) = 0.7 \text{ million}$$

\ The male population decreased.

Required percentage $= \dfrac{0.78 - 0.7}{0.78}(100) \cong 10\%$

4.03: If in the previous question, 60% of the female population in 1981 and 80% of those in 1982 were literate, then find the increase (in millions) in the number of literate women from 1981 to 1982.
 (A) 0.16 (B) 0.192
 (C) 0.213 (D) 0.248

 Sol: Number of women in 1981
$$= \frac{40}{100}\left(1.3\,\text{million}\right) = 0.52 \text{ million}$$

Number of women who were literate
$$= \frac{60}{100}\left(0.52\,\text{million}\right) = 0.312 \text{ million}$$

Number of women in 1982
$$= \frac{50}{100}\left(1.4\,\text{million}\right) = 0.7 \text{ million}$$

Number of women who were literate

$$=\frac{80}{100}\left(0.7\,\text{million}\right)=0.56\,\text{million}$$

The increase = 0.56 – 0.312 = 0.248 million

4.04: In which of the given years, from 1981 to 1985, did the population increase by the highest percentage over the previous year?
(A) 1981   (B) 1982
(C) 1983   (D) 1984

Sol: As the maximum increase in population between any two years is 0.2 million (1981, 1983 and 1985) and as the increase in population in 1981 is on a lower base, the percentage increase in 1981 would be the highest.

4.05: If the percentage of women in the population of country X in the years from 1980 to 1985 are 40, 45, 50, 55, 60 and 65, respectively, then in which of the given years when compared to its previous year, did the female population show the highest percentage increase?
(A) 1985   (B) 1981
(C) 1983   (D) 1982

Sol: As the percentage increase in total population, and the percentage increase in the share of female population in 1981 (40 – 45, i.e., 12.5%) is the highest, the percentage increase in female population would be the highest in that year.

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

Exports of tea of Niligiri tea Ltd., from 1992 to 1997
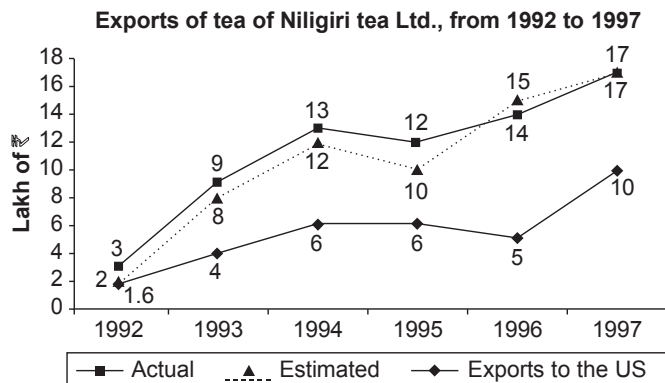
1. In which year is the ratio of actual exports of tea to the estimated exports of tea, the highest?

2. Total exports to the US is approximately what per cent of total actual exports for the given period?

3. In the year 1996, the estimated exports to the US were `5.5. lakh when $1 was estimated as `40. However, the actual exports to the US were only `5 lakh due to the appreciation of the value of rupee. What was the actual value of $1 (other factors remained constant)?

4. In the year 1994, if $1 was equal to `40, then find the quantity of tea exported (in kg) to the US where the cost of tea per kilo is $8.

5. In which year is the ratio of exports of tea to the US when compared to the actual exports of Nilgiri tea Ltd, the highest?

Directions for questions 6 to 10: Answer these questions based on the information given below.

The line graph gives the percentage increase in the number of students and the fee per student at a coaching institute across five years. The increase in values for each year is with respect to that of the previous year.
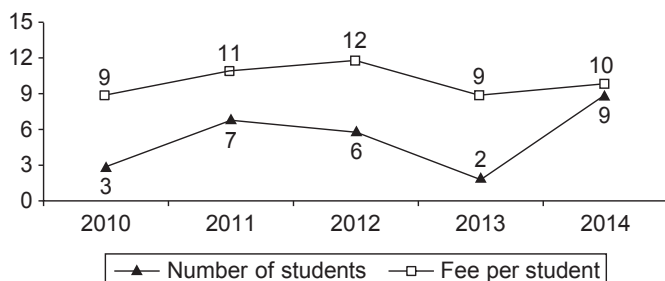
6. What was the approximate percentage increase in the number of students from 2010 to 2013?
(A) 14 (B) 15
(C) 16 (D) 17

7. If the fee per student in 2011 was `26,000, then what was the fee in 2013?
(A) `30,600 (B) `31,740
(C) `32,600 (D) `33,250

8. If the number of students in the institute was 23,348 in 2014, how many students were there in 2012?
(A) 20,000 (B) 20,500
(C) 21,000 (D) 22,000

9. In 2012, the coaching institute had a 32% share of the total number of students who took coaching in the city. What was its share in 2014, given that the total number of students who took coaching in the city increased by 15% from 2012 to 2014?
(A) 32.3% (B) 32.8%
(C) 33.1% (D) 31%

10. If the total fees collected by the institute in 2011 was `29.375 crore and the fee per student that year was `12,500, then what was the total fee collected in 2013?
(A) `38.8 crore (B) `36.2 crore
(C) `34.1 crore (D) `32.2 crore

Directions for questions 11 to 15: Answer these questions based on the information given below.

The graph gives the profit percentage of three companies P, Q and R across six years.
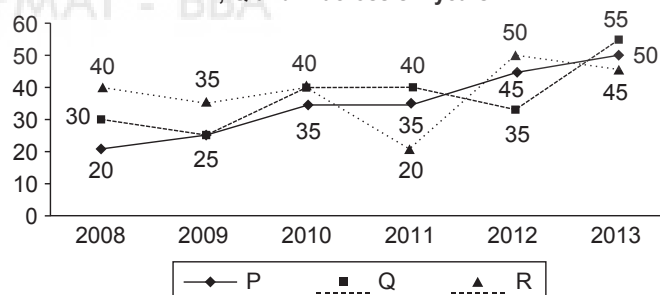
$$\text{Profit percentage} = \frac{\text{Profit}}{\text{Expenditure}} \times 100$$

Profit = Income − Expenditure

11. If, in the year 2011, the ratio of expenditures of companies P and Q is 6 : 8, then what is the ratio of their profits?
(A) 12 : 17 (B) 26 : 37
(C) 5 : 8 (D) 21 : 32

12. In the year 2009, the difference between the expenditure and the profit of company R is ` 2.99 crore. What is the income (in crore) of company R in that year?
(A) `4.6 (B) `6.21
(C) `5.2 (D) `5.82

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13. The income of company P in the year 2012 is `7.25 crore. What is the expenditure (in ` crore) of company P in that year?
(A) 5   (B) 5.25
(C) 6.25   (D) 6.75

14. Which company earns the highest profit in any of the given years?
(A) P   (B) Q
(C) R   (D) Cannot be determined

15. If in 2011, the ratio of the incomes of P, Q and R is 5 : 4 : 3, then the profit of P was approximately what percentage of the profit of Q and R together?
(A) 69   (B) 72
(C) 75   (D) 80

Directions for questions 16 to 20: These questions are based on the following graph which shows the profit percentage earned on three products A, B and C over the years 2002 through 2007.
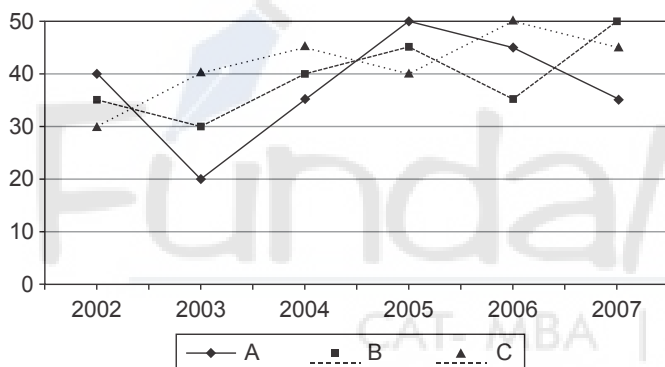
Profit = Selling Price – Cost price

Profit percentage = $\dfrac{\text{Profit}}{\text{Cost price}} \times 100$

16. If the selling price of product B in 2003 was `3.9 lakh, then what was the profit earned on product B in rupees in that year?
(A) 60 thousand   (B) 55 thousand
(C) 80 thousand   (D) 90 thousand

17. The cost price of product A in 2003 is equal to the cost price of product C in 2007. What will be the ratio of the selling price of product A in 2003 to the selling price of product C in 2007?
(A) 24 : 29   (B) 29 : 25
(C) 25 : 29   (D) 29 : 24

18. Selling price of product B in 2004 and 2005 were equal. What was the ratio of its cost prices in 2004 to that of 2005?
(A) 29 : 28   (B) 25 : 27
(C) 36 : 35   (D) 33 : 25

19. Selling price of product B in 2006 is equal to its cost price in 2007. What is the ratio of its selling price in 2006 to that in 2007?
(A) 1.5   (B) 0.66
(C) 0.8   (D) 1.2

20. In which year is the per cent rise/fall in the per cent profit earned by selling product A the least?
(A) 2003   (B) 2004
(C) 2005   (D) 2006

Directions for questions 21 to 25: Answer these questions based on the information given below.
The line graph gives the profit percentage of two companies P and Q from 2009 to 2014.

Profit percentage = $\dfrac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$
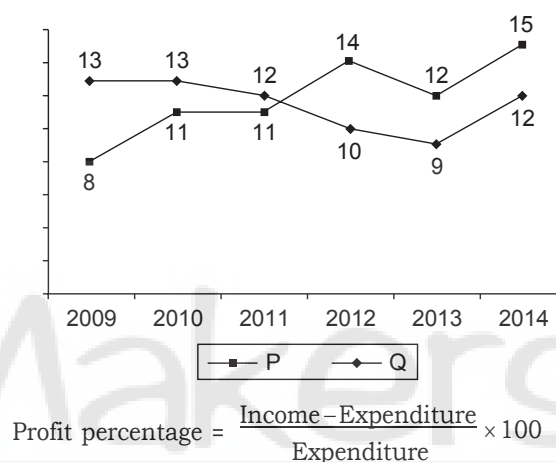
21. If the expenditure of company P in 2012 was `85 lakh, then what was its income (in ` lakh) in that year?
(A) 95.4   (B) 96.9
(C) 98.2   (D) 99.3

22. If in 2013, the ratio of the incomes of the companies P and Q was 224 : 98, then what was the ratio of their expenditures?
(A) 20 : 9   (B) 18 : 7
(C) 1 : 58   (D) None of these

23. If in 2009, the expenditures of the companies P and Q were equal, then what was the ratio of their incomes?
(A) 98 : 99   (B) 73 : 79
(C) 108 : 111   (D) 108 : 113

24. If the profit of company Q in 2013 was `4.23 cr, then what was the income in that year?
(A) `48.76 cr      (B) `50.21 cr
(C) `51.23 cr      (D) `53.16 cr

25. If the ratio of the profits of P and Q in the year 2010 was 4 : 5, then what was the approximate ratio of their expenditures?
(A) 61 : 68   (B) 52 : 55
(C) 71 : 79   (D) 61 : 72

Directions for questions 26 to 30: The following two graphs show the number of employees and profit per employee per annum of company XYZ Ltd.

Number of employees

Profit per employee per annum
(₹ in lakh)
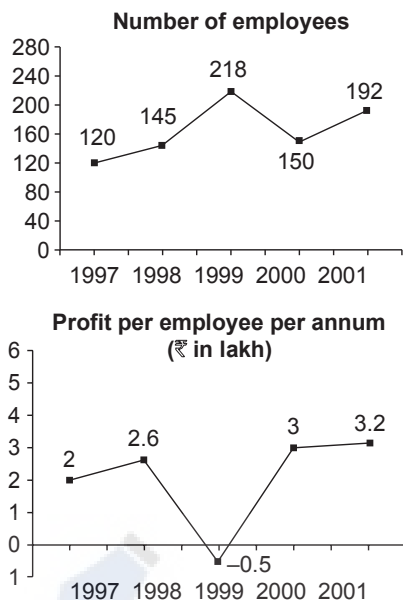
26. In which year was the profit of the company, the highest?

27. If the profit in the year 1998 was 30% of the total sales value, then what was the approximate total sales value (in cr) in that year?

28. In how many years was the number of employees more than the average number of employees for the given period?

29. The company wants to achieve a profit in the year 2002 such that the profit in the year 2001 is 64% of the profit in the year 2002. What should be the profit (in cr) of the company in the year 2002?

30. What was the approximate percentage increase in the profit of the company from 1997 to 1998?

Directions for questions 31 to 33: Answer these questions based on the information given below.

The following line graph gives the percentage growth in the net profit of two companies A and B, over that of the previous year, for the period 2007 to 2012.
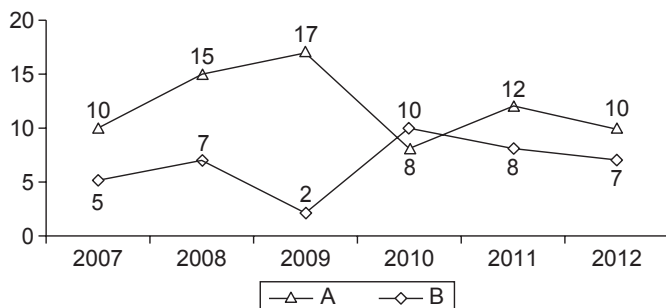
31. What is the approximate percentage growth in the net profit of company A from 2006 to 2012?
(A) 80% (B) 88%
(C) 97% (D) 105%

32. If the net profit of company B in 2006 was `180 crore, then what was its net profit in 2010?
(A) `210 crore  (B) `227 crore
(C) `236 crore  (D) `245 crore

33. If in 2010, company A had a greater increase in net profit than company B, then which of the following cannot be the ratio of the net profit of A and B in 2006?
(A) 7 : 5 (B) 10 : 13
(C) 23 : 24 (D) None of these

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

Five companies Johnson and Johnson, Pfizer, Roche, Sanofi and Ell Lilly make pills for a certain disease.

The composition and cost of the four chemicals Formaldehyde, Naphthalene, Lactic acid and Tannin used in making the pills is as follows:
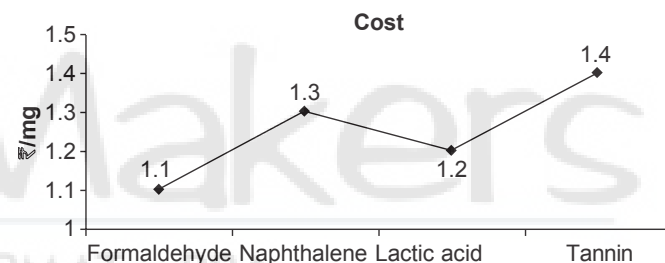
Cost

Composition (in mg)

Company	Formaldehyde	Naphthalene	Lactic acid	Tannin
Johnson and Johnson	200	300	100	400
Pfizer	250	150	200	400
Roche	100	300	300	300
Sanofi	200	200	200	400
Ell Lilly	250	250	250	250

34. Which company incurs the least cost in producing the pill?
(A) Pfizer (B) Roche
(C) Sanofi (D) Ell Lilly

35. For how many of the given companies does Formaldehyde and Naphthalene form at least 50% and Naphthalene and Lactic acid form at least 40% of the pill by weight?

(A) 0   (B) 1

(C) 2   (D) 3

36. If the cost of formaldehyde increases by 10% and the cost of lactic acid increases by 20%, then for which company is the cost of making the pill the highest?

(A) Roche   (B) Pfizer

(C) Sanofi   (D) Johnson and Johnson

Directions for questions 37 to 40: Answer these questions based on the information given below.
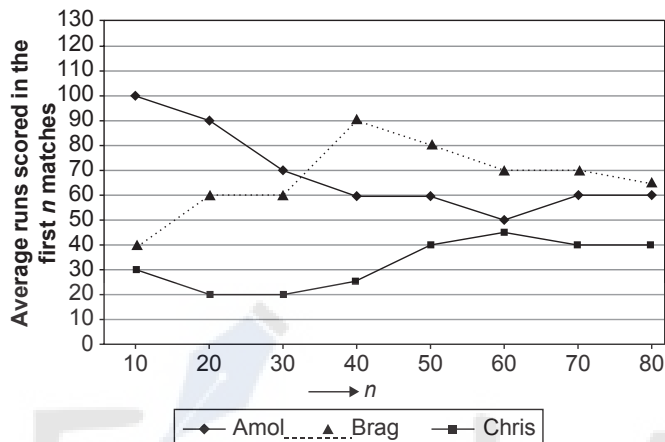
The graph shown above represents the variation in the average runs scored by three leading cricket players, namely Amol, Brag and Chris. Assume that no player was 'not out' in any of the matches he played. All the three players are from the same team. Each of them played in all the 80 matches played by the team. Also, the runs scored by any of the players in any match was always a non-negative number.

For example, average runs scored by Amol in the first 40 matches played is 60, while those scored by Brag in the first 60 matches played is 70.

37. In which of the following groups of ten matches, is the number of runs scored by Amol the same as that scored by Brag?

(A) 41st to 50th   (B) 51st to 60th

(C) 61st to 70th   (D) None of these

38. For which of the following groups of ten matches, is the average number of runs scored by Amol the highest?

(A) 21st to 30th   (B) 31st to 40th

(C) 51st to 60th   (D) 61st to 70th

39. If Brag did not score the same number of runs in any two matches, the highest score made by Brag in any of his first 60 matches is at least.

(A) 180   (B) 184

(C) 185   (D) 187

40. In which of the following groups of ten matches were the runs scored by Chris more than those scored by one of Amol and Brag, but less than the other?

(A) 11th to 20th   (B) 31st to 40th

(C) 41st to 50th   (D) 51st to 60th

Directions for questions 41 to 45: These questions are based on the following line graph which show the statistics of Steel production and exports and imports of India.

Steel plant utilization as percentage of total plant capacity
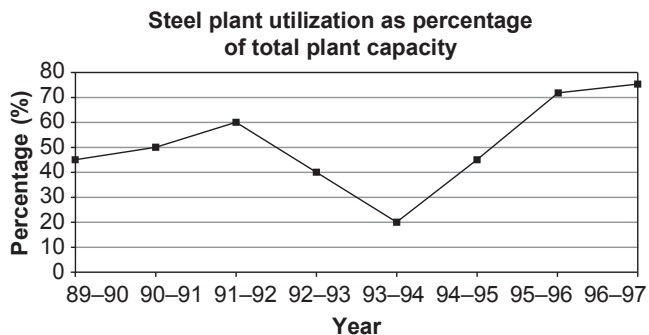
$$\text{Plant utilization} = \frac{\text{Output}}{\text{Capacity}} \times 100$$

Steel output in billion tons

Steel exports and imports in thousand tons (steel equivalent)
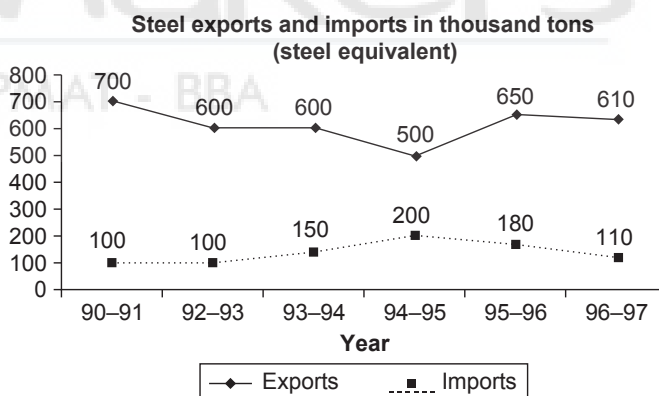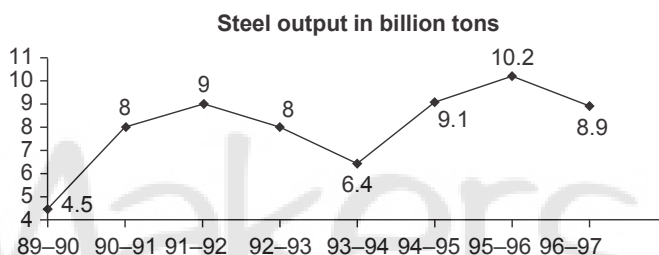
41. What was the total plant capacity of the steel plants in the year 1994–95?

(A) 20.2 billion tons   (B) 15.0 billion tons

(C) 25.0 billion tons   (D) Cannot be determined

42. In which year was the total plant capacity of the steel plants the lowest?

(A) 1996–97   (B) 1991–92

(C) 1994–95   (D) 1989–90

43. Which of the following statements is true?

   I.   A decrease in the plant utilization was accompanied by a proportionate decrease in the output of steel between 1991–1992 to 1993–1994.

II. The total plant capacity increased between 1991–1992 to 1993–1994.

III. Output of steel was the highest when the plant utilization was the highest.

(A) I, II, III
(B) I and II
(C) II Only
(D) II and III

44. In the steel industry, how many times is an increase in the imports accompanied by a decrease in the exports?

(A) 3   (B) 1
(C) 4   (D) Cannot be determined

45. The average annual increase in the total plant capacity for the given period is

(A) 4%   (B) 4.6%
(C) 3.1%   (D) 2.7%

Directions for questions 46 to 50: Answer these questions based on the information given below.

The line graphs give the sales and expenditure of a company across five years, starting from 2010. The value of both sales and expenditure for the year 2010 is indexed to 100.

Sales

Expenditure
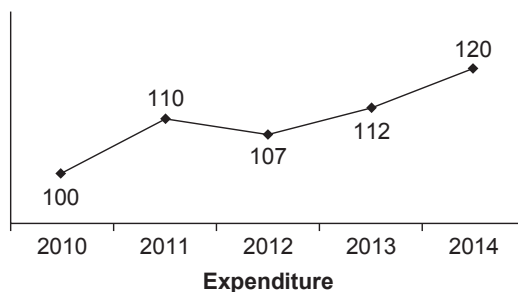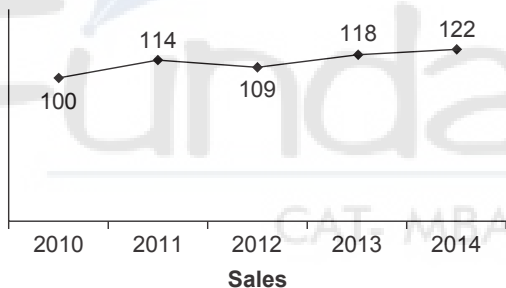
It is known that the profit in 2012 was `1 crore

46. In at least how many years did the company make a profit?

(A) 2   (B) 3
(C) 4   (D) 4

47. In which year was the profit the least?

(A) 2010   (B) 2012
(C) 2014   (D) Cannot be determined

48. In which year was the percentage income in sales the highest?

(A) 2011   (B) 2012
(C) 2013   (D) 2014

49. If the sales of the company in 2010 was `250 crore, then what was the profit in 2013?

(A) 8.6 crore   (B) 10.8 crore
(C) 11.4 crore   (D) 14.1 crore

50. What was the approximate percentage decrease in profit in 2012, when compared to 2011?

(A) 6   (B) 8
(C) 9   (D) Cannot be determined

EXERCISE-2

Directions for questions 1 to 4: Answer these questions based on the information given below.

The brand-wise sales of a Consumer Electronics Dealer ABC Ltd. for the period from 2010 to 2015
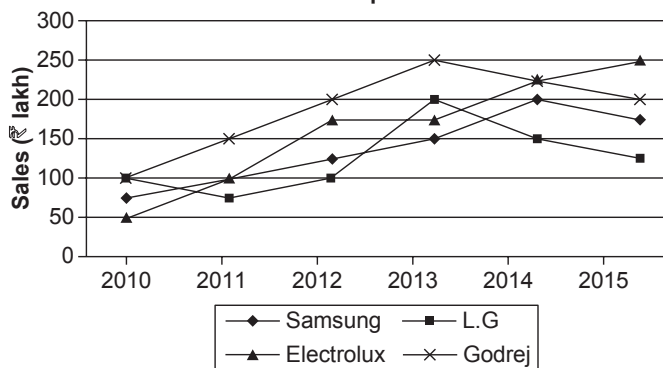
Product-wise split (by value) of the total annual sales of the products of Samsung sold by ABC Ltd. for the period from 2010 to 2015

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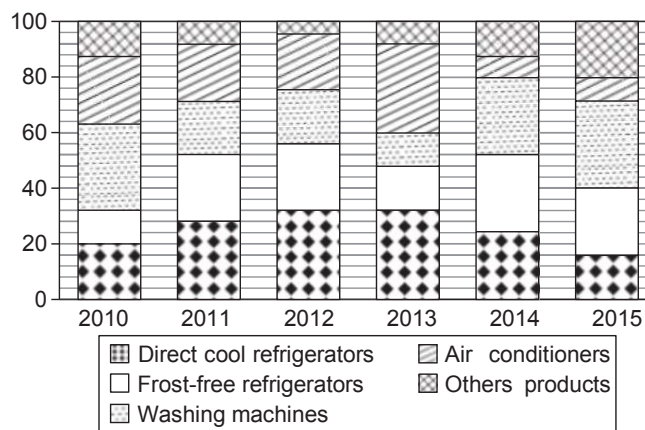
The sales (in units) of the major products of Samsung sold by ABC Ltd. for the period from 2010 to 2015

Legend: ◆ Frost-free refrigerators ■ Air conditioners ▲ Direct cool refrigerators ✕ Washing machines
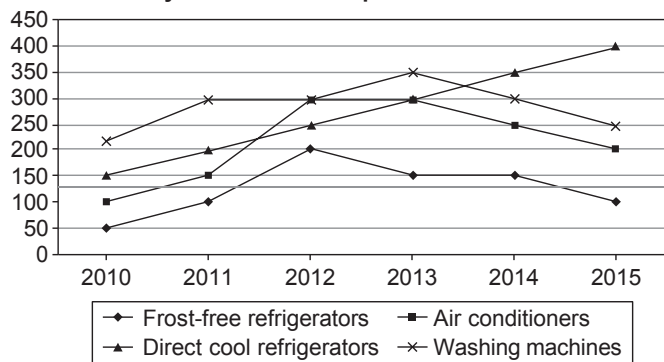
1. What was the total sales of Samsung Frost-Free Refrigerators in the period from 2010 to 2012?
(A) `72 lakh
(B) `81 lakh
(C) `69 lakh
(D) `63 lakh

2. If in the year 2011, the ratio of the sales by value of air conditioners of the four brands is the same as the ratio of the total sales by value of the four brands, then find the sales (by value) of the air conditioners of LG in 2011.
(A) `15 lakh
(B) `24 lakh
(C) `30 lakh
(D) `18 lakh

3. In which year did the sales revenue from Samsung washing machines increased by the greatest percentage over that in the previous year?
(A) 2013
(B) 2014
(C) 2012
(D) 2015

4. Which of the following is the correct descending order of the four brands according to the percentage change in their respective sales (by value) from the year 2010 to the year 2015?
(A) Electrolux, Godrej, Samsung, LG
(B) Samsung, Electrolux, LG, Godrej
(C) Electrolux, Samsung, Godrej, LG
(D) Samsung, Electrolux, Godrej, LG

Directions for questions 5 to 8: Answer these questions based on the information given below.

The following line graph gives the sales of company P and expenses of company Q across five years.
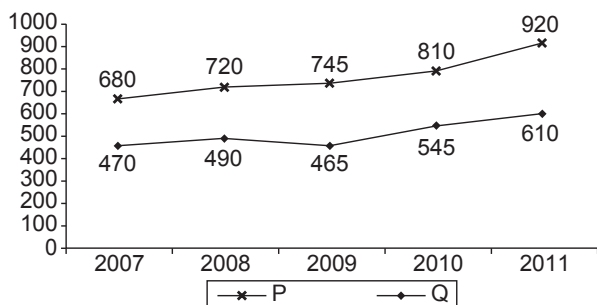
The table gives the profit percentage of the companies in these years.

Year	P	Q
2007	17.2	20.3
2008	18.1	24.8
2009	17.5	19.5
2010	18.6	20.8
2011	19.2	21.6

$$\text{Profit\%} = \frac{\text{Profit}}{\text{Expenses}} \times 100$$

Profit = Sales – Expenses

5. In which year was the difference between the sales of P and Q, the least?
(A) 2007
(B) 2008
(C) 2010
(D) 2011

6. What is the percentage increase in the profit of company Q in the given period?
(A) 38.1
(B) 36.2
(C) 34.3
(D) 32.1

7. What is the average profit of company P from 2007 to 2011?
(A) 122.6
(B) 114.3
(C) 117.1
(D) 119.2

8. In how many years was the percentage increase in expenses of company P, more than that of company Q, for the same year?
(A) 1
(B) 2
(C) 3
(D) 4

Directions for questions 9 to 12: Answer these questions based on the information given below.

XYZ, an electronics company, sells five types of products. The following graph shows the percentage of revenue each product contributed to the total revenue of the company in four years from 2006 to 2009.

Legend: ○ Televisions ◆ Laptops ◇ Washing machines △ Fridges ─ Cell phones

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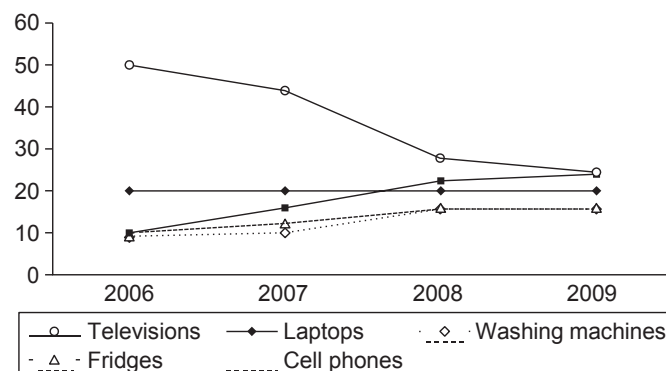
The total revenue in 2008 was more than that in 2006 while the total revenue in 2009 was less than that in 2007 and the total revenue in 2007 was more than that in 2008.

9. The sales of at most how many products could have increased continuously from 2006 to 2009?
   (A) 1   (B) 2
   (C) 3   (D) 4

10. At most how many of the following statements can be simultaneously true?
   The revenue from sales of washing machines in the year 2008 is
   (i) Less than that in 2009
   (ii) Greater than that in 2007
   (iii) Greater than that in 2006
   (iv) Less than 80% of that in 2009

   (A) 1   (B) 2
   (C) 3   (D) 4

11. The revenue from sales of televisions in 2006 is at most how many times the revenue from sales of cell phones in 2007?
   (A) 2.5   (B) 3.0
   (C) 3.33   (D) 3.6

12. What is the least possible number of products which had a definite decrease in sales from 2007 to 2009?
   (A) 0   (B) 1
   (C) 2   (D) 3

Directions for questions 13 to 17: Answer these questions based on the information given below.
   The following line graph gives the percentage increase in the sales and expenses, when compared to the previous year, of company XYZ Ltd, for a period of five years.
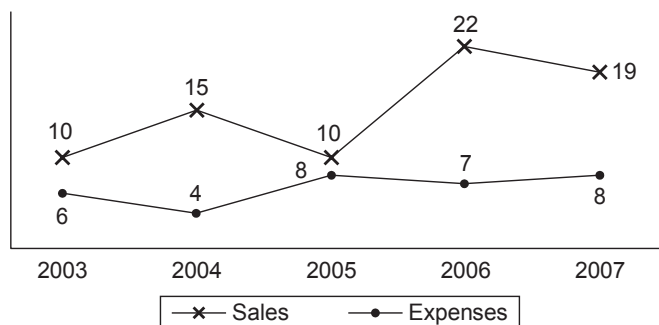
It is known that the company made a profit in 2002.

13. In how many of the given years did the company make a profit?
   (A) 2   (B) 3
   (C) 4   (D) 5

14. In which of the given years was the profit made by the company, the highest?
   (A) 2003   (B) 2004
   (C) 2007   (D) 2006

15. In which of the given years was the increase in the expenses of the company, over the previous year, the highest?
   (A) 2005   (B) 2006
   (C) 2007   (D) Both 2005 and 2007

16. In which of the given years was the increase in sales of the company, over the previous year, the highest?
   (A) 2007   (B) 2006
   (C) 2004   (D) 2003

17. If the ratio of sales to expenses in 2002 was 2 : 1, then what is the ratio of the profits made by the company in 2007 and 2003?
   (A) 7 : 3   (B) 8 : 3
   (C) 7 : 4   (D) 3 : 1

Directions for questions 18 to 22: Answer these questions based on the information given below.

Total petroleum production as a percentage of total crude production

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Total petroleum consumption as a percentage of total crude consumption
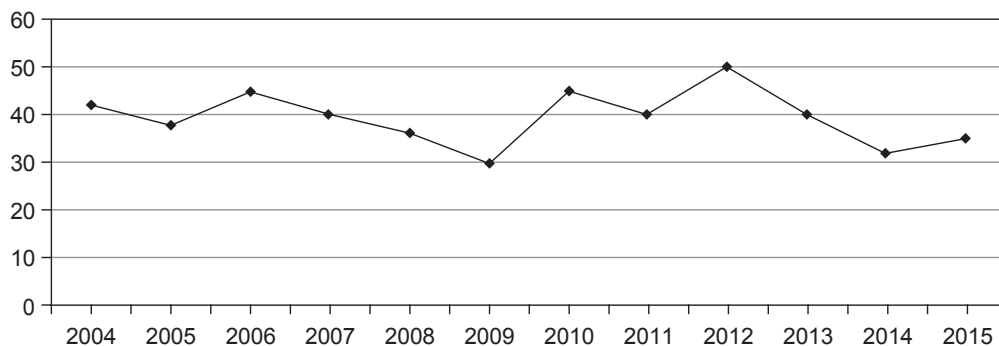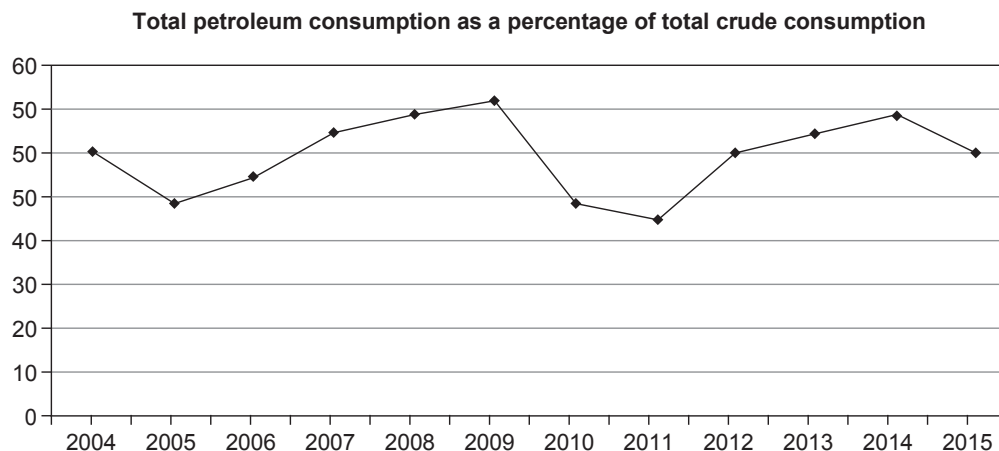
Further, the total crude production (when compared to previous year) increased every alternate year starting from 2004 (i.e., 2006, 2008, ...) and in the remaining years it decreased.

The total crude consumption, when compared to the previous year decreased every year from 2004.

18. What is the maximum possible number of years from 2005 to 2015 in which the total petroleum production increased over the previous year?

19. In at most how many of the years from 2004 to 2011 could the petroleum consumption be the same as that in 2010?

20. What is the minimum possible number of years from 2005 to 2015 in which the total petroleum consumption decreased when compared to the previous year?

21. What is the minimum possible number of years in which the total petroleum production decreased when compared to the previous year?

22. In at most how many of the given years can the petroleum consumption be equal to 5/4 times the petroleum consumption in 2005?

Directions for questions 23 to 26: These questions are based on the following information.

The products of company XYZ are sold both domestically and in the international market. Every year, the exports take place immediately after the production and the remaining products are sent to the godowns. Some quantity is damaged during this process of storing while the others are completely sold off in the domestic market.

The table gives the details of production, export and quantity lost during the storage process while the line graph gives the export and domestic prices for the years 2011 to 2016. Assume that both domestic and export prices remain constant in a year.

Year	Production ('000 kg)	Exports ('000 kg)	Damage during storing ('000 kg)
2011	137	42	5.0
2012	134	52	6.5
2013	161	73	7.2
2014	186	67	4.7
2015	172	75	8.1
2016	197	82	7.8
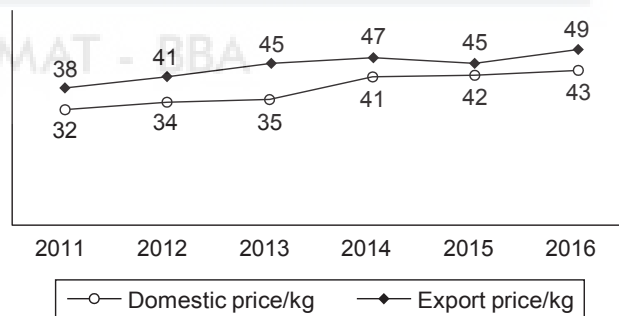
Note: The damaged quantity is discarded, and the company incurs a cost of `3/kg in disposing it off.

Total revenue in a year = Amount obtained from sale of products – Cost incurred in disposing off the damaged products

Domestic revenue = Quantity sold in the domestic market × Domestic price/kg.

23. What was the percentage increase in the revenue of the company from 2012 to 2013?
    (A) 28.3   (B) 29.1
    (C) 30.2   (D) 31.4

24. What was the highest value of the revenue per kg of the quantity produced, in any of the given years?

(A) 46.2   (B) 45.1
(C) 43.6   (D) 41.5

25. What was the highest percentage increase in domestic revenue when compared to the previous year?
(A) 65.7   (B) 58.4
(C) 59.4   (D) 60.2

26. The highest value of revenue from sales in the domestic market, as a percentage of the total revenue in that year, is
(A) 64%   (B) 61%
(C) 59%   (D) 56%

Directions for questions 27 to 29: Answer these questions based on the information given below.
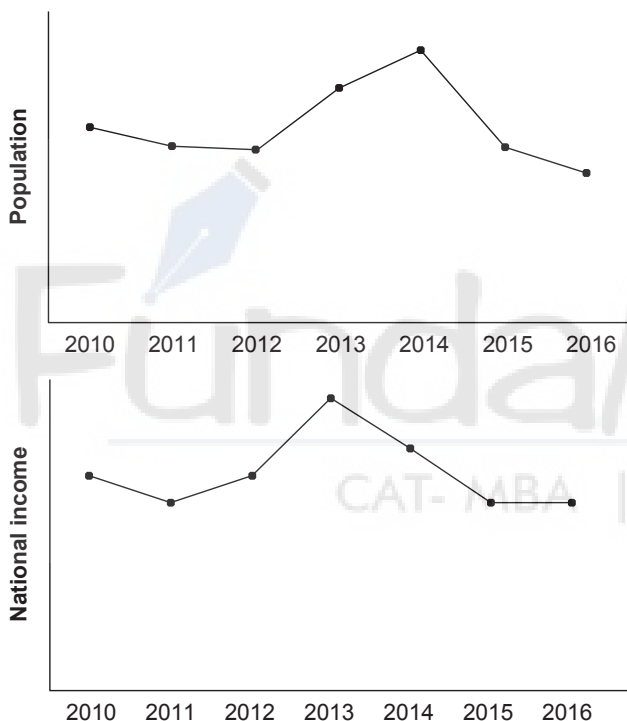
The line graphs give the trend of population and the national income of a country.

$$\text{Per capita income} = \frac{\text{National income}}{\text{Population}}$$

27. In at least how many years was there an increase in the per capita income when compared to the previous year?
(A) 0   (B) 1
(C) 2   (D) 3

28. In at least how many years was there a decrease in the per capita income when compared to the previous year?
(A) 0   (B) 1
(C) 2   (D) 3

29. In at most how many years did the per capita income remain the same as that in the previous year?

(A) 0   (B) 1
(C) 2   (D) 3

Directions for questions 30 to 33: These questions are based on the following line graph and table.
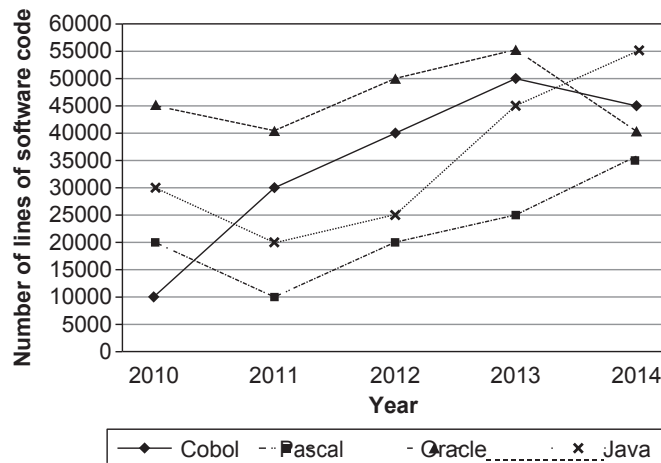
The line graph above represents the number of lines of software code written by four different programmers, namely Oracle, Pascal, Cobol and Java over five different years, from 2010 through 2014. The table given below indicates the rate (`/line of code) charged by each of the four programmers over the given duration (2010–2014).

Rates (`/line of code)

Programmers	Year				
	2010	2011	2012	2013	2014
Cobol	10	11	12	13	14
Pascal	11	12	12	13	14
Oracle	12	12	12	13	14
Java	13	14	15	16	17

Income of each of the programmer is the revenue realized from the lines of software code that the programmer writes.

30. The income of which programmer changed the maximum in percentage terms between any two consecutive years?
(A) Pascal   (B) Java
(C) Cobol   (D) Oracle

31. For how many years was the income of Java more than that of each of the other three programmers?
(A) 4   (B) 1
(C) 2   (D) 3

32. Income of Pascal in the year 2013 expressed as a percentage of that of Java in year 2010 is
(A) $83\frac{1}{3}$%   (B) 120%
(C) 12%   (D) None of these

33. In which year was the income of any of the programmers the maximum?
(A) 2010
(B) 2014
(C) 2013
(D) 2012

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

The following graph gives the market share of five car companies in a country across five years. Assume that the total sales of these five companies increased by 20% every two years.
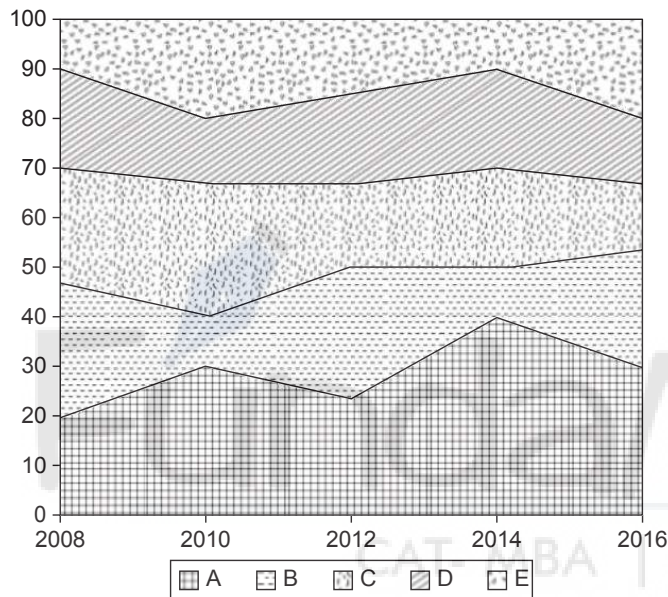
34. What was the percentage increase in the sales of company A from 2008 to 2012?
(A) 100   (B) 80
(C) 75   (D) 25

35. If the total sales of the five companies in 2008 were 2,85,000, then what were the sales of company D in 2014?
(A) 98,500
(B) 99,200
(C) 96,500
(D) 97,500

36. How many companies had an increase of more than 100% in their sales from 2008 to 2016?
(A) 2   (B) 3
(C) 1   (D) 4

37. Which company had the highest percentage increase in sales from 2010 to 2016?
(A) A   (B) B
(C) D   (D) E

Directions for questions 38 to 42: Answer these questions based on the information given below.
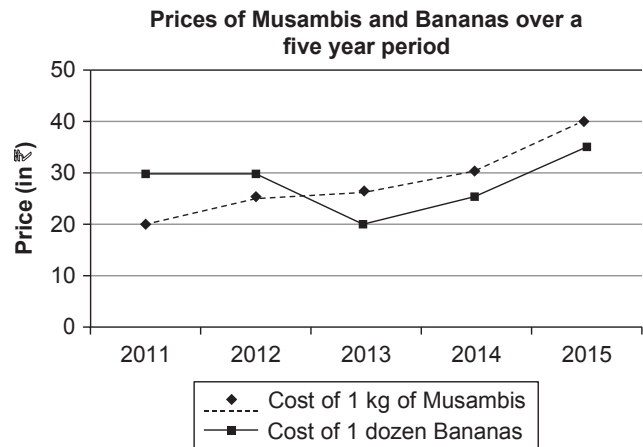
Due to the variation in the size of bananas produced in a particular year, the number of bananas per kg varies as per the table given below.

Average number of bananas per kg in various years	
2011	10
2012	10
2013	11
2014	12
2015	9

38. In 2011, what is the difference between the average price of 1 kg of musambis and 1 kg of bananas?
(A) `5      (B) `10
(C) `7.50   (D) None of these

39. If from 2015 to 2016, the cost of bananas increased by the same amount as it increased from 2014 to 2015, what would be the cost of 1 kg of bananas in 2016?
(A) `49      (B) `28
(C) `35   (D) Cannot be determined

40. Percentage increase in the cost of 1 kg of bananas from 2011 to 2015 is (negative signs show a decrease)
(A) 5%   (B) 10%
(C) −5%   (D) −10%

41. If the total production of musambis during 2011-15 was in the ratio of 1 : 2 : 1 : 3 : 2, then the average cost of 1 kg of musambis during the period would be
(A) `28      (B) `29.44
(C) `29      (D) `30

42. If the total production of bananas had remained constant throughout the given period, the average cost of 1 kg of bananas during the period would have been

(A) `28	(B) `29
(C) `24	(D) `31

Directions for questions 43 to 46: These questions are based on the information given below.

The following line graph shows the sales of mobile phones by company ABC (in '000s), in the 4 quarters of the years 2010, 2012 and 2014.
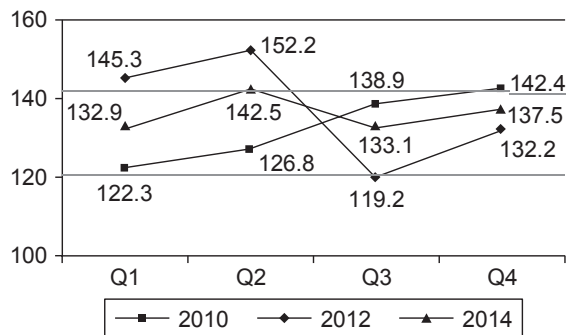
The table below gives the percentage change in the sales of mobile phones of ABC in the different quarters of each year compared to the previous year from 2010 through 2015.

% Change	Q1	Q2	Q3	Q4
2010	−7.95	−2.0	−1.6	4.9
2011	8.25	4.8	−1.6	9.55
2012	9.77	14.52	−12.81	−15.23
2013	5.4	1.9	2.6	2.7
2014	−13.26	−8.08	8.87	1.22
2015	3.9	3.4	7.15	3.8

43. During the period 2009 to 2015, in how many years did the mobile phone sales of ABC exceeded 5,50,000?

(A) 1	(B) 2
(C) 3	(D) 4

44. In which of the following years during the given period is the change in the number of mobile phones sold compared to the previous year, the lowest?

(A) 2010	(B) 2012
(C) 2013	(D) 2015

45. What is the difference in the number of mobile phones sold by the company in the years 2009 and 2014?

(A) 6840	(B) 7120
(D) 6680	(D) 7280

46. What is the average number of mobile phones sold by the company in the quarter in which the most number of mobile phones were sold during the period 2010 to 2015?

(A) 136.74	(B) 142.8
(C) 140.9	(D) 141.1

Directions for questions 47 to 50: These questions are based on the graph given below.
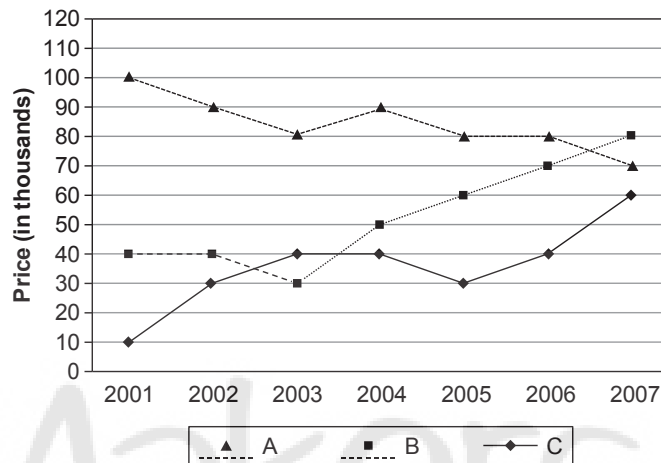
The above graph gives the prices of products A, B and C for the period 2001–2007. The prices for products A and C are in rupees per cubic metre while that of B is expressed in rupees per ton. Assume that one ton is equal to 1000 kg and one cubic metre of B weighs 600 kg.

47. The maximum increase in price per cubic metre for any product over two successive years was

48. If one cubic metre of C weighs 800 kgs, the largest difference in price between one ton of C and that of one ton of B was in the year

49. In 2005, the total sales of company (as measured in cubic metres) was made up of 50% A, 40% B and 10% C. The average realization per cubic metre in 2005 was

50. In 2008, the prices of A, B and C went up by 1%, 2% and 5%, respectively and the total sales measured in cubic metres were made up of 50% A, 30% B and 20% C. The average realization per cubic metre in 2008 was closest to

Directions for questions 1 to 5: Answer these questions on the basis of the information given below.

A survey was done regarding the number of mobile phone subscribers of six companies in a country over the period 2010 to 2016. The graph gives the percentage break up of number of subscribers of these six companies P, Q, R, S, T and U. It is observed that, each year, the total number of subscribers of these six companies increased by 25% over the previous year.
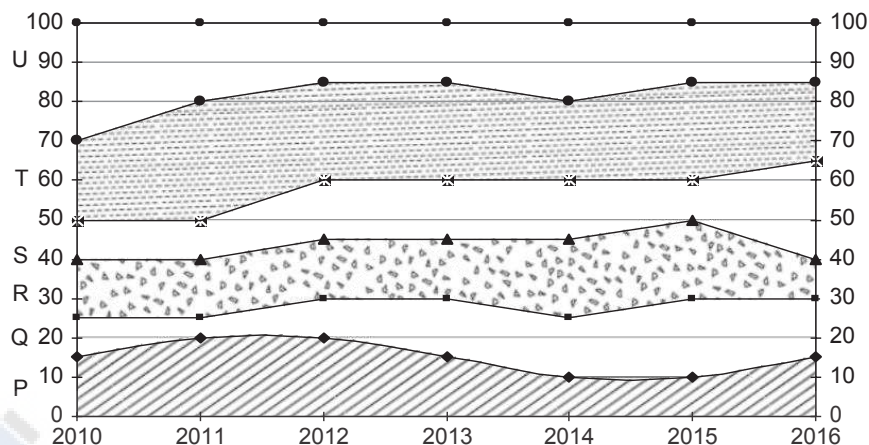
1. What is the percentage increase in the number of sub-scribers of company P from 2011 to 2016?
(A) 110%   (B) 121%
(C) 129%   (D) 137%

2. The ratio of the number of subscribers of company R in 2013 and company T in 2015 was approximately
(A) 2 : 7   (B) 5 : 13
(C) 4 : 9   (D) 7 : 13

3. Which company had the maximum numerical increase in the number of subscribers from one year to the next?
(A) P   (B) R   (C) S   (D) T

4. What was the percentage increase in the number of sub-scribers of all the six companies from 2010 to 2015?
(A) 225%   (B) 205%
(C) 180%   (D) 175%

5. How many companies had a decrease in the number of subscribers from one year to the next, at least once during the given period?
(A) 2   (B) 4
(C) 5   (D) 6

Directions for questions 6 to 9: Answer the following questions based on the information given below.

The following table gives the average selling price per ton of iron ore and the revenue generated from iron ore exports as a percentage of the total revenue for 15 multinational companies among A, B, C, D, E, F G, H, I, J, K, L, M, N and O. The average selling price is given in US dollars.
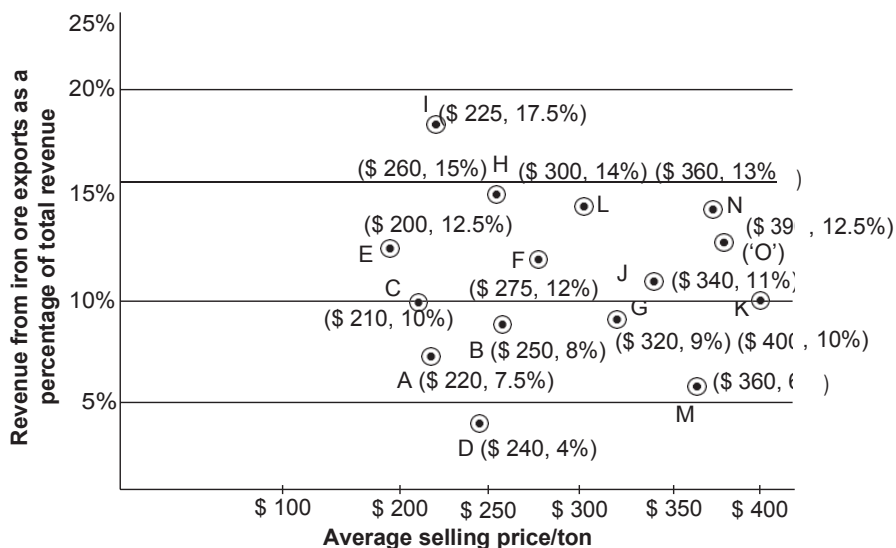
6. It was found that the total volume of iron ore exported by companies B and E were equal. Which of the following is true?
(A) The total revenue in both the companies were same.
(B) Total revenue of B was 2 times that of E.
(C) Total revenue of B was 3 times that of E.
(D) Total revenue of E was 2 times that of B.

7. It is expected that in 2017, the revenue from iron ore exports as a percentage of the total revenue will double for C and quadruple for M. Assume that in 2017, the total revenue for C is twice that of M and the volume of iron ore exported by both the companies is same. What is the approximate percentage increase in the selling price per tonne of iron ore for company C if the percentage increase of the same for M is 25?

(A) 150%   (B) 230%
(C) 260%   (D) 360%

8. If the total revenue is the same for the pairs of companies listed in the choices below, choose the pair that has approximately the same volume of iron ore exports.
(A) A and C   (B) F and N
(C) E and I   (D) D and M

9. If the total volume of iron ore exported by all the companies were equal, which company had the highest total revenue?
(A) D
(B) I
(C) M
(D) More than one of the above

Directions for questions 10 to 13: These questions are based on the following information.

Performance vs Price of players in IPL
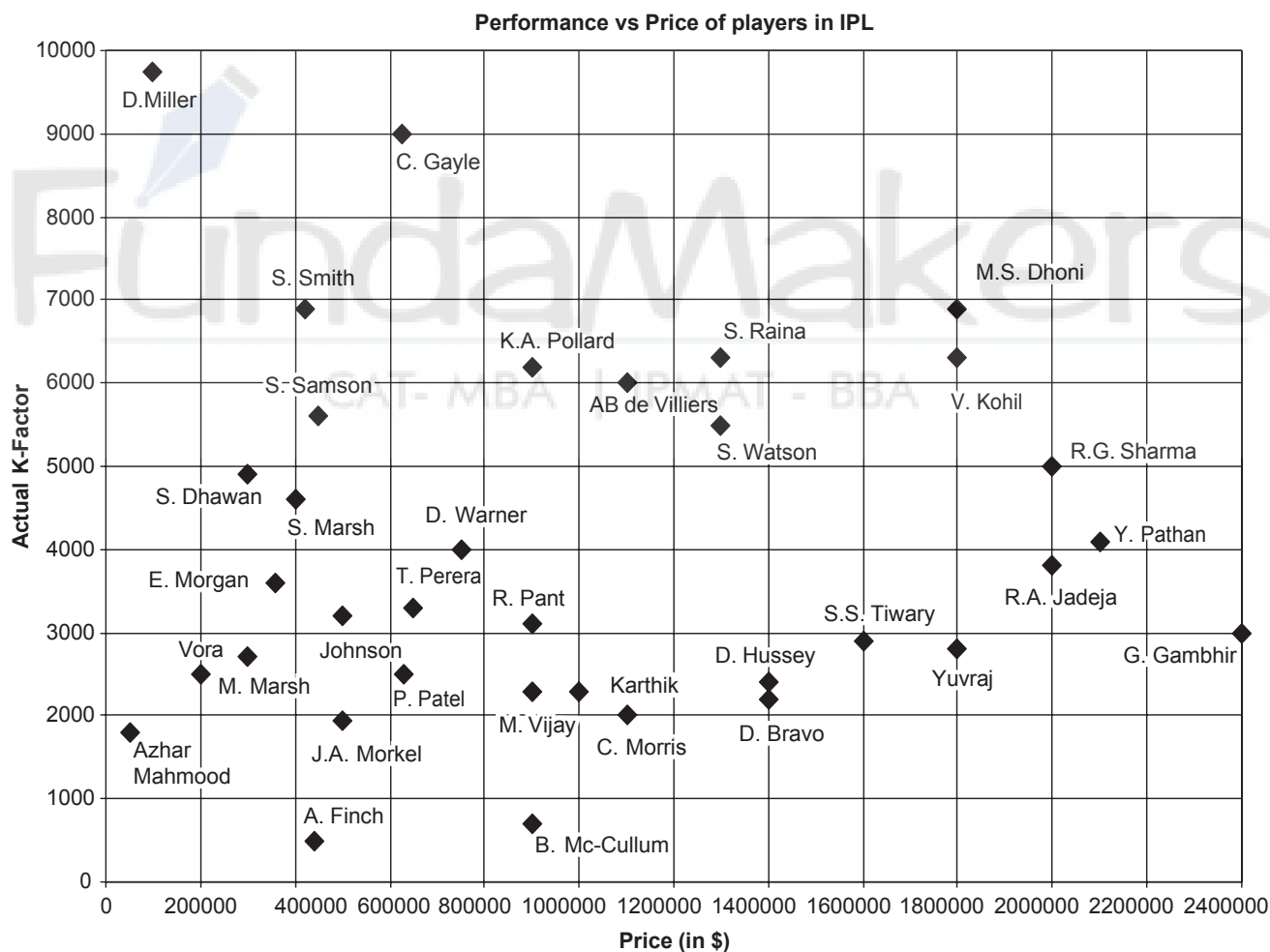
Note:
(1) For a player, the expected K-factor is directly proportional to the price.
(2) The return on investment (ROI) of a player is higher if his actual K-factor as a percentage of his price is higher.
(3) Expected (ROI) is the expected K-factor by the price.

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10. Among players whose price is more than $1 million, whose ROI is the highest?
(A) AB de Villiers (B) S. Raina
(C) M. S. Dhoni (D) R. G. Sharma

11. Which player was the biggest disappointment in terms of ROI?
(A) A. Finch (B) McCullum
(C) G. Gambhir (D) None of these

12. How many players had a higher ROI than Chris Gayle?
(A) 2 (B) 3
(C) 4 (D) 5

13. If the expected K-factor for a price of $600000 is 3000 and that for a price of $1800000 is 9000, then ROI for how many players was better than the expected ROI?
(A) 13 (B) 15
(C) 17 (D) 19

Directions for questions 14 to 16: Answer these questions on the basis of the information given below.

The income and expenditure of two companies A and B from 2012 to 2017
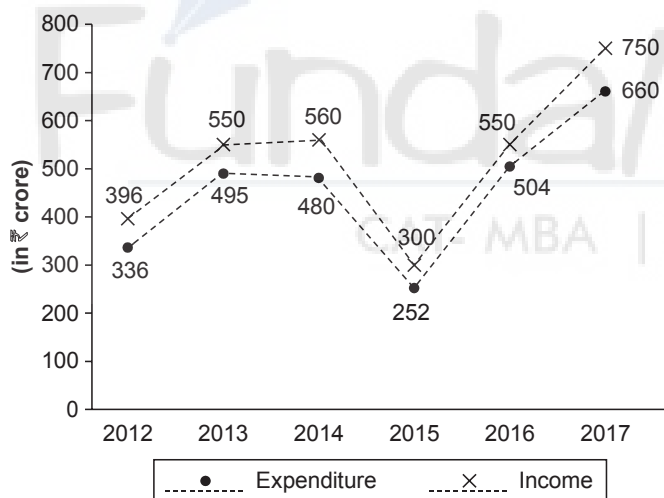
Ratio of expenditure and income of the two companies

Year	Expenditure	Income
2012	4 : 3	6 : 5
2013	6 : 5	6 : 5
2014	7 : 5	4 : 3
2015	3 : 4	2 : 3
2016	4 : 5	5 : 6
2017	5 : 6	7 : 8

Note:
(i) Profit = Income – Expenditure;
(ii) Profit % = $\dfrac{\text{Profit}}{\text{Expenditure}} \times 100\%$

14. What is the profit earned (in ` crore) by company B in 2012, 2014 and 2017 together?

15. What is the difference (in ` crore) between the profit earned by company A and company B over the years 2013, 2014 and 2015 together?

16. In which year, was the income of company A, the second highest?

Directions for questions 17 to 20: Answer the questions on the basis of the information given below.

The following graph gives the details of population of a country, its per capita consumption of rice and the production of rice in the country for a period of six years.

Production of rice

Population
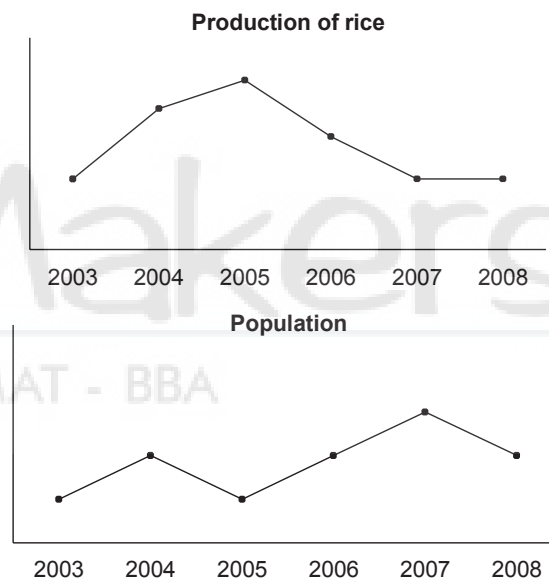
If the total consumption of rice is more than the production of rice in the country, the extra rice is imported that year and if the total consumption is less than the production in that year, the excess rice is exported the very same year.

17. At least in how many of the given years did the country export rice?
(A) 0 (B) 1
(C) 2 (D) Cannot be determined

18. At most in how many years did the consumption of rice in the country when compared to previous year show an increase?
(A) 5 (B) 4
(C) 3 (D) 2

19. If it is known that the country exported rice in the year 2003, then at most in how many years did it import rice in the given period?

(A) 5   (B) 3

(C) 2   (D) 1

20. At most in how many years, even though the population of the country increased, did the total consumption of rice in the country decrease, both when compared to the previous year?

(A) 1   (B) 2

(C) 3   (D) 4

ANSWER KEYS

Exercise-1

1. 1992	10. (A)	19. (B)	28. 2	37. (D)	46. (B)
2. 47	11. (D)	20. (D)	29. 9.6	38. (A)	47. (D)
3. 36.36	12. (B)	21. (A)	30. 57	39. (C)	48. (A)
4. 1875	13. (A)	22. (A)	31. (C)	40. (B)	49. (B)
5. 1997	14. (D)	23. (D)	32. (B)	41. (A)	50. (D)
6. (C)	15. (D)	24. (C)	33. (B)	42. (D)	
7. (B)	16. (D)	25. (B)	34. (D)	43. (C)	
8. (C)	17. (A)	26. 2001	35. (C)	44. (B)	
9. (D)	18. (A)	27. 12.6	36. (A)	45. (D)	

Exercise-2

1. (D)	10. (D)	19. 0	28. (B)	37. (B)	46. (B)
2. (A)	11. (C)	20. 4	29. (D)	38. (A)	47. 20000
3. (B)	12. (C)	21. 5	30. (B)	39. (D)	48. 2001
4. (C)	13. (D)	22. 5	31. (A)	40. (A)	49. 57.4
5. (B)	14. (C)	23. (C)	32. (B)	41. (B)	50. 62.65
6. (A)	15. (C)	24. (C)	33. (D)	42. (C)	
7. (D)	16. (A)	25. (A)	34. (B)	43. (C)	
8. (C)	17. (A)	26. (A)	35. (A)	44. (A)	
9. (C)	18. 6	27. (C)	36. (B)	45. (A)	

Exercise-3

1. (C)	4. (B)	7. (C)	10. (A)	13. (B)	16. 2014	19. (A)
2. (B)	5. (D)	8. (D)	11. (B)	14. 116	17. (D)	20. (B)
3. (C)	6. (B)	9. (D)	12. (C)	15. 19	18. (C)	

EXERCISE-1

1. The ratios of actual exports of tea to the estimated exports of tea from 1992 to 1997 are 3 : 2, (1.5), 9 : 8 (125), 13 : 12 (1.083), 12 : 10, (1.2), 14 : 15 (0.93), 17 : 17 (1) So, in 1992 the ratio of actual exports is the highest when compared to estimated exports.
Hence, in 1992, the ratio of the actual exports to the estimated exports is the highest.

2. Total actual exports for the given period
= (3 + 9 + 13 + 12 + 15 + 17) lakh = 69 lakh
Total exports to the U.S. = 1.6 + 4 + 6 + 6 + 5 + 10
= 32.6 lakh
Required per cent = (32.6/69) (100) = 47%

3. Let the actual value of 1 dollar be `x. Number of dollars

to be received when 1 dollar is `40 = $\dfrac{5.5 \times 10^5}{40}$

Number of dollars received when 1 dollar is `x = $\dfrac{5 \times 10^5}{x}$

$\Rightarrow \dfrac{5.5 \times 10^5}{40} = \dfrac{5 \times 10^5}{x} \Rightarrow x =$ `36.36

Alternate Solution

The decrease in exports is due to the appreciation of the rupee.

Percentage decrease in exports = $\dfrac{50000}{5,50,000} \times 100 = 9.09\%$

The percentage appreciation in rupee would be the same, i.e., 9.09%.

\ Value of \$1 = $40 \times \dfrac{(100 - 9.09)}{100} = 40 \times \dfrac{90.91}{100} = 36.36$

4. Quantity exported to the US = $\dfrac{6 \times 10^5}{8 \times 40} = 1875$ kg

5. The ratio of exports of tea to the US to actual exports from 1992 to 1997 are in the same order as 1.6 : 3 (i.e., 0.53) 4 : 9 (i.e., 0.44); 6 : 13 (i.e., 0.46) 6 : 12 (i.e., 0.50); 5 : 14 (i.e., 0.33); 10 : 17 (i.e., 0.58)
Hence, in 1997, the required ratio is the highest.

6. If the number of students in 2010 is 100, the number of students in 2013 would be

$100 \times \dfrac{107}{100} \times \dfrac{106}{100} \times \dfrac{102}{100} = 115.68$

The percentage increase M 16.

7. The fee in 2013 = $24000 \times \dfrac{112}{100} \times \dfrac{109}{100} = 31.740$

8. Number of students in 2012 = $\dfrac{23,348}{1.09 \times 1.02} = 21,000$

9. The number of students in the coaching institute went up by 20% from 2012 to 2014.
Assume that the total number of students who took coaching in 2012 were 100. The number in 2014 would be 115.
The share of the coaching institute in 2014

= $\dfrac{32 \times 1.11}{1.15} \times 100 = \dfrac{35.58}{115} \times 100 \cong 31\%$

10. The number of students in 2011 = $\dfrac{29.375 \times 10}{12,500} = 23,500.$

Number of students in 2013 = $23,500 \times 1.06 \times 1.02$
= 25408
Fee collected per student in 2013
= $12,500 \times 1.12 \times 1.09 = 15260$
Total fee collected = 38.77 crore

11. Let the expenditures of the companies P and Q in the year 2011 be $6x$ and $8x$, respectively.
The profit of company P in the year 2011

= $\dfrac{35}{100} \times 6x = 2.1x$

The profit of company Q in the year 2011

= $\dfrac{40}{100} \times 8x = 3.2x$

The required ratio = $2.1x : 3.2x = 21 : 32.$

12. Let the expenditure of company R in the year 2009 be `x crore.

Profit = $\dfrac{35}{100} x = 0.35x$

$x - 0.35x = 2.99$
$0.65x = 2.99$

$x = \dfrac{2.99}{0.65} = 4.6$

Income = Profit + Expenditure = 0.35 (4.6) + 4.6 = 6.21.

13. Profit percentage = $\dfrac{\text{Profit}}{\text{Expenditure}} \times 100$

Profit = $\dfrac{\text{Expenditure} \times \text{Profit percentage}}{100}$

Income = Expenditure + $\dfrac{\text{Expenditure} \times 45}{100}$

7.25 = 1.45 (expenditure)

Expenditure = $\dfrac{7.25}{1.45} = 5$ crore

14. We do not know the expenditures of the companies, so we can't find which company had the highest profit.

15. If the incomes of P, Q and R are in the ratio of 5 : 4 : 3, their expenditures approximately would be in the ratio 74 : 57 : 50.

    The profits would be in the ratio 26 : 23 : 10.

    The required percentage = $\dfrac{26}{33}$ × 100 = 79%

16. Given S.P. = 3.9 lakh

    $3.9 = \text{C.P.}\left(1+1\dfrac{30}{100}\right)$

    ⇒ C.P. = 3 lakh

    \ Profit = S.P. - C.P. = 3.9 - 3 = 0.9 lakh

17. Let the C.P. of A and C in 2003 and 2007 respectively, be 100. Then the

    S.P. of A in 2003 = 120

    S.P. of C in 2007 = 145

    \ Required ratio = $\dfrac{120}{145} = \dfrac{24}{29}$

18. Let the S.P. of B in 2004 and 2005 be 100. Therefore,

    C.P in 2004 = $\dfrac{160}{1.4}$

    C.P in 2005 = $\dfrac{100}{1.45}$

    \ Required ratio = $\dfrac{100}{1.4} : \dfrac{100}{1.45}$

    = 1.45 : 1.4 = 29 : 28

19. Let the S.P. of B in 2006 and its C.P. in 2007 be `100. S.P. of B in 2007 = 150

    \ Required ratio = 100 : 150 = 0.66.

20. Percentage rise or fall in A is as follows:

    2003: $\dfrac{20}{40}$ × 100 = 50%

    2004: $\dfrac{15}{20}$ × 100 = 75%

    2005: $\dfrac{15}{35}$ × 100 = 42.85%

    2006: $\dfrac{5}{50}$ × 100 = 10%

    2007: $\dfrac{10}{45}$ × 100 = 22.22%

21. Expenditure of P = `85 lakh.

    As profit percentage = 14, profit = $\dfrac{14}{100} \times 85$ = 11.9.

    \ Income = 85 + 11.9 = 96.9 lakh.

22. Income = Expenditure + Profit

    The expenditure of P and Q in 2013 would be 200 and 90, respectively ($224 = 200 + 200 \times \dfrac{12}{100}$)

    The required ratio = 20 : 9

23. Let the expenditure be 100 each in 2009.

    Income of P in 2009 = 100 + 100 × $\dfrac{8}{100}$ = 108 .

    Income of Q in 2009 = 100 + 100 × $\dfrac{13}{100}$ = 113.

    The required ratio = 108 :113.

24. As profit = Expenditure × Profit percentage

    Expenditure = $\dfrac{4.23}{9}$ 100 = 47 crore.

    Income = 47 + 4.23 = 51.23 crore.

25. Let the profit be `4 crore and `5 crore, respectively. If the expenditure of P and Q are x and y, respectively.

    $\dfrac{11}{100}$ × x = 4 crore \ $x = \dfrac{400}{11}$ crore

    $\dfrac{13}{100}$ × y = 5 crore \ $y = \dfrac{500}{13}$ crore

    The required ratio = 52 : 55.

26. In the year 2001, the number of employees and profit per employee per annum is also the maximum. So, in the year 2001, the profit of the company was the highest.

27. Profit in year 1998 = 145 × 2.6 lakh

    30% of total sales value in the year 1998 = 145 × 2.6 lakh

    Total sales value in the year 1998

    = $\dfrac{145 \times 2.6 \times 100}{30}$ lakh = 1257 lakh = 12.57 crore

28. Average number of employees for the given period

    = $\dfrac{120 + 145 + 218 + 150 + 192}{5}$ = 165

    In the years 1999 and 2001, the number of employees is more than the average number of employees.

29. Profit made in the year 2001 = 192 × 3.2 lakh. So, 192 × 3.2 lakh is 64% of the profit made in 2002.

    Profit in 2002 = $\dfrac{192 \times 3.2}{64}$ × 100 lakh

    = 960 lakh = `9.6 crore

30. Profit in the year 1997 = 120 × 2 lakh = `240 lakh

    Profit in the year 1998 = `145 × 2.6 lakh = `377 lakh

    Required percentage = $\dfrac{377 - 240}{240}$ × 100 = 57%

31. The approximate percentage growth in net profit of company A from 2006 to 2012 was

    1.1 × 1.15 × 1.17 × 1.08 × 1.12 × 1.1 = 1.969 ≈ 97%

32. If the net profit of company B in 2006 was `100, its net profit in 2010 would have been approximately 100 × 1.05 × 1.07 × 1.02 × 1.1 = 126 in 2010.
Hence, the value in 2010 would be 1.26 times the value in 2006. Since the actual profit in 2006 is `190 crore, the required value = 180 × 1.26 = 227 crore

33. Assume that the net profits of company A in 2006 was $100x$ and that of company B was $100y$.
The net profit of company A in 2009 = $148x$
That in 2010 = $160x$
Increase in profit = $12x$
The net profit of company B in 2009 = $115y$
That in 2010 = $126.5y$
Increase in profit = $11.5y$
$12x > 11.5y$
$\therefore \dfrac{x}{y} > \dfrac{11.5}{12} = \dfrac{23}{24}$
Hence, the ratio of 10 : 13 is not possible.

34. The cost of pill for each company is as follows:
Johnson and Johnson = 200 × 1.1 + 300 × 1.3 + 100 × 1.2 + 400 × 1.4 = 1290
Pfizer = 250 × 1.1 + 150 × 1.3 + 200 × 1.2 + 900 × 1.4 = 1270
Roche = 100 × 1.1 + 300 (1.3 + 1.2 + 1.4) = 1280
Sanofi = 200 (1.1 + 1.3 + 1.2) + 400 × (1.4) = 1280
Ell Lilly = 250 (1.1 + 1.3 + 1.2 + 1.4) = 1250
The cost is the least for Ell Lilly.

35. The weight of the pill is 1000 mg.
Johnson and Johnson = 200 + 300
= 500 and 300 + 100 = 400
Pfizer = 250 + 150 < 500 and 150 + 200 < 400
Roche = 100 + 300 < 500 and 300 + 300 > 400
Sanofi = 200 + 200 < 500 and 200 + 200 = 400
Ell Lilly = 250 + 250 = 500 and 250 + 250 > 400
For two of the companies the given condition is satisfied.

36. Cost of the pill for each company is as follows:
Johnson and Johnson
= 200 × 1.21 + 300 × 1.3 + 100 × 1.44 + 400 × 1.4 = 1336
Pfizer = 250 × 1.21 + 150 × 1.3 + 200 × 1.44 + 400 × 1.4 = 1345.5
Roche = 100 × 1.21 + 300 (1.3 + 1.44 + 1.4) = 1363
Sanofi = 200 (1.21 + 1.3 + 1.44) + 400 × 1.4 = 1350
Ell Lilly = 250 (1.21 + 1.3 + 1.44 + 1.4) = 1337.5
The cost will be the highest for Roche.

37. In none of the groups of ten matches, given in choices (1), (2), (3) and (4), did both Amol and Brag score the same number of runs. Number of runs scored by Amol from the 31st to the 40th match = 40 × 60 – 30 × 70 = 300
Similarly, values for others can be determined.

38. By similar calculations as above, Amol has the highest average from the 61st to the 70th match.

39. His least possible highest score from the 31st to the 40th match will be when he scored (the maximum) 1800 runs in 10 matches. The least possible highest score will be 185 and the other 9 scores will be 184, 183...175.

40. It happened for the 31st to the 40th match, when the number of runs scored by Chris is more than that of Amol but less than that of Brag.

41. Capacity = $\dfrac{\text{Output}}{\text{Utilization}}$ × 100 = $\dfrac{9.1}{45}$ × 100 = 20.2 bn tons

42. In 1996–1997 → $\dfrac{8.9}{75}$ × 100 ≅ 11.86
In 1991–1992 → $\dfrac{9}{60}$ × 100 = 15
In 1994–1995 → $\dfrac{9.1}{45}$ × 100 ≅ 20.2
In 1989–1990 → $\dfrac{4.5}{45}$ × 100 = 10

43. In Statement I, the decreases are not in the same proportion.
In Statement II:
1991–92, capacity = 15
1993–94, capacity = 32
Statement III is obviously wrong (by observation).

44. As shown in the graph during (93–94) to (94–95), imports increased from 150 to 200 and exports decreased from 600 to 500.

45. Capacity in 1989–1990 = $\dfrac{4.5}{45}$ × 100 billion tons
= 10 billion tons
Capacity in 1996–1997 = $\dfrac{8.9}{75}$ × 100 billion tons
= 11.9 billion tons
Average annual increase = $\left| \dfrac{11.9 - 10}{10} \right| \times \dfrac{1}{7} \times 100 \cong 2.7\%$

46. It is given that the profit in 2012 was `1 crore.
$\therefore$ 109 (Sales) > 107 (Expenses)
As the corresponding ratio of sales and profit in 2011 and 2013 are more than $\dfrac{109}{107}$, we can definitely conclude that the company made a profit in these years.

47. The given information is not sufficient to find out in which year the profit was the least.

48. From 2010 to 2011, the percentage increase in sales was 14%, which was the highest.

49. Sales in 2012 = 272.5 crore
Profit in 2012 = 271.5 crore
$107x = 271.5$ $\therefore 112x = 284.2$
Sales is 2013 = $\dfrac{118}{100}$ × 250 = 295 crore.
Profit in 2013 = 295 – 284.2 = 10.8 crore.

50. As the value of sales and expenditure cannot be determined, we cannot find the percentage decrease in profits.

1.

Year	Total sales	Frost-Free %
2010	75	12%
2011	100	24%
2012	125	24%

\Total sales of Samsung Frost-Free Refrigerators

= (`75 × 0.12 + 100 × 0.24 + `125 × 0.24) lakh

= (`9 + `24 + `30) = `63 lakh

2. Year 2011: Ratio of the total sales of the companies Godrej, Electrolux, LG and Samsung = 150 : 100 : 75 : 100 = 6 : 4 : 3 : 4

Given that it is same as the ratio of air conditioner sales.

A   E   L   S

6 :   4 :   3 :   4

Now we know that for Samsung in 2011, the value of the Air Conditioner sales = 24% of (Total sales) = (0 × 20)(100) = `20 lakh

From the above ratio, 4k = `20 lakh

\ 3k = `15 lakh.

3. By observing the bar chart, the sales of Samsung Washing Machines as a percentage of the total sales of Samsung brand, experienced the steepest increase (from 12 percentage points to 28 percentage points) in 2014. Also, the total sales of Samsung experienced the steepest climb in the same year. 2014 must be the answer.

Alternative method:

Year	Value of sales of Washing M/Cs Samsung
2010	75 × 32% = `24 lakh
2011	100 × 20% = `20 lakh
2012	125 × 20% = `25 lakh
2013	150 × 12% = `18 lakh
2014	200 × 28% = `56 lakh
2015	175 × 32% = `56 lakh

By observation, the percentage increase is the highest in the year 2014.

4. By observation, Electrolux and LG must have the highest and the least percentage changes, respectively. By this we can eliminate choices (B) and (D). Among the other two brands we can observe that increase from 2010 to 2015 is the same but the base (in 2010) is lesser for Samsung. Hence, Samsung will experience higher growth rate. Thus choice (C) is correct.

5. The sales of Q in the different years are

2007 – 470 × 1.203 = 565

2008 – 490 × 1.248 = 612

2009 – 465 × 1.195 = 556

2010 – 545 × 1.208 = 655

2011 – 610 × 1.216 = 742

The difference is the least in 2008.

6. The profit of company Q in 2007 = 20.3 × 470 = 95.4

The profit of company Q in 2011 = 21.6 × 610 = 131.7

The percentage increase = $\dfrac{131.7 - 95.4}{95.4} \times 100$

$= \dfrac{36.3}{95.4} \times 100 = 38.1\%$

7. The profit of company P in the different years are as follows:

Year	Profit
2007	$680 - \dfrac{680}{1.172} = 100$
2008	$720 - \dfrac{720}{1.181} = 110$
2009	$745 - \dfrac{745}{1.175} = 111$
2010	$810 - \dfrac{810}{1.186} = 127$
2011	$920 - \dfrac{920}{1.192} = 148$

The average profit = $\dfrac{100 + 110 + 111 + 127 + 148}{5}$

$= \dfrac{596}{5} = 119.2$

8. The expenses of companies P and Q and the percentage increase in the different years are as follows:

Year	P	%	Q	%
2007	580		470	
2008	610	5	490	4
2009	634	4	465	–5
2010	683	7.5	545	17
2011	772	13	610	12

It is true for three years, such as 2008, 2009 and 2011.

	Percentage			
Years	2006	2007	2008	2009
Cell phones	10	15	22	25
Laptops	20	20	20	20
Washing machine	10	10	15	15
Fridges	10	12	15	15
Televisions	50	43	28	25

9. It could have increased continuously for cell phones, for fridges (if the total revenue in 2009 was more than that in 2008) and for washing machines.

10. All the four statements can be simultaneously true.

11. Let the total revenue in 2006 be x and that in 2009 be y.
$y > x$
Revenue from sales of televisions in 2006 = $x/2 = 0.5x$
Revenue from the sales of cell phones in 2007 = 15% of the total sales = $0.15y$.
To find the maximum ratio, revenue from total sales in 2006 and 2007 must be nearly equal.
\ It can be at most
$\dfrac{0.50}{0.15} = 3.33$ times the revenue from sales of cell phones in 2007.

12. The total revenue in 2007 is more than that in 2009.
As the share of laptops remain at 20% and the share of televisions decreased, these two items would definitely show a decrease.

13. As it is given that the company made a profit in 2002, sales is more than the expenses in that year. As in each year from 2003, the growth in sales is more than the growth in expenses, the company would have made a profit in each of the given years.

14. As it is given that the company made a profit in 2002 and the percentage increase in sales in each year is more than the expenses, the profit would increase each year and would be the highest in 2007.

15. Even though the percentage increase in sales is the same in 2005 and 2007, as the percentage increase in 2007 is on a higher base, the increase in expenses will be highest in 2007.

16. As the percentage increase in sales values are the highest in 2006 and 2007, and those being the years at the end, we need to only check for the years 2006 and 2007. Assume that the value of sales in 2005 is 100. The sales in 2006 will be 122 and that in 2007 will be 122 × $\dfrac{119}{100}$ = 145.18.
\ The increase is the highest in 2007.

17. Assume that the sales in 2002 was 200 and the expenses is 100. The corresponding values in the following years are as follows:

Year	2003	2004	2005	2006	2007
Sales	220	253	278.3	339.5	404
Expenses	106	110.2	119.0	127.3	137.5

\ The profit in 2007 = 404–137.5=266.5
The required ratio = $\dfrac{266.5}{114} = \dfrac{7}{3}$

Solutions for questions 18 to 22:
It is given that the crude consumption, compared to the previous year, decreased in every year and the share of petroleum consumption is also given for each of the years. From these two, regarding consumption of petrol we can say the following.
(i) Petroleum consumption will definitely decrease, if the share of petrol in crude consumption decreases.
(ii) Petroleum consumption may increase or decrease or remain the same, if the share of petrol in crude consumption increases.
The same applies for the production of petrol also, but in alternate years.

18. The maximum possible number of years in which the production of petroleum increased is 6, i.e., 2006, 2008, 2010, 2012, 2014 and 2015.

19. As the total crude consumption decreased every year from 2004, the crude consumption in 2011 was the lowest till that point, starting from 2004. As petroleum consumption is given as a percentage of crude consumption and as the percentage in 2010 is the lowest till that point, the petroleum consumption would be lowest in 2010. The consumption in 2011 would also be lower than in 2010.

20. The minimum possible number of years is 4, i.e., 2005, 2010, 2011 and 2015.

21. The minimum possible number of years is 5, i.e., 2005, 2007, 2009, 2011 and 2013.

22. The consumption in 2005 is 24%
$\dfrac{5}{4}$ times the consumption in 2005 = $\dfrac{5}{4}$ (24%) = 30%
But the consumption decreases every year.
\ The per cent consumption should be more than 30 for the years following 2005 and it should be less than 30 for the years preceding 2005.
This happens only in years 2007, 2008, 2009, 2013 and 2014.

23. Revenue in 2012
= 52,000 × 41 + 75,500 × 34 – 6,500 × 3
= 21,32,000 + 25,67,000 – 19,500 = 46,79,500

Revenue in 2013
= 73,000 × 45 + 80,800 × 35 – 7,200 × 3
= 32,85,000 + 28,28,000 – 21,600 = 60,91,400

The percentage increase = $\dfrac{14,11,900}{46,79,500}$ × 100 = 30.2%

24. As the export as well as the domestic price is the highest in the year 2016, the average revenue realized per kg of the product will be the highest in 2016.
The revenue in 2016
= 82,000 × 49 + 107,200 × 43 – 7,800 × 3
=40,18,000 + 46,09,600 – 23,400
= 86,27,600 – 23,400 = 86,04,200

The revenue per kg of production = $\dfrac{86,04,200}{1,97,000}$ = 43.6

25. It can be seen that there is a significant increase in the domestic price in 2014 and the quantity in the domestic market also shows a significant increase.
\ The percentage increase in domestic revenue would be the highest in 2014.
Domestic revenue in 2013 = 80,800 × 35 = 28,28,000
Domestic revenue in 2014 = 1,14,300 × 41 = 46,86,300

The required percentage = $\dfrac{18,58,300}{28,28,000}$ × 100 = 65.7%

26. The approximate values for the different years would be as follows:

2011 = $\dfrac{90 \times 32}{90 \times 32 + 42 \times 38}$

2012 = $\dfrac{75.5 \times 34}{75.5 \times 34 + 52 \times 41}$

2013 = $\dfrac{80.8 \times 35}{80.8 \times 35 + 73 \times 45}$

2014 = $\dfrac{114.3 \times 41}{114.3 \times 41 + 67 \times 47}$

2015 = $\dfrac{89 \times 42}{89 \times 42 + 75 \times 45}$

2016 = $\dfrac{107 \times 43}{107 \times 43 + 82 \times 49}$

It can be easily seen that the ratio is the highest in 2011. The required value would be

$$\dfrac{90 \times 32}{90 \times 32 + 42 \times 38 - 5 \times 3} \times 100$$

$$= \dfrac{2880}{2880 + 1596 - 15} = \dfrac{2880}{4461} \times 100 = 64\%$$

27. We can say that there is a definite increase in per capita income only during the below conditions:
(i) The national income increases and the population decreases or remains constant.
or
(ii) The national income remains constant and the population decreases.
This happens in 2012 and in 2016.

28. The per capita income definitely decreases only during the below conditions:
(i) The national income decreases and the population remains constant or increases.
or
(ii) The national income remains constant and the population increases.
This happens only in 2014.

29. The per capita income can remain constant only if both the national income and the population either simultaneously increase or simultaneously decrease or remain constant.
This happens in 2011, 2013 and 2015.

30. The number of males in 2011

$= \dfrac{1073}{2073} \times 8.4 = 4.351$ lakh × 8.4 = 4.351 lakh

The number of males in 2012

$= \dfrac{1061}{2061} \times 8.7 = 4.48$ lakh × 8.7 = 4.48 lakh

The required percentage = $\dfrac{0.13}{4.35} \times 100 = 3\%$

31. The number of females in the different years are as follows:

$2010 = \dfrac{1000}{2031} \times 7.3 = 3.59 \times 7.3 = 3.59$

$2011 = \dfrac{1000}{2073} \times 8.4 = 4.05 \times 8.4 = 4.05$

$2012 = \dfrac{1000}{2061} \times 8.7 = 4.22 \times 8.7 = 4.22$

$2013 = 2013\dfrac{1000}{2089} \times 4.2 = 4.40 \times 4.2 = 4.40$

$2014 = \dfrac{1000}{2007} \times 8.1 = 4.03 \times 8.1 = 4.03$

$2015 = \dfrac{1000}{1981} \times 7.8 = 3.93 \times 7.8 = 3.93$

The percentage increase is the highest in 2011.

32. The number of males in 2013 = 9.20 – 4.40 = 4.80 lakh

The total literates = $\dfrac{56.3}{100} \times 9.2 = 5.18$ lakh × 9.2
= 5.18 lakh
The number of literate males

$= \dfrac{64.8}{100} \times 4.8 = 3.11 \times 4.8 = 3.11$

The number of literates among females
= 5.18 – 3.11 = 2.07
The percentage of literates among females

$= \dfrac{2.07}{4.40} \times 100 = 47.0\% \times 100 = 47.0\%$

33. As the ratio of males to females was the highest in 2013 and the total population was also the highest in that year, the ratio of literate males to literate females would be the highest in that year.

34. Sales of A in 2008 = 20% of 100 (assuming total as 100)
Sales of A in 2012 = 25% of 144
\ The required percentage

$$= \frac{36 - 20}{20} \times 100 = 80\%$$

35. Share of D = 20%
Total sales in 2014 = 2,85,000 × (1.2)^3 = 4,92,480
Sales of company D = 0.2 × 4,92,480 ≈ 98,500.

36. The increase in total sales from 2008 to 2016 would be 100 × (1.2)^4 = 207.36
Any company which had an increase in share would definitely have a more than 100% increase companies A, B and E.

37. Just by observing the graph, company B has more than doubled its market share. Therefore, it would have the highest percentage increase in sales from 2010 to 2016.

38. In 2011, cost of 1 kg of musambis = `20
Cost of 1 dozen bananas = `30
1 kg = 10 bananas

\ Cost of 1 kg of bananas = $\frac{10}{12}$ × 30 = `25

Difference = `5

39. As we do not know how many guavas we get per kg in 2016, the cost of 1 kg of guavas cannot be found.

40. In 2011, cost of 10 bananas = `30

\ Cost of 1 kg = $\frac{10}{12}$ × 30 = 25

In 2015, cost of 12 bananas = 35
\ Cost of 1 kg = 26.25

Percentage increase = $\frac{1.25}{25}$ × 100 = 5%

41. Let the production be x, $2x$, x, $3x$, $2x$ kg, respectively.
\ Average

$$= \frac{x \times 20 + 25 \times 2x + x \times 25 + 30 \times 30 + 40 \times 2x}{x + 2x + x + 3x + 2x} = 29.44$$

42. $\dfrac{25 + 25 + 18.3 + 25 + 26.25}{5}$

[∵ The production is constant; the average will now be the average of prices]
= 23.9

43. The mobile phone sales of ABC in each quarter can be calculated based on the sales values for the year 2010, 2012 and 2014 and the table given.

Sales	Q1	Q2	Q3	Q4	Total
2009	132.9	129.38	141.18	135.74	539.2
2010	122.33	126.79	138.92	142.39	530.43
2011	132.42	132.88	136.7	156	558
2012	145.36	152.18	119.18	132.24	548.96
2013	153.21	155.07	122.28	135.81	566.37
2014	132.9	142.54	133.13	137.47	546.04
2015	138.08	147.39	142.65	142.69	570.81

As can be seen from the table, the sales exceeded 5,50,000 in 2011, 2013 and 2015.

44. From 2009 to 2010, the difference in the annual sales is only 8770.

45. The difference is (546.04 – 539.2) × 1000 = 6840.

46. From the table above, we can see that the sales were highest in Q2 during 2010 to 2015. Average number of mobiles sold = (126.79 + 132.88 + 152.18 + 155.07 + 142.54 + 147.39)/6 = 142.81

47. For A: Maximum increase in price (`/m^3) is 10000 (2003–2004).
For B: Maximum increase in price (`/ ton) is `20000 in (2003–04).
Converting this amount in (`/m^3) = (20000) (600)/1000 = 12000
For C: Maximum increase in price (`/m^3) = 20000 (2001–02 and 2006–07)

48. Price of C is expressed in (`/m$^3$). To convert it into (` / ton), it has to be multiplied with a constant factor k = (1000/800) = 5/4

Year	Difference in prices (in thousands of rupees)
2001	40 – 10 × $\frac{5}{4}$ = 37.5
2005	60 – 30 × $\frac{5}{4}$ = 22.5
2006	70 – 40 × $\frac{5}{4}$ = 20
2003	40 × $\frac{5}{4}$ – 30 = 20

The largest difference occurs in the year 2001.

49. Average realization
= (0.5) (80) + (0.4) (60) (3/5) + (0.1) (30)
= 40 + 14.4 + 3 = `57.4/m³

50. Price in the year 2008 (in `/m³).
(P)A = Price of A = 70 + (1/100) (70) = 70.7

(P)B = Price of B = [80 + (2/100) (80)] $\frac{3}{5}$

= 81.6 = (81.6) (3/5) ≅ 49
(PC) = Price of C = 60 + (5/100) (60) ≅ 63
Average realization
= (0.5) (70.7) + (0.3) (49) + (0.2) (63)
= 35.35 + 14.7 + 12.6
= `62.65

EXERCISE-3

1. Let the total subscribers in 2011 be 100.
The total subscribers in 2016 would be 305.
The subscribers of company P in 2011 = 20

Subscribers of company P in 2016 would be $\frac{15}{100}$ × 305

= 45.75

The percentage increase in subscribers = $\frac{25.75}{20}$ × 100

= 128.75%.

2. Let the total subscribers in 2013 be 100.
Total subscribers in 2015 would be 156.25.

Number of subscribers of R in 2013 = $\frac{15}{100}$ × 100 = 15

Number of subscribers of T in 2015 = $\frac{25}{100}$ × 156.25

= 39.06.
The required ratio = 5 : 13.

3. We need to only check for the last two years as the number of subscribers is continuously increasing. The maximum increase would be for company S in 2016 as its share in the total doubled.

4. From the first question in the set we can see that over a period of five years, the total number of subscribers increased from 100 to 305. That is 205% increase.

5. Company P in 2013, Q in 2011, R in 2016, S in 2015, T in 2014 and U in 2011. All the six companies had a decrease in the number of subscribers at least once.

6. Selling price/ton of company B is $225 and that of E is $200.
If K tons are exported by both the companies, then the total revenue of the companies is

$\frac{255K}{0.08}$ = 3187.5 K for company B and $\frac{200K}{0.125}$ = 1600K for company E.

Therefore, the total revenue of company B is approximately double that of company E.

7. In 2012, iron ore exports as a percentage of total revenue of the companies C and M will be 20% and 24%, respectively.
Let the volume of iron ore exported by both the companies be K ton.
Selling price /ton of M = 360 (1.25) = $450

Total revenue for M = $\frac{450K}{0.24}$ = 1875K

Therefore, total revenue of C = (1875K)2 = 3750K
Thus, selling price/tonne for company C = 3750(20%)
= $750
Therefore, the percentage increase in the selling price

for company C = $\frac{750 - 210}{210}$ × 100% ≈ 257%

8. From the options we can check that only for companies D and M, the total revenue will be the same. Let us consider that the total volume of iron-ore exports for companies D and M be K ton.

Total revenue of company D = $\frac{240K}{0.04}$ = 6000K

Total revenue of company M = $\frac{360K}{0.06}$ = 6000K

9. We need to basically look for companies which are lower in the y-axis and have higher values along the x-axis. Assuming one unit of export for all the companies, we can see that the total revenue would be the highest for companies D and M.

10. The ROI of a player is higher if he has a higher value of

$\frac{actual\ k.\ factor}{price}$ AB de Villiers would have the highest

ROI among all players with a price more than $1 million.

11. The rate of actual K-factor to price is the lowest for McCullum. So, he was the biggest disappointment in terms of ROI.

12. Four Players-David Miller, Azhar Mahmood, S. Dhawan and S. Smith gave a higher ROI than Chris Gayle.

13. A straight line drawn through (0, 0) and (2000000, 10,000) would give the expected ROI for each price. Any player above the line would have given a ROI which was better than expected, i.e., 15 players.

14. Required amount
= `(180 – 144) + (240 – 200) + (400 – 360) crore
= `116 crore

15. Profit gained in 2013, 2014 and 2015 together, by company A:
    `(300 – 270) + (320 – 280) + (120 – 108) crore
    = `82 crore
company B:
    ` ((250 – 225) + (240 - 200) + (180 – 144) crore
    = `101 crore
\ Required amount = ` (101 – 82)crore = `19 crore

16. Income of company A, over the years is as follows:
2012 : `216 crore;       2010: `300 crore
2014: `320 crore;       2012: `120 crore
2016 : `250 crore;      2014: `350 crore
\ In 2014, it was the second highest.

17. As nothing is said with regards to whether the country exported or imported rice in 2003, we cannot find the answer for this.

18. The consumption of rice, when compared to the previous year, showed an increase when either the population or the per capita consumption or both show an increase, i.e., in 2004, 2006 and 2007.

19. Even though the country exported rice in 2003, it could have imported rice in each of the following years as the total consumption could have been more than the production.

20. The population of the country increased in 2004, 2006 and 2007. Of this, in 2004 and 2007, the total consumption of rice in the country could have decreased.

Chapter

5 Caselets

Learning Objectives

In this chapter, you will:

- Gain understanding of data presented in the form of paragraphs.
- Learn how to convert data given in caselets into equations.
- Learn how to jot down points and conditions simultaneously while reading the caselet and forming equations out of them.
- Get familiar with different kinds of cases – DI based and reasoning-based.
- Get familiar with venn-diagram based caselets, which frequently appear in MBA entrance exams.

❏ Introduction

At times the information in a DI set is not represented in the form of a bar graph, pie chart or any other graphical tool, it is described in a theoretical manner and the students need to interpret and organize the given data to solve the set.

Caselets appear frequently in the DI & LR sections in competitive exams like CAT, XAT, NMAT etc. While solving a caselet, the student should list down all the important points in the set and try and represent the given information in a table or some other systematic format.

Solved Examples

Directions for questions 5.01 to 5.05: These questions are based on the information given below.

Anurag, Anil and Anmol worked together to paint Arun's house. Arun gave an amount of `13,500 for the work. It was decided among themselves that Anurag should get one third more than Anil and Anmol should get 8/15th of the total amount.

Solution:

Let the amounts received by Anurag, Anil and Anmol for their respective works be x, y and z.

Given that $x + y + z = $ `13,500 $\qquad(1)$

$$x = \left(1 + \frac{1}{3}\right) y$$

$$\Rightarrow x = \frac{4}{3} y \qquad(2)$$

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$$z = \frac{8}{15}(`13{,}500) = `7{,}200 \qquad (3)$$

$(1) \Rightarrow x + y = `13{,}500 - `7200$

$\Rightarrow x + y = `6300$

From (2), we get: $\frac{4}{3} 4 + y = `6300 \Rightarrow \frac{7y}{3} = `6300$

$\Rightarrow y = `2700$

$\Rightarrow x = 6300 - `2700 = `3600$

5.01: What is the amount received by Anmol and Anil together?
(A) `9300
(B) `9600
(C) `9900
(D) `10,200

Sol: Amount received by Anmol and Anil together
= $y + z = `2700 + `7200 = `9900$

5.02: What is the difference between the amounts received by Anurag and Anil?
(A) `900
(B) `1000
(C) `1100
(D) `1200

Sol: The difference between the amounts received by Anurag and Anil = $x - y$
= `3600 − `2700 = `900

5.03: What is the ratio of the amounts received by Anurag and Anmol together to the amount received by Anil?
(A) 3 : 2
(B) 4 : 1
(C) 2 : 3
(D) 1 : 4

Sol: The ratio of the amounts received by Anurag and Anmol together to the amount obtained by Anil = $(x + z) : y = (`3600 + `7200) : (`2700)$
= `10,800 : `2700 = 4 : 1

5.04: The amount received by Anurag and Anil together is what percentage of the amount received by Anmol?
(A) 67.5%
(B) 75%
(C) 80%
(D) 87.5%

Sol: The total amount received by Anurag and Anil together = $x + y = `3600 + `2700 = `6300$
\The required percentage

$= \dfrac{`6{,}300}{`7{,}200} \times 100\% = 87.5\%$

5.05: The difference between the amounts received by Anurag and Anil is what part of the total amount received by the three together?

(A) $6\frac{2}{3}\%$
(B) 8%

(C) $9\frac{2}{3}\%$
(D) 10%

Sol: The difference between the amounts received by Anurag and Anil = $x - y$
= `3600 − `2700 = `900

\ The required part = $\dfrac{`900}{`13{,}500} \times 100\% = 6\frac{2}{3}\%$

Directions for questions 1 to 5: Answer these questions based on the information given below.

Four crates of luggage A, B, C and D are measured for their weights and then loaded onto a cargo plane. The weight of crate A, which is 100 kg is less than that of crate C by the same amount by which the weight of crate C is less than that of crate D. The average weight of crates A, C and D is 300 kg. It is also known that the average weight of the 4 crates is 75 kg more than the weight of crate C.

1. The weight of how many crates is more than the average weight of the four crates?
   - (A) One
   - (B) Two
   - (C) Three
   - (D) Cannot be determined

2. Crate C weighs less than crate D by
   - (A) 40%
   - (B) 150 kg
   - (C) 100 kg
   - (D) 60%

3. The weight of crate B is
   - (A) 600 kg
   - (B) 250 kg
   - (C) 350 kg
   - (D) 100 kg

4. If the heaviest crate is not loaded on the plane, what is the average weight of the 3 loaded crates?
   - (A) 300 kg
   - (B) $333\frac{1}{3}$ kg
   - (C) 400 kg
   - (D) $466\frac{2}{3}$ kg

5. The ratio of the difference in weights of crates A and B and the sum of the weights of crates C and D is
   - (A) 5 : 2
   - (B) 1 : 2
   - (C) 5 : 8
   - (D) 3 : 8

Directions for questions 6 to 10: Answer these questions based on the information given below.

Hiralal wrote his will on his deathbed. The terms of his will are as follows:
   - **(i)** Hiralal's wife gets a third of his property originally worth `51,00,000.
   - **(ii)** After Hiralal's wife, his son Haralal gets 50% of the remaining property.
   - **(iii)** After Haralal, Hiralal's daughters Heera and Henna get the remaining property in the ratio 8 : 9, respectively.

6. The share of the property that Hiralal's wife gets, is what percentage of the property that Haralal and Heera together get?
   - (A) 60%
   - (B) 58%
   - (C) 85%
   - (D) 68%

7. What is the difference in the amounts received by Haralal and Henna (in ` lakh)?
   - (A) 8
   - (B) 9
   - (C) 11
   - (D) 12

8. The difference in the share of property that Heera and Henna gets is what percentage of the property that Hiralal's wife got?
   - (A) 5%
   - (B) $5\frac{15}{17}\%$
   - (C) 6%
   - (D) $6\frac{8}{17}\%$

9. The share of the total property that Hiralal's wife gets, is how many percentage points more than Heera's share?
   - (A) 33
   - (B) 17.64
   - (C) 15.69
   - (D) 13.5

10. If the shares of Henna and Haralal are interchanged, then Heera's share of the property would be what percentage (approx.) of the property share of Haralal and Hiralal's wife together?
    - (A) 29%
    - (B) 31%
    - (C) 33%
    - (D) 35%

Directions for questions 11 to 15: Answer these questions based on the information given below.

Amar, Akbar and Anthony sold their three cycles manufactured in different years to Kishanlal. Kishanlal gave a total of `1700 to the three and said that Amar should get `50 more than half of the total amount as his cycle was used less. Akbar's cycle being used more than Amar's, he should get about 6/17th the total amount and the last one gets the remaining amount. Each individual gets his amount only in denominations of `100.

11. What is the difference between the amounts received by Amar and Anthony?
    - (A) `900
    - (B) `700
    - (C) `800
    - (D) `600

12. The amount that Amar has is how much more than what Akbar and Anthony together have?
    - (A) `200
    - (B) `300
    - (C) `100
    - (D) `400

13. If the shares of Amar and Anthony are interchanged, then Akbar has how much more than what Amar has?
    - (A) `300
    - (B) `200
    - (C) `400
    - (D) `100

14. The ratio in which the amount shared among Akbar, Amar and Anthony is

(A) 2 : 9 : 6   (B) 9 : 6 : 2

(C) 2 : 6 : 9   (D) 6 : 9 : 2

15. The difference of the amount that Anthony and Akbar have is what percentage of the amount that Amar has?

(A) $25\dfrac{3}{5}$ (B) $44\dfrac{4}{9}$

(C) $33\dfrac{1}{3}$ (D) $66\dfrac{2}{3}$

Directions for questions 16 to 20: These questions are based on the following information.

In an MBA college $83^1/_3\%$ of the students like either Tennis or Formula 1 and their ratio is 7 : 4, respectively. Of those who like either Tennis or Formula 1, the ratio of boys and girls is 2 : 9, respectively. Of the boys who like Tennis or Formula 1, 60% like Tennis and 4 boys like Formula 1. Also the number of boys and girls who does not like either Tennis or Formula 1 is in the ratio 6 : 5. No student likes both the games.

16. The number of girls who like Formula 1 is what percentage of the boys who like Tennis?

(A) 220   (B) $266^2/_3\%$

(C) $233^1/_3\%$ (D) Cannot be determined

17. What is the total number of girls?

(A) 20   (B) 10

(C) 35   (D) None of these

18. What is the ratio of the total number of boys to the number of girls who like Tennis?

(A) 4 : 3   (B) 3 : 2

(C) 16 : 29   (D) 29 : 16

19. What is the total number of students in the college?

(A) 55   (B) 66

(C) 60   (D) Cannot be determined

20. The total number of girls who like Tennis is what percentage of the total strength of the college?

(A) 43.93%   (B) 39.67%

(C) 41.72%   (D) 47.33%

Directions for questions 21 to 25: Answer these questions based on the information given below.

Madhusudhan invested his savings of `10 lakh in 3 schemes, whose details are mentioned below:

Scheme 1: A fixed deposit scheme which gives a return of 8% per annum.

Scheme 2: A monthly recurring deposit scheme, which gives a return of 0.5% per month.

Scheme 3: Agri silver's land gold scheme guarantees a 10% appreciation in the value of the land over a years' time.

In the recurring deposit scheme, an investor invests a fixed amount (decided by him) every month and the amount earns simple interest on a monthly basis for the remainder of the period. For example, the first instalment invested in the first month of a year, earns interest for 12 months by the end of the year, the second instalment earns interest for 11 months and so on.

Madhusudhan invests equal sums of money in Scheme 2 and Scheme 3 and $33\dfrac{1}{3}\%$ more money in Scheme 1 than he invested in Scheme 2. The amount that he invested in Scheme 2 is spread over 12 instalments throughout the year.

21. What is the net worth of Madhusudhan's investments at the end of a year?

(A) `10.21 lakh      (B) `11.4 lakh

(C) `10.2 lakh      (D) `11.11 lakh

22. The return on Scheme 3 was what percentage higher/lower than the return on Scheme 1?

(A) 6.25%   (B) 10%

(C) 20%   (D) 12%

23. What would have been Madhusudhan's return from Scheme 2 if he had invested twice the money as he originally invested in the scheme?

(A) `9750      (B) `19,500

(C) `39,000      (D) `28,500

24. If the amounts that are invested in Scheme 1 and Scheme 3 are interchanged, then what will be the change in the net worth of Madhusudhan at the end of 1 year?

(A) `10,000      (B) `5000

(C) `2000      (D) `20,000

25. If Madhusudhan continues to invest the same amount in Scheme 2 for one more year, then how much would he earn more/less than the amount he earned through Scheme 1 and Scheme 3 together in the first year?

(A) `17,800      (B) `22,500

(C) `20,700      (D) `24,500

Directions for questions 26 to 30: Answer these questions based on the information given below.

After my retirement, I decided to invest my savings in four different categories.

I invested 20% of the amount in shares, 30% of the amount in National Savings Certificate (NSC), 40% of the remaining in land and the rest in FD's.

After the first year, the value of my shares increased by 20%. I get an 8% return, which is tax free, on my investment in NSCs. My FD's fetched me 6% returns on which I had to pay 5% TDS on the interest earned and the land prices appreciated by 10%.

At the end of the second year, due to the stock market boom, the value of my shares increased by a further 45% and

I sold off my shares and earned 100% tax free profits. NSCs again gave me an 8% tax free returns, the FD (my initial investment along with the interest earned after taxes in the first year) again gave me 6%, but again I had to pay 5% TDS on the interest earned in the second year and land prices appreciated by a further 10% when I sold it off and had to pay 10% tax on the gains I made.

At the end of two years I found that the difference between my gain from investment in shares and land was `55,100.

26. What was the amount invested (in lakh) by me in shares in the first year?

27. What was the total amount invested (in lakh) initially?

28. What is the value of all my investments (in lakh) at the end of two years (approximately)?

29. What is the approximate compounded annual return on my investment for the two-year period?

30. At the end of the two years, the difference in the amounts due to me for my investments in NSC and FD was approximately.

Directions for questions 31 to 35: Answer these questions based on the information given below.

Four friends Nikhil, Joy, Rohit and Binoy have their shops on the same lane and they sell plyboards, tyres, textbooks and jars of spices, respectively. On a given day, the four friends sell goods worth `2600 altogether. Rohit sold text books worth `600 and Rohit's revenue for that day was less than Joy's by the same amount by which Binoy's revenue was less than Rohit's. Nikhil's sales revenue for that day was `200 more than the average sales of Joy, Rohit and Binoy.

31. If each jar of spices sold by Binoy is worth `18, then which of the following cannot be Joy's sales on that day?
(A) `660
(B) `624
(C) `840
(D) `920

32. If the sales of Nikhil and Rohit together exceed those of Joy and Binoy together by `200 on that day, what were the sales of Binoy?
(A) `500
(B) `550
(C) `570
(D) Cannot be determined

33. If each plyboard that Nikhil sold is worth an integral number of rupees, then which of the following could be the number of plyboards Nikhil sold on that day?
(A) 30
(B) 25
(C) 35
(D) 15

34. If Nikhil, Joy, Rohit and Binoy pay 10%, 20%, 30% and 20% of their daily revenue respectively as trade tax to the trade association, how much did the four friends pay as tax on that day?
(A) `480
(B) `500
(C) `600
(D) `520

35. If Joy sold all tires at the same price of `20/tyre on that day and the sales of Nikhil and Binoy together equal the sales of Rohit and Joy together, then how many tyres did Joy sell on that day?
(A) 30
(B) 35
(C) 40
(D) 45

Directions for questions 36 to 40: Answer these questions based on the information given below.

In Indian Public School (IPS), 80% of the students who appeared for the Class X Board exams in 2014 passed the exam. Among these who passed the board exams, 60% joined Indian Intermediate college (IIC) for their Class XI. The students of IPS who joined IIC opted for Science, Commerce and Humanities streams in the ratio 3 : 4 : 5. Therefore, 60% of students in Science stream, 40% of students in Commerce stream and 50% of students in Humanities stream of Class XI in IIC happen to be students of IPS who passed in 2014. The total number of students in all the three streams of Class XI in IIC is 800. Each student opts for only one stream.

36. How many students failed in the board exams in IPS in 2014?
(A) 160
(B) 120
(C) 200
(D) 240

37. If 10% of the students who opted for Humanities in Class XI in IIC are awarded a scholarship, then how many students got the scholarship?
(A) 10
(B) 26
(C) 32
(D) 45

38. For every 3 students from IPS who opted for science stream in Class XI in IIC, there are 2 students from another school APS pursuing Science stream in Class XI in IIC. If the students of APS who joined Class XI in IIC opted for Science, Commerce and Humanities in the ratio of 2 : 3 : 4, then how many students pursuing Commerce stream in Class XI in IIC are from APS?
(A) 120
(B) 130
(C) 156
(D) 96

39. Using the data from the above question, what percentage of students pursuing Humanities in Class XI of IIC are from neither IPS nor APS?
(A) 15%
(B) 18%
(C) 10%
(D) 20%

40. If IIC collects a monthly fee of `1000, `1500 and `2000 from Class XI students of Science, Humanities and Commerce, respectively, then what would be the fee collected from the 3 streams in a month from Class XI of IIC?
(A) `10.2 lakh
(B) `10.8 lakh
(C) `12.8 lakh
(D) Cannot be determined

Directions for questions 41 to 45: Answer these questions based on the information given below.

Five students Ajay, Bharat, Kumar, Sanjay and Vishal, when asked about their scores in a quant test, replied as follows:

Ajay: Bharat, Kumar and I together scored 135 marks.
Bharat: Kumar, Sanjay and I together scored 137 marks.
Kumar: Sanjay, Vishal and I together scored 132 marks.
Sanjay: Vishal, Ajay and I together scored 138 marks.
Vishal: Ajay, Bharat and I together scored 133 marks.

41. Who scored the least marks among the given students?
(A) Vishal
(B) Bharat
(C) Kumar
(D) Sanjay

42. Who scored the highest marks among the given students?
(A) Ajay
(B) Bharat
(C) Kumar
(D) Sanjay

43. How many of the given students scored more marks than Ajay?
(A) 0
(B) 1
(C) 2
(D) 3

44. What is the maximum difference in the marks scored by any two of the five students?
(A) 6
(B) 8
(C) 9
(D) 10

45. Bharat's score is what per cent of Sanjay's score?
(A) 88.88%
(B) 80%
(C) 90%
(D) 125%

Directions for questions 46 to 50: Answer these questions based on the information given below.

A club had organized cricket, music and painting summer camps for children. The number of children who enrolled for both music and painting is 5. The number of children who enrolled for only painting and cricket and only cricket and music were 7 more and 4 more, respectively than the number of children who enrolled for all the three. The number of children who enrolled for cricket is the same as those who enrolled for more than one event. Eight more children enrolled for music than cricket and the number of children who enrolled for painting was twice that of cricket. It is also known that the highest number of children who enrolled for any one event alone was 29.

46. What is the number of children who enrolled in all the three camps?
(A) 2
(B) 3
(C) 4
(D) Cannot be determined

47. How many children enrolled in more than one camp?
(A) 14
(B) 18
(C) 22
(D) None of these

48. The number of children who enrolled in exactly one camp is
(A) 39
(B) 42
(C) 44
(D) 49

49. How many children enrolled for music?
(A) 32
(B) 30
(C) 28
(D) 26

50. How many children enrolled in exactly two camps?
(A) 19
(B) 21
(C) 23
(D) None of these

EXERCISE-2

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

The following is the rate of income tax for different income groups:

Annual income (`)	Tax rate
Up to 1 lakh	0%
1 – 1 × 5 lakh	10% of income in excess of `1 lakh
1 × 5 to 5 lakh	Up to `1×5 lakh as above + 20% of income in excess of `1×5 lakh
More than 5 lakh	Up to `5 lakh as above + 30% of income in excess of `5 lakh

Tax is always calculated on income, after deductions, if any.

The only allowed deductions are as follows.
(A) Maximum of `1 lakh per year on investments in specified securities.
(B) Maximum of `3 lakh per year as housing loan repayment.

The eligibility for housing loan is a minimum annual income of `1 lakh and annual repayment less than or equal to 20% of annual income. There is a service tax of 10% on the tax paid at the rate of 30%.

1. What can be the maximum income for which one need not pay any tax?
(A) `1 lakh
(B) `2 lakh
(C) `2.5 lakh
(D) `3 lakh

2. What is the minimum tax to be paid by a person with an annual income of `10 lakh?

(A) 1.2 lakh (B) 1.245 lakh
(C) 1.35 lakh (D) None of these

3. The difference between the minimum and the maximum tax that one has to pay on an annual income of `6 lakh is

(A) `80,000  (B) `54,000
(C) `57,000  (D) `83,000

Directions for questions 4 to 7: These questions are based on the information given below.

Murali sells samosas for a living. He sells each samosa for `4 and works from Monday to Saturday every week. He observes that he sells X samosas less than the previous day on 2 days of any week and X samosas more than the previous day on the other three days of the week. Every week, the highest number of samosas that he sells on any day is 150 and the least number of samosas he sells is 90.

4. If Murali sells 750 samosas in a particular week, then how many samosas does he sell on Friday?

(A) 90 (B) 120
(C) 150 (D) Cannot be determined

5. If Murali sold the minimum number of samosas on Friday and did not sell the maximum number of samosas on Thursday, then how much money did he earn that week?

(A) `2760  (B) `2880
(C) `3000  (D) `2840

6. How many samosas does Murali sell on Tuesday, if he sold 130 samosas on Friday?

(A) 90 (B) 110
(C) 120 (D) Cannot be determined

7. If Murali sells 130 samosas on Wednesday, then which of the following statement/s is/are necessary to find the number of samosas Murali sold on Saturday?
   I. He sold 150 samosas on Thursday.
   II. He sold 130 samosas on Friday.
   III. X = 20

(A) Only III (B) Only II
(C) II and III (D) None of these

Directions for questions 8 to 12: Answer these questions based on the information given below.

The population of country XYZ is currently 100 million in Year 1. It is projected that by Year 25 the population will become 125 million. There are only 2 states A and B in XYZ. If the population of states A and B increases by 20% and 35% respectively, then the country will have the same population as it is predicted to have in Year 25.

Further, it is known that a third of the citizens of State A and a fourth of the citizens of State B are city-dwellers. By Year 25, the number of city dwellers in both the states is ex-

pected to double. Assume that all the predictions and expectations turn out to be true.

8. What is the total population of city dwellers in year 25?

(A) 61.1 million (B) 30.55 million
(C) 20 million (D) 15.28 million

9. Assuming that the population of both states grows at the same rate as that of the country, the percentage of citizens living in rural areas in Year 25 is approximately how many percentage points (approximately) more/less than the rural population in Year 1?

(A) 16 (B) 18
(C) 20 (D) 22

10. If State A grew by 35% and State B grew by 20%, then the population of the country would exceed the projections by

(A) 10 million (B) 7 million
(C) 5 million (D) None of these

11. In Year 1, 20% of the city dwellers are children and 30% of those living in rural areas are children. How many grown-ups are there in the country in Year 1?

(A) 70 million (B) 73 million
(C) 75 million (D) 78 million

12. If State A's population increased by 2% of the base value each year and State B's increased by 3% each year, in how many years will the projection be true?

(A) 7 (B) 9
(C) 10 (D) 11

Directions for questions 13 to 17: These questions are based on the information given below.

The information below gives partial details of the employees of ABC Pvt. Ltd. It tells us about the number of employees who had specialized in Finance, Marketing and HR during their MBA programme. It also tells us about the number of engineers and that of the non-engineers who had specialized in each of these streams. Each employee who was an MBA graduate specialized in exactly one stream.

| | Specialization | | |
Educational background	F	M	H
Engineers			
Non-engineers	7		5
Total		35	

Note: F = Finance, M = Marketing and H = HR
   The following details are known:
   (i)   The number of engineers is 20% more than the number of non-engineers.

(ii) The number of employees who specialized in Finance and the number of non-engineers are in the ratio 8 : 15.

(iii) The number of employees who specialized in HR and the number of engineers are in the ratio of 5 : 12.

13. How many non-engineers specialized in Marketing?
(A) 15   (B) 16
(C) 17   (D) 18

14. How many non-engineers did not specialize in Finance?
(A) 19   (B) 20
(C) 23   (D) 22

15. Find the number of employees who specialized in HR.
(A) 14   (B) 15
(C) 16   (D) 17

16. Which of the following is the least?
(A) The number of non-engineers who specialized in HR.
(B) The number of engineers who specialized in Finance.
(C) The number of non-engineers who specialized in Marketing.
(D) The number of engineers who specialized in Marketing.

17. What percentage of MBA graduates are engineers?
(A) $63^7/_{11}\%$ (B) $72^8/_{11}\%$
(C) $54^6/_{11}\%$ (D) $45^5/_{11}\%$

Directions for questions 18 to 22: These questions are based on the information given below.

The weights (in kg) of each of the five members of the Don Bosco school wrestling team, namely for Ajay, Bhushan, Chetan, Deepak and Emmanuel is a distinct integer. Before leaving for an inter-school competition, the coach decided to check the weights of all the five members. But in the only available weighing machine in the school, the weights from 0 to 100 were not properly visible. But while checking the weights was necessary to register them, he decided to weigh the students in groups of three making sure that no group of three students was repeated. The weights obtained while weighing them were as follows. 106 kg, 116 kg, 122 kg, 126 kg, 132 kg, 146 kg, 120 kg, 126 kg, 136 kg and 142 kg. It is also known that the weight of Ajay is the average of that of Bhushan and Emmanuel. Further, Emmanuel is heavier than Chetan but lighter than Deepak.

18. What is the weight (in kg) of the heaviest boy?

19. What is the weight (in kg) of Bhushan?

20. What is the weight (in kg) of Emmanuel?

21. What is the weight (in kg) of Chetan?

22. What is the average weight (in kg) of all the five boys?

Directions for questions 23 to 25: Answer these questions based on the information given below.

A survey was conducted among 180 employees in an organization to find out whether they were active on any of the three networking sites, such as Facebook, LinkedIn and Twitter. The number of employees who were active on any of the sites was 400% more than the number of employees who were not active on any of the three. The number of employees who were active on Facebook, LinkedIn or Twitter was 68, 61 and 59, respectively. The number of employees active on Twitter and exactly one other site was 21. 15 employees were active on Face book as well as LinkedIn. The number of employees active on Twitter alone was equal to the number of employees active on more than one of the sites.

23. If 15 employees are active on both Twitter and LinkedIn, then how many employees are active only on Facebook?
(A) 49   (B) 47
(C) 45   (D) 43

24. What percentage of the employees were active on exactly one of the sites?
(A) 72.5   (B) 76.0
(C) 67.5   (D) 63.33

25. What is the number of employees who are active only on Twitter?
(A) 30   (B) 36
(C) 39   (D) None of these

Directions for questions for 26 to 28: Answer these questions based on the information given below.

A survey was conducted among students to find out who was the person whom they admired the most among Mahatma Gandhi, Mother Teresa and Nelson Mandela. Each student had to vote for exactly one of the three persons. Off the 330 boys with an urban background, 40% voted for Mahatma Gandhi. The number of girls with a rural background was the average of the number of boys with a rural background and the number of girls with an urban background. The number of girls with an urban background who voted for Mother Teresa was 80, which was equal to the number of girls with an urban background who voted for Mahatma Gandhi or Nelson Mandela. The number of boys with an urban background who voted for Nelson Mandela was 78. The total number of boys with a rural background was equal to the number of boys with an urban background who voted for Mother Teresa. All the three persons got the same number of votes from boys with a rural background and the number of girls with a rural background who voted for Mahatma Gandhi and Mother Teresa were the same. A total of 290 students voted for Mother Teresa which was 23 more than those who voted for Mahatma Gandhi.

26. What is the total number of students surveyed?
(A) 750   (B) 600
(C) 900   (D) 800

27. The number of girls with a rural background who voted for Nelson Mandela was
(A) 30
(B) 35
(C) 40
(D) 45

28. Girls with a rural background who voted for Mahatma Gandhi was what percentage of the total girls?
(A) 15
(B) 16.67
(C) 17.5
(D) 20

Directions for questions 29 to 32: These questions are based on the following information.

Ramesh wrote his final exams which consists of four subjects, such as Maths, Physics, Chemistry and English. He expected 80, 40, 60 and 50 marks, respectively in those subjects (out of 300 in each subject). After the results, his friend asked him the marks he scored. Ramesh told that he got half the expected marks in one of the subjects, thrice the expected marks in the second one, twice the expected marks in the third and in the remaining subject he got exactly the expected marks.

29. If the average marks obtained by Ramesh is 95, then he definitely scored more than the expected marks in
(A) Maths
(B) Physics
(C) English
(D) Chemistry

30. Which of the following is true regarding the above statements?
 (I)   Ramesh's average marks is more than 100.
 (II) Ramesh scored the expected marks in Maths.
(A) If (I) is true, (II) is false.
(B) If (I) is true, (II) is true.
(C) If (I) is false, (II) is false.
(D) None of these

31. If Ramesh got the same marks in two subjects, then which subject is definitely one of those?
(A) Maths
(B) Physics
(C) English
(D) Chemistry

32. If marks in one subject are thrice that in two other subjects, then the total marks of Ramesh is
(A) 330
(B) 350
(C) 375
(D) 380

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

XYZ Ltd. had introduced a battery fitted car in the year 2006. The batteries would last a year and need to be recharged once a year after that. For the first two years, the company would recharge the batteries for free. From the third year onwards, it charges `20,000 for a recharge. However, there are third party vendors who do the same recharge for `17,000. Every year, 40% of the customers who opt for a battery recharge, do it from the company while the remaining 60% opt for the cheaper option. The following table gives the details of the number of paid recharges by the company and by third party vendors for all years from 2009 to 2013. Three values in the table have been intentionally left out. Assume that all cars from 2006 are in operation and are recharged after exactly one year.

Replacement Source	2009	2010	2011	2012	2013
Company	--	--	--	1880	2276
3rd party	1524	2214	2526	2820	3414

33. How many cars were sold by XYZ Ltd. in 2009?
(A) 470
(B) 490
(C) 510
(D) 540

34. How many cars were sold by XYZ Ltd. in the three years from 2006 to 2008?
(A) 3750
(B) 4050
(C) 4210
(D) None of these

35. How many batteries were recharged by the company in 2010?
(A) 1440
(B) 1476
(C) 1510
(D) Cannot be determined

36. How many cars were sold by the company in 2011?
(A) 630
(B) 720
(C) 690
(D) Cannot be determined

Directions for questions 37 to 39: Answer these questions based on the information given below.

In a class of 100 students, each student will play at least one of the games, such as Cricket, Hockey, Football and Chess. For each game or for any combination of the games there will be at least two students in the group who play only that game or that combination of games, i.e., there will be at least two students who play only Cricket, two students who play only Chess and at least two students who play both Cricket and Chess and so on. It is also known that at least 50 students play each game.

37. If each game is played by exactly 60 students, the number of students playing at most two games is at least
(A) 0
(B) 20
(C) 37
(D) 100

38. If the number of students playing any game is exactly 52, then the number of students who play exactly two games is at most
(A) 76
(B) 78
(C) 80
(D) 82

39. If each game is played by 50 students, then the number of students playing all the four games is at most
(A) 20
(B) 22
(C) 24
(D) 26

Directions for questions 40 to 42: Answer these questions based on the information given below.

Ramesh was given a weighing balance and nine identical balls. One or more of the nine balls was faulty (weighed more or less than the others).

40. What is the minimum number of weighing's required to certainly identify the faulty ball if only one ball is faulty and it is known that it weighs more than the other balls?

41. If there are two balls which are faulty, but if it is known that both these balls weigh the same and are heavier than the others, then the number of weighing's required to certainly identify the faulty balls is at least

42. It is known that there is only one ball which is faulty and it is not known whether it weighs more or less than the other bells. What is the minimum number of weighing's required to certainly identify the faulty ball?

Directions for questions 43 to 46: These questions are based on the following information.

A company produces 4 different products, namely microwave ovens, refrigerators, ACs and washing machines. It produces two different types of each product, i.e., P and Q. The company produces a total of 1500 products. 20% of the total number of products are washing machines, of which 65% are of type Q. Three-twentieth of the total number of products are ACs. $33^1/_3$% of the ACs are of type P. One-fourth of the total number of products are refrigerators out of which 120 are of type Q. Nine-tenth of the number of microwave ovens are of type P.

43. Find the average number of products of type Q made by the company.
(A) 131.25   (B) 141.25
(C) 136.25   (D) 126.25

44. Find the ratio of the number of microwave ovens of type P to the number of washing machines of type Q.
(A) 48 : 17   (B) 17 : 48
(C) 36 : 13   (D) 13 : 36

45. Find the difference in the number of refrigerators of both the types.
(A) 215   (B) 225
(C) 135   (D) 245

46. Find the total number of ACs and microwave ovens of type P, washing machines and refrigerators of type Q produced by the company.
(A) 870   (B) 890
(C) 910   (D) 930

Directions for questions 47 to 50: These questions are based on the following information.

Anand invested in the shares of four companies, namely A, B, C and D. Each of these companies belonged to a differ-ent industry, such as Metals, IT, Automobiles and Infrastructure, in no particular order. At the time of investment, the price of each share was `400. Anand purchased ten shares of each of these companies. He was expecting returns of 25%, 10%, 20% and 45% from the shares of companies A, B, C and D, respectively. Returns are defined as the percentage change in the value of the share after one year. The returns for two companies were higher than the expected returns. One of these two companies belonged to the Metals or Automobile sector while the other one belonged to the IT or Infrastructure sector. For the company belonging to the Metals or Automobile sector, the returns were twice those of the expected returns and for the company belonging to the IT or Infrastructure sector, the returns were three times the expected returns. For the remaining two companies, the returns were the same as expected.

47. What is the minimum average return Anand could have earned during the year?
(A) 35%   (B) 32%
(C) 30%   (D) None of these

48. What is the maximum average returns Anand could have earned during the year?
(A) 47.5%   (B) 50%
(C) 53.75%   (D) None of these

49. If Anand earned 42.5% returns during the year, then which of these statements is definitely true?
I.   Company A belonged to either IT or Infrastructure sector.
II.   Company B belonged to either Metals or Automobiles sector.
III. For Company C, the returns were more than expected.
IV.   For Company D, the returns were more than expected.
(A) I and III
(B) II and IV
(C) I and IV
(D) II and III

50. If Company C belonged to the IT or the Infrastructure sector and the returns from C were more than expected, then which of the following statements would necessarily be true?
 I.   Anand earned at most 45% returns.
 II. Anand earned at least 37.5% returns.
 III. If Anand earned 41.25% returns, then Company D belonged to the Metals or Automobile sector.
 IV. If Anand earned 41.25% returns, then Company A gave more than the expected returns.
(A) I and II
(B) I and III
(C) III and IV
(D) II and IV

Directions for questions 1 to 4: Answer these questions on the basis of the information given below.

CAT 2008 paper had three sections, namely Quantitative (Q), Verbal (V) and Data Interpretation (DI) with maximum marks in each section being 100. Each section had questions with 1, 2 and 3 marks. Each section had the same number of total questions and in each section had the number of one-mark questions was one more than the number of two-mark questions which in turn was one more than the number of three-mark questions. The penalty for each wrong answer was one fourth of the marks for that question.

1. The number of three-mark questions in the paper was
   (A) 45   (B) 48
   (C) 54   (D) 60

2. The total number of questions in the paper was
   (A) 135   (B) 144
   (C) 153   (D) 162

3. What is the maximum score possible if a person attempts less than half of the total questions in the paper with an accuracy of less than 80%?
   (A) 108   (B) 120
   (C) 146   (D) 164

4. What is the maximum possible score of a person with an accuracy of exactly 50%?
   (A) 108   (B) 114.5
   (C) 138.0   (D) 175.5

Directions for questions 5 to 8: Answer these questions on the basis of the information given below.

145 people who visited a bakery on a certain day ordered at least one and at most three items among burgers, pastries and bread. 103 customers ordered exactly two items. The number of customers who ordered only one item is six times the number of customers who ordered all the three. The number of customers who ordered only pastries and bread is two times the number of customers who ordered only burgers and pastries. The number of customers who ordered only bread is four more than those who ordered only burger and four less than those who ordered only pastries. The number of customers who ordered bread is 25 more than those who ordered burger.

The following table gives information about the average amount paid by customers who ordered different number of items.

Customers ordering	Average amount (in `)
Only one item	170
Only two items	290
Three items	?
All customers	266

5. How many customers ordered only pastries?

6. How many customers ordered both pastries and bread?

7. What is the average amount paid by customers who ordered all the three items?

8. Among customers who ordered only one item, the average amount paid by customers who ordered burgers, pastries and bread are in the ratio of 1 : 2 : 3. What is the average amount paid by customers who ordered only pastries (approximated to the closest integer)?

Directions for questions 9 to 13: Answer these questions on the basis of the information given below.

In a survey conducted among certain number of students, the ratio of the number of students who play Tennis, Football, Cricket and Hockey is 10 : 15 : 6 : 4. 25% of the students who play Tennis, play only Tennis. Among the students who play Football, boys are 12.5% less than girls. Among the students who play Cricket, boys are twice the number of girls. Among the students who play Hockey, boys are $33\frac{1}{3}$% of the number of girls.

No student plays only Hockey, only Hockey and Cricket, only Hockey and Tennis. The number of girls who play any combination of exactly three of the given four sports is equal to the number of girls who play all the four sports. No girls play only Tennis, only Tennis and Football, only Tennis and Cricket. The number of girls who play Tennis is 80 and the number of girls who play Hockey is 40 more than those who play Tennis. Among the boys, those who play only Tennis, those who play Tennis and Cricket, those who play Football and Cricket are equal. The number of boys who play only Tennis, Football and Hockey and the number of students who play all the four sports are 30 each. The number of boys who play only Tennis and Cricket are 20% less than the number of boys who play only Tennis, Football and Cricket. The number of students who play only Football is 260.

9. Find the number of boys who play at least two of the given games?
   (A) 220   (B) 240
   (C) 260   (D) 320

10. Find the number of girls who play at most two of the given games.
    (A) 120   (B) 160
    (C) 180   (D) Cannot be determined

11. Among the students who play Tennis and Hockey, what is the difference between the number of boys and the number of girls?
    (A) 20   (B) 10
    (C) 30   (D) 40

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12. If 10 boys and 10 girls do not play any of the given four sports, then among the students surveyed what is the ratio of the number of boys to the number of girls?

(A) 12 : 7   (B) 8 : 5

(C) 9 : 8   (D) None of these

13. Among the students who play Tennis, Football and Cricket, by what per cent was the number of girls less than the number of boys?

(A) 12.5%   (B) $33\frac{1}{3}$ %

(C) 50%   (D) 150%

Directions for questions 14 to 17: Answer these questions on the basis of the information given below.

XYZ Ltd. was in the business of providing coaching classes for CAT. The number of students joining the institute would depend on whether or not they provide videos for the chapters taught.

The fee charged by the institute is `40,000 when no videos are provided and `45,000 when videos are provided, and a student can enrol by paying 25% as the first instalment and the remaining after two months. At the time of joining, a student knows whether he/she is joining a course with or without videos and pay the fee accordingly. But it was observed that 20% of the students who enrolled drop out, and thus do not pay the second instalment.

The cost incurred by the Institute on each student who does not drop out (without considering the cost of videos) is `25,000 per student. It also incurs a cost of `6000 per student who drops out without paying the second instalment. The following table gives the number of students who are expected to enrol in the institute with and without videos, in the next four months. For each month, all students who join are provided videos or none are provided videos.

Month	With videos	Without videos
June	7400	4600
July	5300	3900
August	6500	4200
September	6800	4900

14. What is the profit expected from students who enrol in June if the institute decides to go ahead without videos?

(A) `5.21 crore       (B) `5.62 crore

(C) `5.89 crore       (D) `6.23 crore

15. What can be the maximum amount spent on producing videos for students who enrol in July, if the institute wants to make at least 10% more profit than it would have done without videos?

(A) `3.72 crore       (B) `3.55 crore

(C) `3.38 crore       (D) `3.21 crore

16. If the videos for students who enrolled in September is expected to cost `4.9 crore, what should the institute do to maximize its profit with the information available with it regarding the number of students expected to join?

(A) Do not provide videos

(B) Provide videos

(C) Both give equal profit

(D) Cannot be determined

17. If the institute provided videos for students who enrolled in all the four months and it earned a total profit of `21.6 crore in this time, then what was the total cost of providing videos?

(A) `19.21 crore       (B) `20.34 crore

(C) `21.64 crore       (D) `22.73 crore

Directions for questions 18 to 21: Answer these questions on the basis of the information given below.

The table given below shows 12 numerical values. Each numerical value represents exactly one of the following two data.

(a) Sales of any fruit on any particular day (in pieces). OR

(b) Sales of any fruit on any particular day (as a % of the total sales of all the fruits on that particular day).

For example, sales of apples on Day 2 was either 24 pieces or 24% (of the total fruits sold on Day 2).

Sales (either in pieces or in percentage terms) of any fruit (on any day) was a two-digit natural number. Also, no two types of fruits had the same sales on any day. Further, no fruit had the same sales on any two days. On any day, at least one numerical figure was (in pieces) terms while at least one numerical figure was (in percentage) terms. Total sales of any fruit (across three days put together) was more than 100 and less than 200.

	Day 1	Day 2	Day 3
Apples	36	24	33
Oranges	38	41	27
Mangoes	31	68	22
Guavas	28	13	58

18. Find the total number of fruits sold across three days put together.

(A) 400   (B) 500

(C) 600   (D) None of these

19. How many of the following statements are false?

(i) There were exactly seven occasions when the total number of fruits (of any kind) sold on any day was more than 50 pieces.

(ii) The total number of oranges and mangoes sold across three days is more than the total number of apples and guavas sold across three days.

(iii) The total number of mangoes sold on Day 3 is not more than the total number of guavas sold on Day 2.
(A) 0   (B) 1
(C) 2   (D) 3

20. What was the maximum percentage increase in the sales (in pieces) of any fruit across two consecutive days?
(A) 115.79%   (B) 123%
(C) 175%   (D) 346.15%

21. Which fruit registered the maximum change in sales (in percentage points) from Day 1 to Day 3?
(A) Apples   (B) Oranges
(C) Mangoes   (D) Guavas

Directions for questions 22 to 25: Answer these questions on the basis of the information given below.

In a city, there are 13,600 employees. The ratio of number of males and females among them is 11 : 6. All the employees work in one establishment among Pizza point, Pasta centre, Frenzy ice-cream, Cookieyum, Caketake and Sandwichy. 20% of the total employees are employed at Pizza point. 24% of the females work in Sandwichy. $10\frac{2}{11}$ % of the males work in Cookieyum. Females working in Caketake are 50% of the females working in Sandwichy. $20\frac{5}{11}$ % of the males work in Frenzy ice-cream. Males working in Frenzy ice-cream are 20% more than females working there. 30% of the total employees work in Sandwichy. Number of females working in Sandwichy is equal to the number of males working in Pasta centre. The ratio of the number of males to females working in Pasta centre is 3 : 1 and that working in Caketake is 5 : 8. It is also know that all employees in the six establishments are from the city.

22. How many people work in Cookieyum?

23. The females working in Caketake form what percentage of the females working in Pasta centre?

24. How many people work in Frenzy ice-cream?

25. How many people work in Pasta centre?

ANSWER KEYS

Exercise-1

1. (B)	10. (B)	19. (B)	28. 6.35	37. (C)	46. (B)
2. (A)	11. (B)	20. (A)	29. 12	38. (D)	47. (C)
3. (A)	12. (C)	21. (C)	30. 7500	39. (C)	48. (D)
4. (A)	13. (C)	22. (A)	31. (D)	40. (C)	49. (B)
5. (C)	14. (D)	23. (B)	32. (D)	41. (A)	50. (A)
6. (D)	15. (B)	24. (C)	33. (B)	42. (D)	
7. (A)	16. (B)	25. (D)	34. (B)	43. (B)	
8. (B)	17. (D)	26. 1	35. (B)	44. (D)	
9. (B)	18. (C)	27. 5	36. (A)	45. (C)	

Exercise-2

1. (C)	10. (C)	19. 30	28. (B)	37. (C)	46. (D)
2. (D)	11. (B)	20. 50	29. (C)	38. (B)	47. (A)
3. (C)	12. (D)	21. 36	30. (A)	39. (C)	48. (C)
4. (D)	13. (D)	22. 42.4	31. (B)	40. 2	49. (A)
5. (A)	14. (C)	23. (C)	32. (B)	41. 4	50. (D)
6. (B)	15. (B)	24. (D)	33. (B)	42. 3	
7. (D)	16. (A)	25. (B)	34. (C)	43. (A)	
8. (A)	17. (C)	26. (A)	35. (B)	44. (C)	
9. (B)	18. 56	27. (C)	36. (D)	45. (C)	

Exercise-3

1. (B)	5. 16	9. (C)	13. (B)	17. (D)	21. (C)	24. 3300
2. (C)	6. 48	10. (D)	14. (C)	18. (C)	22. 1028	25. 1536
3. (D)	7. 430	11. (A)	15. (B)	19. (A)	23. 150	
4. (D)	8. 161	12. (D)	16. (B)	20. (C)		

SOLUTIONS

EXERCISE-1

1. Let A, B, C and D be the weights of the 4 crates.
A = 100 kg (Given)
C – A = D – C (given)
2C = D + 100 (1)

$\dfrac{A + C + D}{3}$ = 300

C + D = 800 (2)
Solving (1) and (2), C = 300 kg, D = 500 kg

$\dfrac{A + B + C + D}{4}$ = 375 ⇒ B = 600 kg

\ A = 100 kg, B = 600 kg, C = 300 kg D = 500 kg.
Crates B and D weigh more than the average of the 4 crates.

2. $\dfrac{C}{D}$ = 60%

\ Crate C weighs 40% less than crate D.

3. Crate B weighs 600 kg.

4. If crate B is not loaded, the average weight of crates A, C and D = $\dfrac{900}{3}$ = 300 kg.

5. $\dfrac{B - A}{D + C}$ = $\dfrac{500}{800}$ = $\dfrac{5}{8}$

6. Hiralal's wife gets $\dfrac{1}{3}$ of 51 lakh = `17 lakh

Haralal gets $\dfrac{1}{2}$ of (51 – 17) lakh = `17 lakh

Heera's share : Henna's share = 8 : 9

Heera's share = $\dfrac{8}{17}$(17)lakh = `8 lakh

Henna's share = 17 – 8 = `9 lakh

Hiralal's wife's share = `17 lakh

Heralal + Heera's share = `25 lakh

$\dfrac{17}{25}$ × 100 = 68%

7. Haralal's share – Henna's share = `8 lakh

8. $\dfrac{(Heera - Henna)}{Hiralal's \ wife}$ × 100

$\dfrac{1}{17}$ × 100 = 5$\dfrac{15}{17}$%

9. Hiralal's wife got = $\dfrac{17}{51}$ = $\dfrac{1}{3}$ = 33.33% of the total property.

Heera got $\dfrac{8}{51}$ = 15.69% of the total property.

\ Hiralal's wife got 17.64 percentage points of the property more than Heera.

10. After interchanging their shares, Henna gets `17 lakh and Haralal gets `9 lakh.

$\dfrac{Heera}{Haralal + Hiralal's \ wife}$ × 100

$\dfrac{8}{9 + 17}$ × 100 = $\dfrac{8}{26}$ × 100 = 30.77%.

11. Amar's share = ½ × 1700 + 50 = 900

Akbar's share = $\dfrac{6}{17}$ × 1700 = 600

Anthony's share = 1700 – 1500 = `200
Difference between the amount with Amar and Anthony = `900 – `200 = `700

12. The amount Amar has more than Akbar and Anthony = `900 – (`600 + `200) = `100.

13. The amount Akbar has more than Amar = `(600 – 200) = `400.

14. Required ratio = 6 : 9 : 2.

15. Required percentage = $\dfrac{(600 - 200)}{900}$ × 100 = 44$\dfrac{4}{9}$ %

Solutions for questions 16 to 20: Given 60% of boys who either like Tennis or Formula 1, like Tennis, hence 40% of them like Formula 1. Let the number of boys be x.

Therefore, $\dfrac{40}{100}x = 4$ ⇒ $x = 10$

Hence, the number of girls who like either Tennis or Formula 1.

\ $\dfrac{10}{G}$ = $\dfrac{2}{9}$ ⇒ G = 45

= $\dfrac{9}{2}$ × 10 = 45

This simplification can be tabulated as below:

	Tennis	Formula 1	
Boys	6	4	10
Girls	29	16	45
	35	20	

Also, the number of students in the school = $\dfrac{6}{5}$ × 55 = 66.

Among the remaining students who did not like any of these games, the number of boys = 11 × $\dfrac{6}{11}$ = 6 and the number of girls = 5

Number of boys who like Tennis = $\dfrac{60}{100}$ × 10 = 6

∴ Number of girls who like Tennis = 35 – 6 = 29
Number of boys who like Formula 1 = 4
Number of girls who like Formula 1 = 20 – 4 = 16

16. Required percentage = $\dfrac{16}{6}$ × 100 = 266 $\dfrac{2}{3}$%

17. Total number of girls = 45 + 5, i.e., 50

18. Total number of boys = 10 + 6 = 16
Number of girls who like Tennis = 29
∴ Required ratio = 16 : 29

19. Total number of students in the college = number of boys + girls = 66

20. Required percentage = $\dfrac{29}{66}$ × 100 = 43.93

21. Madhusudhan invested `3 lakh each in Schemes 2 and 3 and `4 lakh in Scheme 1.
Scheme 1: Amount at the end of 1 year
= 400000 (1.08) = `4,32,000.
Scheme 2: Amount invested every month

= `25,000 $\left(\square \dfrac{300000}{12}\right)$

Amount at the end of a year
= 25000 (1 + 12r) + 25000 (1 + 11r) +.....25000 (1 + r)
= 25000 (12 + 78r)
= 25,000 (12 + 78 (0.5%)) = `3,09,750.
Scheme 3: Amount at the end of a year
= 300000 (1.1) = `3,30,000.
Net worth at the end of a year = `10,71,750.

22. Return on Scheme 3 = `30,000
Return on Scheme 1 = `32,000
$\dfrac{32000 - 30000}{32000}$ × 100 = 6.25%

23. Madhusudhan's return on Scheme 2 was `9750. If he invests twice the amount he originally invested, then he would get a return of `19,500.

24. Instead of 4(1.08) lakh + 3.0975 lakh + 3(1.1)lakh, the total net worth would be 3(1.08) lakh + 3.0975 lakh + 4(1.1) lakh which comes to `10.7375 lakh.
∴ There is a change of `2000.

25. By investing a similar amount in Scheme 2 for another year, Madhusudhan's return can be determined by
25000 (1 + 24r) + 25000(1 + 23r) +..........25000 (1 + r)
= 25000 (24) + 25000 (300r)
= `6,37,500
∴ Return on Scheme 2 = `37,500
Return on Scheme 1 and Scheme 3 for the first year
= 32000 + 30000 = `62,000
∴ He earns `24,500 less.

Solutions for questions 26 to 30:
Let the total savings be 100%. Divisions of the savings will be as follows:
Stocks → 20%
NSC → 30%
Land → 40% of the remaining → 40% of 50% = 20%,
FD → (100 – (20 + 30 + 20)) = 30%

26. Since the same amount is invested in shares and land, let us assume this is 100x each

⇒ Total amount is $100x \times \dfrac{100}{20}$ = 500x

Value of my shares after two years

= $100x \left(1+\dfrac{20}{100}\right)\left(1+\dfrac{45}{100}\right)$ = 174x.

The value of land is $100x \left(1+\dfrac{10}{100}\right)\left(1+\dfrac{10}{100}\right)$ = 121x.

My gain from land is 121x – 100x = 21x on which I pay 10% tax.
∴ Net gain = 21x – 2.1x = 18.9x
Differences in gain = 74x – 18.9x = 55.1x
55.1x = 55,100
∴ x = 1000
Investment in shares and land = 1000 × 100 = 1 lakh

27. The total amount invested initially was `5 lakh.

28. Amount invested in NSC = 1,50,000

After 1 year it becomes 1,50,000 $\left(1+\dfrac{8}{100}\right)$ = 1,62,000

After the second year it is 1,62,000 × $\left(1+\dfrac{8}{100}\right)$

= 1,74,960 ≈ 1.75 lakh
Amount from shares = 1,74,000
Amount from land = 1,18,900 ≈ 1,19,000
Amount from FD after 1 year

= 1,50,000 $\left(1+\dfrac{6}{100}\right)$ = 1,59,000

= 1,59,000 – $\left(\dfrac{5}{100} \times 9,000\right)$ = 1,58,550

In the second year, I get another 8500 (which is same as the first year's net interest) and 5.7% on 8500.

$\dfrac{5.7}{100} \times 8{,}550 = `488 \approx `500$ (since 5% is paid as tax, 5% of

6% is 0.3%, therefore, 6 – 0.3 = 5.7)

\ Total amount from FD's = M 1,67,500

Total amount = 1.75 + 1.74 + 1.19 + 1.67 = 6.35 lakh.

29. 5 lakh invested becomes 6.35 lakh in two years.

Since the actual gain is $\dfrac{1.35}{5.00} \times 100 = 27\%$ for two years,

the compounded annual rate of return should be a little

less than half of it (i.e., $\left(\sqrt[3]{.27} - 1 \right) = 12\%$

30. From solution to Q.18, the amount in NSC after two years = 1,74,960

Total amount from FD = 1,67,500

The difference = 1,74,960, – 1,67,500 = 7500

31. Let N, J, R, B represent sales of the 4 friends on that day.

N, R + x, R, R – x are the 4 friends sales

We also know, R = 600

N, 600 + x, 600, 600 – x are their sales.

Average of 600 + x, 600, 600 – x = 600

N = 600 + 200 (given) $\Rightarrow$ N = `800

800, 600 + x, 600, 600 – x are the sales of Nikhil, Joy, Rohit and Binoy, respectively.

We do not know Joy's and Binoy's sales for that day but we know J + B = 1200.

And since each jar costs R18, B should be a multiple of 18.

In options A, B and C Binoy's sales namely 540, 576, 360) are multiplies of 18 but in option D, Binoy's sales are not a multiple of 18.

32. (800 + 600) exceeds (600 – x + 600 + x) by 200 irrespective of the value of x. Therefore, B cannot be determined.

33. Nikhil couldn't have sold 30, 35 or 15 plyboards as the cost of each plyboard will not be an integral number of rupees in that case.

34. 0.1(800) + 0.2(600 – x) + 0.3(600) + 0.2(600 + x) = `500.

35. 800 + 600 – x = 600 + x + 600

200 = 2x $\Rightarrow$ x = 100

Sales of Joy = 600 + x = `700

\ Joy sold 35 tyres at $\dfrac{700}{35}$ = `20/tyre

36. Let the total number of students who appeared for the board exams in IPS be N.

0.8N passed the board exams while 0.2N failed. Of the 0.8N who passed, 60% or 0.48N joined IIC.

The 0.48N students opted for Science, Commerce and Humanities in the ratio of 3 : 4 : 5.

\ 0.12N from IPS opted for Science, 0.16N for IPS opted for Commerce and 0.2N from IPS opted for Humanities.

60% of Science stream = 0.12N

$\Rightarrow$ Total Science stream = 0.2N

Similarly, total Commerce stream = 0.4N

Total Humanities stream = 0.4N

Given, Science + Commerce + Humanities

= 0.2N + 0.4N + 0.4N = N = 800

Students who failed = 0.2N = 160

37. 10% of 0.4N = 10% of 0.4(800) = 32

38. Science stream has 0.2N = 160 students. Of the 160, 96 are from IPS and 64 are from APS.

$\dfrac{2}{3} = \dfrac{64}{x} \Rightarrow x = 96$

\ 96 students in Commerce stream are from APS.

39. $\dfrac{2}{4} = \dfrac{64}{y} \Rightarrow y = 128$

In the Humanities stream, 50% or 160 students are from IPS and 128 students are from APS.

That leaves 32 students who are from neither school. Therefore, there are 10% students.

40. Total fees = 160 (1000) + 320 (1500) + 320 (2000)

= `12.8 lakh

Solutions for questions 41 to 45: Let the scores of Ajay, Bharat, Kumar, Sanjay and Vishal be denoted by A, B, K, S and V, respectively.

A + B + K = 135	B + K + S = 137
K + S + V = 132	S + V + A = 138
V + A + B = 133	

Adding, we get

3(A + B + K + S + V) = 675

A + B + K + S + V = 225.

S + V = (A + B + K + S + V) – (A + B + K) = 225 – 135

A = (A + V + S) – (V + S) = 138 – 90 = 48

K = (K + S + V) – (S + V) = 132 – 90 = 42

B = (A + B + K) – (A + K)= 135 – (48 + 42) = 45

S = (B + K + S) – (B + K)= 137 – (45 + 42) = 50

V = (S + V) – S = 90 – 50 = 40

Thus, the scores are as follows:

A	B	K	S	V
48	45	42	50	40

41. Vishal scored the least marks among the given students.

42. Sanjay scored the highest marks among the given students.

43. Only Sanjay scored more marks than Ajay.

44. The maximum difference in the marks scored by any two students = 10

45. Bharat scored 90% of Sanjay's score.

Solutions for questions 46 to 50: The Venn diagram for the given information is as follows:

Cricket   Music

5 – x   x + 4   x + 15

x

x + 7   5 – x

29
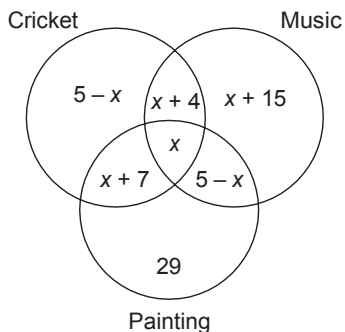
Painting

As the maximum value of *x* is 5 and the maximum number of children who enrolled for any single event alone was 29, it has to be in painting alone.

Given, $5 – x + x + 4 + x + 7 + x = 2x + 16 = 1/2 (x + 4)$
$4x + 32 = x + 41$
$\therefore x = 3$

46. The number of children who enrolled for all the three events is 3.

47. The number of children who enrolled for more than one event is the same as the number of children who enrolled for cricket = $2x + 16 = 22$.

48. The number of children who enrolled for exactly one event is $29 + 5 – x + x + 15 = 49$.

49. The number of children who enrolled for music is $2x + 24 = 30$.

50. $22 – 3 = 19$. Therefore, 19 children enrolled for exactly two events.

EXERCISE-2

1. Maximum non-taxable income after deduction = 1 lakh
Maximum deduction on investments in securities = 1 lakh
Now he can also avail a housing loan such that the loan repayment is equal to 20% of his annual income.
If X is the annual income, $2 + 0.2X = X$
$X = 2.5$ lakh.

2. For an income of `10 lakh, maximum housing loan repayment of 20% of `10 lakh = 2 lakh
Maximum deductions = $2 + 1 = 3$ lakh
Income on which tax is applicable = 7 lakh.
Tax on 7 lakh:
Up to $1 × 5$ lakh = 5,000
1.5 to 5 lakh = 70, 000
5 lakh to 7 lakh = $60,000 + 0.1 (60,000)$
Total tax (minimum) = 1,41,000

3. Maximum tax is applicable when the deductions are zero.
Up to 1.5 lakh = 5,000
1.5 to 5 lakh = 70,000
5 to 6 lakh = $30000 + 3000 \Rightarrow$ total = 1, 08,000
Minimum tax is when he has a deduction of 1 lakh on investments and 1.2 lakh (20% of 6 lakh) as housing loan repayment.
$\therefore$ Taxable income = $3 × 8$ lakh
Up to 1.5 lakh = 5000
1.5 to $3 × 8$ lakh = 46, 000
Total tax (minimum) = 51,000
Difference = 57,000

Solutions for questions 4 to 7: Let the number of samosas that Murali sells on the first day, i.e., on Monday be *n*.

It is given that the number of samosas that he sells on one day will be X less than the previous day twice during the week and X more than the previous day thrice during the week. The maximum and minimum number of samosas he sells on any day are 150 and 90, respectively.

So, we have to arrange 2 decrease by X and 3 increase by X from Tuesday to Saturday, which can be done in $\dfrac{5!}{2!3!} = 10$ ways

The 10 possible cases are below:

Case	Mon	Tue	Wed	Thur	Fri	Sat	Total
1	n	n –x	n – 2x	n – x	n	n + x	6n – 3x
2	n	n – x	n	n – x	n	n + x	6n – x
3	n	n – x	n	n + x	n	n + x	6n + x
4	n	n – x	n	n + x	n + 2x	n + x	6n + 3x
5	n	n + x	n	n – x	n	n + x	6n + x
6	n	n + x	n	n – x	n	n + x	6n + 3x
7	n	n + x	n	n – x	n + 2x	n + x	6n + 5x
8	n	n + x	n + 2x	n + x	n	n + x	6n + x
9	n	n + x	n	n – x	n	n + x	6n + x
10	n	n + x	n	n – x	n	n + x	6n + x

For Case I, $n – 2x = 90$ and $n + x = 150$
Difference = $3x$
$3x = 60$
$x = 20$

So, the number of samosas he sells are as follows.

Mon	Tue	Wed	Thu	Fri	Sat
130	110	90	110	130	150

Case	Mon	Tue	Wed	Thu	Fri	Sat	Total	Money earned in the week
1	130	110	90	110	130	150	720	2880
2	120	90	120	90	120	150	690	2760
3	120	90	120	150	120	150	750	3000
4	110	90	110	130	150	130	720	2880
5	120	150	120	90	120	150	750	3000
6	90	150	90	150	90	150	720	2880
7	90	120	90	120	150	120	690	2760
8	90	120	150	120	90	120	690	2760
9	90	120	150	120	150	120	750	3000
10	90	110	130	150	130	110	720	2880

4. If Murali sells 750 samosas in a particular week, it must be case 3, case 5 or case 9.
Number of samosas he sells on Friday:
Case 3: 120
Case 5: 120
Case 9: 150
So, he sells either 120 or 150 samosas on Friday.

5. Murali sells the minimum number of samosas on Friday.
So, it is either Case 6 or Case 8.
Since he does not sell the maximum number of samosas on Thursday, it is not Case 6.
So, it must be Case 8 and he earns `2760 in that week.

6. Since Murali sells 130 samosas on Friday, it can be either Case 1 or Case 10.
In both the above cases, he sells 110 samosas on Tuesday.

7. Since he sells 130 samosas on Wednesday, the number of samosas he sells on Saturday can only be 110.
Thus, we do not need any other information in this case to answer the question.

8. $1.2a + 1.35b = 1.25a + 1.25b \Rightarrow a = 2b$
\ a = 66.66 million; b = 33.33 million
In State A, 22.22 million live in cities.
In State B, 8.33 million live in cities.
In Year 25, total city dwellers
= 2(22.22 + 8.33) = 61.1 million

9. Rural population in Year 25 = 125 – 61.1 = 63.9 million = 51.12%
Rural population in Year 1 = 69.45 million = 69.45%
Change = 69.45 – 51.12 = 18.33 percentage points

10. 1.35(66.66) + 1.2(33.33) = 130 million

11. 0.8(22.22) + 0.7(44.44) + 0.8(8.33) + 0.7(25) = 73 million

12. $66.66[1 + 0.02x] + 33.33[1 + 0.03x] \geq 125$
$\Rightarrow x \geq 11$ \ In 11 years it can happen.

Solutions for questions 13 to 17: Let the number of engineers and that of non-engineers be e and n, respectively.

(i) $e = n\left[1 + \dfrac{20}{100}\right], e = \dfrac{6}{5}n$

(ii) Number of employees who specialized in Finance = $\dfrac{8}{15}n$

(iii) Number of employees who specialized in HR = 5/12
i.e., = $\dfrac{5}{12}\left[\dfrac{6}{5}n\right] = \dfrac{n}{2}$
Total number of employees = $\dfrac{8}{15}n + 35 + \dfrac{n}{2}$
$= e + n = \dfrac{6}{5}n + n$

$35 = \dfrac{11}{5}n - \left[\dfrac{8}{15}n + \dfrac{n}{2}\right] = \dfrac{35n}{60}$
$n = 30$
\ e = 36 and $e + n$ = 66
$\dfrac{8}{15}n = 16$ and $\dfrac{n}{2} = 15$

The conclusions above are represented below:

EB	SP			
	F	M	HR	T
E	a	b	c	36
N.E	7	d	5	30
T	16	35	15	66

$a + 7 = 16.$ \ $a = 9.$
$7 + d + 5 = 30.$ \ $d = 18$
$b + d = 35.$ \ $b = 17$
$c + 5 = 15.$ \ $c = 10$

13. Required number = d = 18

14. Required number = Total number of non-engineers – Number of non-engineers who specialized in Finance
= 30 – 7 = 23

15. Required number = 15

16.

    Choice (A) = 5,
    Choice (B) = a = 9,
    Choice (C) = d = 18,
    Choice (D) = b = 17

17. Required percentage = Percentage that 36 forms of 66

$$= \frac{36}{66}(100)\% = \frac{6}{11}(100)\% = 54\,6/11\%.$$

Solutions for questions 18 to 22: Let the weights of the 1st light-est, 2nd lightest, 3rd lightest, 4th lightest and heaviest boys be ℓ_1, ℓ_2, ℓ_3, ℓ_4 and ℓ_5, respectively. When they are weighed in groups of three, the possible combinations are $\ell_1\ell_2\ell_3$, $\ell_1\ell_2\ell_4$, $\ell_1\ell_2\ell_5$, $\ell_1\ell_3\ell_4$, $\ell_1\ell_3\ell_5$, $\ell_1\ell_4\ell_5$, $\ell_2\ell_3\ell_4$, $\ell_2\ell_3\ell_5$, $\ell_2\ell_4\ell_5$ and $\ell_3\ell_4\ell_5$.

When we add, we get:

    $6(\ell_1 + \ell_2 + \ell_3 + \ell_4 + \ell_5)$ = 106 + 116 + 122 + 126 + 132 + 146
                       + 120 + 126 + 136 + 142

$$\backslash\ \ell_1 + \ell_2 + \ell_3 + \ell_4 + \ell_5 = \frac{1272}{6} = 212$$

Since the weights are in the order of ℓ_1, ℓ_2, ℓ_3, ℓ_4 and ℓ_5.
    $\ell_1 + \ell_2 + \ell_3$ = 106 kg (lowest weight) and
    $\ell_3 + \ell_4 + \ell_5$ = 146 kg (heaviest weight)
    $\backslash\ \ell_1 + \ell_2 + 2\ell_3 + \ell_4 + \ell_5$ = 252 kg and
    since $\ell_1 + \ell_2 + \ell_3 + \ell_4 + \ell_5$ = 212 kg
    ℓ_3 = 40 kg
    $\backslash\ \ell_1 + \ell_2$ = 106 − 40 = 66 kg and
    $\ell_4 + \ell_5$ = 146 − 40 = 106 kg

The group with the second heaviest weight must be $\ell_2\ell_4\ell_5$, which is 142 kg.
    $\backslash\ \ell_2$ = 142 − 106 = 36 kg
    and ℓ_1 = 66 − 36 = 30 kg

The group with the second lightest weight is $\ell_1\ell_2\ell_4$ and $\ell_1 + \ell_2 + \ell_4$ = 116 kg.
    $\backslash\ \ell_4$ = 116 − 66 = 50 kg and ℓ_5 = 106 − 50 = 56 kg.
    $\Rightarrow \ell_1$ = 30, ℓ_2 = 36, ℓ_3 = 40, ℓ_4 = 50 and ℓ_5 = 56

Given, Ajay = Average of Bhushan and Emmanuel and also Chetan < Emmanuel < Deepak
    $\Rightarrow$ Bhushan = 30, Ajay = 40, Emmanuel = 50,
          Chetan = 36, Deepak = 56

18. The weight of the heaviest boy is 56 kg.

19. Bhushan's weight is 30 kg.

20. Emmanuel's weight is 50 kg.

21. Chetan's weight is 36 kg.

22. Average weight = $\dfrac{212}{5}$ = 42.4 kg

Solutions for question 23 to 25: The number of employees who are active would be 150 and 30 employees are not active on any of the three sites.

Facebook (68)   Linkedin (61)

Twitter (59)

As 36 + 21 + x = 59, x = 2 (employees active on all the sites).
\ We shall draw the following Venn diagram.

Facebook   Linkedin

Twitter (59)

23. Given, 21 − y = 13 \ y = 8
    Only Facebook = 53 − 8 = 45

24. Exactly one site = 150 − (13 + 2 + 21) = 114

    The required percentage = $\dfrac{114}{180} \times 100$ = 63.33%

25. The number of employees active only on Twitter is 36.

Solutions for question 26 to 28: The given information can be tabled as follows.

	Boys		**Girls**		
	Urban	**Rural**	**Urban**	**Rural**	**Total**
Mahatma Gandhi	132	40	45	50	267
Mother Teresa	120	40	80	50	290
Nelson Mandela	78	40	35	40	193
Total	330	120	160	140	750

26. The total number of students surveyed was 750.

27. 40 girls with a rural background voted for Nelson Mandela.

28. Girls with a rural background who voted for Mahatma Gandhi was one sixth of the total girls surveyed.

29. Total marks = 95 × 4 = 380
    Expected total marks = 230

\Difference = 150
The possibilities are as follows:

(1) $50 \times 2 + 80 - \dfrac{60}{2} = 150$

(2) $60 \times 2 + 50 - \dfrac{40}{2} = 150$

In both the cases, he got more than the expected marks in English.

30. Let (I) be true.
Total marks > 400
Difference > 170
When Ramesh gets the expected marks in Maths, then the maximum possible difference

$= 60 \times 2 + 50 - \dfrac{40}{2} = 150$

\ (II) is false.

31. Ramesh gets equal marks in two subjects if
(1) $40 \times 2 = 80 \times 1$
(2) $40 \times 3 = 60 \times 2$
(3) $40 \times 1 = 80 \times \dfrac{1}{2}$

\Physics is always one of the subjects.

32. It is possible only in the following case.
Here, $80 \times \dfrac{1}{2} = 40 \times 1$ and each of them multiplied by

3 gives 60×2.
In this case, he must have got thrice the expected marks in English.

☐ Total marks $= 40 \times 1 + 80 \times \dfrac{1}{2} + 50 \times 3 + 60 \times 2 = 350$

33. The cars which were sold in 2009 would come for a paid recharge in 2012. As 60% of the owners would go for a 3rd party replacement and the increase there is 294 (2820 – 2526), 294 is 60% of the cars sold, the number of cars sold would be 490.

34. All cars manufactured from 2006 to 2008 would come for a paid recharge in 2011. As 60% of them go to third-party vendors and 60% of the total = 2526
\ Total = 4210.

35. 60% were recharged by 3rd party vendors and that is equal to 2214. Then, 40% would be recharged by the company and that would be $\dfrac{40}{60} \times 2214 = 1476$.

36. As the cars sold in 2011 would come for a paid recharge in only 2014, we cannot determine the value.

37. As we have to allocate 2 to each of the 15 values, a total of 64 instances is covered.
Now the remaining 70 students must cover 176 (60 × 4 – 64) instances.

Let us try to maximize the students who are playing three games and minimize the students who play one or two games. This happens only when all these students are playing exactly one game.
Let x students play one game and y students play 3 games.
$x + y = 70$
$x + 3y = 176 \Rightarrow y = 53$ and $x = 17$
⇒ Now, the total number of students playing at most two games is 20 (i.e., initial 10 values) + 17 = 37.

38. As each of the values is at least 2, the remaining number of students is 70.
Now, as each of the games is played by the same number of persons, each of the six letters which represent students who play exactly two games must be equal, i.e., each of b, d, f, l, n and k must be 11. The remaining four students must be distributed for e, h, m and j.
\ The number of students playing exactly two games is $11 \times 6 + 2 \times 6 = 78$.

39. Let the number of students playing exactly one, two, three and four games be a, b, c and d, respectively.
Now, $a + b + c + d = 70$ (As all the 15 values take 2 each).
$a + 2b + 3c + 4d = 136$
d can at most be 22 and, in this case, $a = 48$, i.e., as follows:
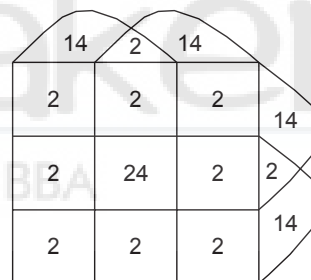
\ The total number of students playing all the four games is 24.

40. To identify the faulty ball in the minimum number of weighings, first divide the nine balls into three equal groups and keep three balls on each pan and if they balance, the faulty ball is in the other three balls kept aside and it can be identified with one more weighing. If the pans are not in equilibrium, the faulty ball is among the three balls in the heavier pan and can be identified in one more weighing.
\ The faulty ball can be identified in two weighings.

41. Divide the nine balls, into groups of three each. The different situations that can arise are
(A) No faulty balls in both the group weighed
(B) One faulty ball in one of the groups weighed
(C) One faulty ball in each of the group weighed
(D) Both the faulty balls in one of the group weighed

When any two groups are weighed, we can have two cases
(1) they are balanced (2) there is an imbalance.
Case (1) they are balanced:
If the two groups are balanced, it could either be case
(A) or case (C).
Replace one group of balls with the group kept aside in
the first weighing. If the new group of balls is heavier,
then both the faulty balls are in the new group weighed
and can be identified in one more weighing. If the new
group is lighter, both the groups which were weighed
first had a faulty ball each and both can be identified in
one more weighing each.

\ In four weighing's one can identity the faulty balls. In
Case (2) there is an imbalance:
If there is an imbalance in the first weighing it could ei-
ther be case (B) or (D).
Replace the heavier group with the third group of balls
and if these is still an imbalance, the group removed after
the first weighing and the group newly weighed would
have a faulty ball each and can be identified in one more
weighing each, i.e., a total of four weighings. If the pans
are balanced in the second weighing, the replaced balls
contain both the faulty balls and it can be identified in
one more weighing.

\ The faulty balls can be definitely identified in four
weighings.

42. Divide the balls into groups of three each and weigh two
groups. If they are balanced, then the faulty ball is in the
third group and can be identified with two more weigh-
ing's, i.e., a total of these weighings. If the balls do not
balance in the first weighing, replace one group of balls
with the third group and depending on the outcome
one can identify the group which contain the faulty ball.
Once the group containing the faulty ball is identified,
we can identify the faulty ball in one more weighing, i.e.,
a total of three weighings.

Solutions for questions 43 to 46: Number of washing machines

produced $=\dfrac{20}{100}(1500) = 300$

Number of washing machines of type Q produced

$=\dfrac{65}{100}(300) = 195$ and that of type P produced

$= 300 - 195 = 105$

Number of AC's produced $=\dfrac{3}{20}(1500)$

$= 225$ number of ACs of type P produced $= \dfrac{33\frac{1}{3}}{100}(225)$

$= 75$ and that of type Q produced $= 150$.

Number of refrigerators produced $= \dfrac{1}{4}(1500)= 375$.
Number of refrigerators of quality Q produced = 120 and
that of type P produced = 255.
Number of microwave ovens produced
$= 1500 - (300 + 225 + 375) = 600$.
Number of microwave ovens of type P produced
$= \dfrac{9}{10}(600) = 540$ and that of quality Q produced = 60.

The table below summarizes all the results obtained above:

Product	Type		
	P	**Q**	**Total**
Microwave ovens	540	60	600
Refrigerators	255	120	375
ACs	75	150	225
Washing machines	105	195	300

43. Average number of products of type Q

$= \dfrac{60 + 120 + 150 + 195}{4} = 131.25$

44. Required ratio = 540 : 195 = 36 : 13

45. Required difference = 255 – 120 = 135

46. Required total = (75 + 540) + (195 + 120) = 615 + 315
= 930.

47. For the minimum possible returns, Anand has to get
three times the expected returns from the company and
expected to give 10% returns and two times the expected
return from the company expected to give 20% returns.

The returns would be $\dfrac{25 + 30 + 40 + 45}{4} = 35\%$

48. For the maximum possible returns, Anand has to get
three times the expected returns from the company and
expected to give 45% returns and two times the expected
returns from the company expected to give 25% returns.

The returns would be $\dfrac{50 + 10 + 20 + 135}{4} = \dfrac{215}{4} = 53.75\%$

49. For 42.5% returns on average, Anand has to get three
times the returns from the company expected to give
25% return (A) and double the returns from the com-
pany expected to give 20% return (C).
\ Company A belonged to the IT or Infrastructure
sector.

50. If Company C belonged to the IT or Infrastructure sector, the returns from it would be 60%.
The maximum returns would be
$$\frac{25 + 10 + 60 + 90}{4} = \frac{185}{4} = 46.25\%$$
and the minimum returns would be
$$\frac{25 + 20 + 60 + 45}{4} = \frac{150}{4} = 37.5\%$$

If Anand earned 41.25% returns, he would have got double the returns from the company that was expected to give 25% (Company A). Therefore, Company A belonged to the Metals or Automobile sector and gave more than the expected returns.

EXERCISE-3

Solutions for questions 1 to 4: Let the number of two-mark questions be x. Therefore, the number of one-mark questions is $x + 1$ and the number of three-mark questions is $x – 1$.

$(x + 1) 1 + 2x + (x – 1) 3 = 100$

$\ x = 17$

\ The number of one-mark, two-mark and three-mark questions in each section are 18, 17 and 16, respectively.

\ Total number of questions = 51 × 3 = 153 and total number of three-mark questions = 16 × 3 = 48.

3. Maximum number of attempts = 76
To score the maximum, he has to attempt more of two and three-mark questions with the mistakes being in the one-mark questions.
Minimum number of mistakes = 16

\ Net score = $48 × 3 + 12 × 2 – 16 × \frac{1}{4} = 144 + 24 – 4 = 164$

4. To have an accuracy of exactly 50%, he can attempt at most 152 questions. Therefore, he answered at most 76 questions correctly.
Maximum possible score
$$= 48 × 3 + 28 × 2 – 22 × \frac{1}{2} – 54 × \frac{1}{4}$$
$$= 144 + 56 – 11 – 13.5$$
$$= 200 – 11 – 13.5 = 175.5$$

Solutions for questions 5 to 8: As 103 customers ordered exactly two items, 42 customers opted for one for three items. If x is the number of customers who opted for all three items, then we have

$x + 6x = 42$

\ $x = 6$

Now, the given information can be represented as follows:

Burger / 8 / x / 16 Pastries
6
y / $2x$
12
Bread
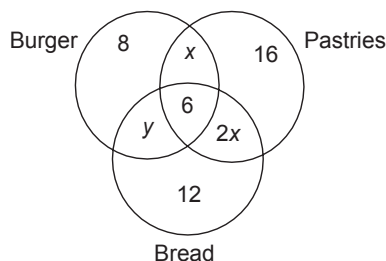
We have $18 + 2x = 14 + x + 25$

$4 + x = 25$

\ $x = 21$

and $2x + x + y = 103$

$y = 103 – 63 = 40$

The complete information is as given below.

Burger / 8 / 21 / 16 Pastries
6
40 / 42
12
Bread
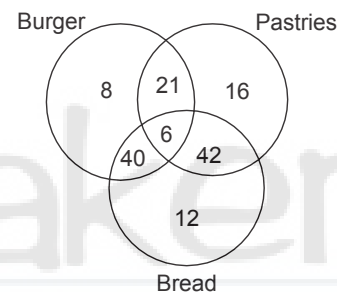
5. 16 customers ordered only pastries.

6. 42 + 6 = 48 customers ordered both pastries and bread.

7. 170 × 36 + 290 × 103 + x × 6 = 145 × 266
6120 + 29870 + 6x = 38570
6x = 38570 – 35990
6x = 2580
x = 430

8. $\frac{8x + 16(2x)+ 12(3x)}{36} = 170$

$\frac{76x}{36} = 170$

$x = 80.5$

The average amount paid by customers who ordered only pastries = $2x = 161$.

Solutions for questions to 9 to 13: Let $10k$, $15k$, $6k$ and $4k$ be the number of students who play Tennis, Football, Cricket and Hockey, respectively.

Let x be the number of girls who play all the given four games.

The following Venn diagram depicts the data given.
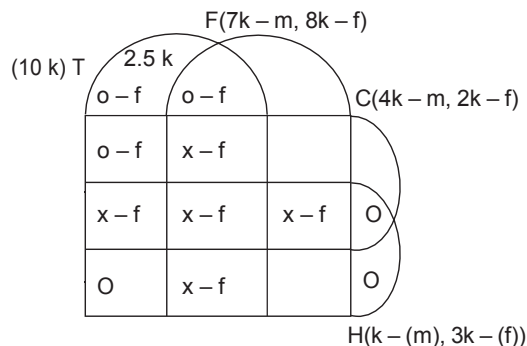
Given, number of girls who play tennis = $4x$ = 80
$\Rightarrow x$ = 20: $3k$ = 80 + 40 $\Rightarrow k$ = 40.
Since, boys who play hockey is k, i.e., 40 and
given $n(T \cap F \cap C \cap H)$ = 10 : $n(T \cap F \cap H)$ = 30
$\Rightarrow n(T \cap C \cap H) = n(F \cap C \cap H)$ = 0
\ The following Venn diagram can be drawn.
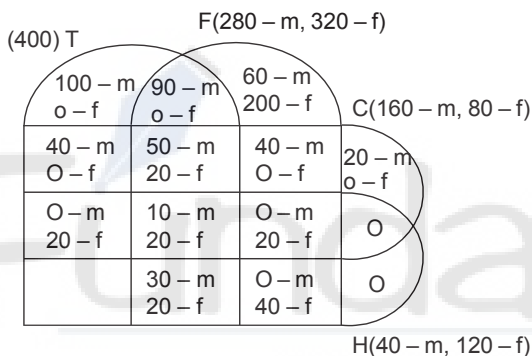
9. Required number of boys
= (90 + 40 + 50 + 40 + 10 + 30) = 260

10. As we do not know the number of girls who do not play any of the given sports, we cannot determine the required value.

11. Number of boys who play Tennis and Hockey
= 10 + 30 = 40
Number of boys who play Tennis and Hockey
= 3(20) = 60
Required difference = 60 – 40 = 20

12. Total number of boys = 440 + 10 = 450
Total number of girls = 340 + 10 = 350
Required ratio = 450 : 350 = 9 : 7

13. The number of girls who play Tennis, Football and Cricket = 40.
The number of boys who play Tennis, Football and Cricket = 60
Girls are less than boys by 60 – 40 = 20.

Required percentage = (20/60)*100% = $33\frac{1}{3}$ %

14. Number of students expected to join = 4600
Students expected to drop out = 920
Total fee collected = 920 × 10,000 + 3680 × 40,000
Total cost = 3680 × 25,000 + 920 × 6000
Profit = 3680 × 15,000 + 920 × 4000
= 5.52 crore + 36.8 lakh
= 5,88,80,000

15. Profit if no videos are provided
= 3120 × 15,000 + 780 × 4000
= 4.68 crore + 31.2 lakh
= 4.99 crore
\ The institute wants to have a profit of at least 5.49 crore.
Profit if videos are provided (without considering video cost)
= 4240 × 20,000 + 1060 × 5250
= 8.48 crore + 55.65 lakh
= 9.036 crore
\ The institute can afford to spend a maximum of 9.036 5.49 = 3.546 crore on videos.

16. Expected profit when no videos are provided
= 4120 × 15,000 + 780 × 4000
6.18 crore + 31.2 lakh = 6.492 crore
Expected profit when videos are provided
= 5440 × 20,000 + 1080 × 5,250 4.9 crore
= 10.88 crore + 56.7 lakh 4.2 crore
= 6.547 crore
\ The institute must provide videos to maximize its profit.

17. Total profit 20,800 × 20,000 + 5200 × 5250
= 41.6 crore + 2.73 crore
= 44.33 crore
Expenses on videos = 44.33 21.6 = 22.73 crore

Solutions for questions 18 to 21: Total sales have to be less than 800 but more than 400.

Further, the sales on any day have to be more than or equal to 100. Further, the sales have to be a multiple of 100 (200 or 300). Further, a total of 300 fruits cannot be sold across each of the three days. For example, 100 fruits cannot be sold on Day 1 (as the sum total of the numbers itself is working out to be more than 100). Similarly, a case of 150 fruits on Day 1 can be rejected.

Total sales (in pieces):

	Day 1	Day 2	Day 3
Apples	72	24	66
Oranges	38	82	54
Mangoes	62	68	22
Guavas	28	26	58
Total	200	200	200

Percentages:

	Day 1	Day 2	Day 3
Apples	36	12	33
Oranges	19	41	27
Mangoes	31	34	11
Guavas	14	13	29
Total	100	100	100

18. Total number of fruits sold is 600.

19. Since it can be observed from the above table that all the statements are true. Hence, nothing is false.

20. As observed from the table, apples registered the maximum % increase in sales from Day 2 to Day 3. Increase is $((66 - 24)/24) \times 100 = 175$ %.

21. For mangoes, sales changed by 20 percentage points.

Solutions for questions 22 to 26: From the data given, the following table can be tabulated.

Establishment	Males	Females	Total
Pizza point	1664	1056	2720
Pasta centre	1152	384	1536
Frenzy ice-cream	1800	1500	3300
Cookieyum	896	132	1028
Cakestake	360	576	936
Sandwichy	2928	1152	4080

22. Number of persons working in Cookieyum is 1028.

23. Required percentage $\dfrac{576}{384} \times 100 = 150\%$

24. Number of people working in Frenzy ice-cream is 3300.

25. Number of people working in Pasta centre is 1536.

6 Games and Tournaments

Chapter

Learning Objectives

In this chapter, you will:

- Learn about some common tournament formats, like knockout tournaments, round robin tournaments etc.
- Learn to interpret the points table and complete the incomplete fields in a table.
- Learn about seeded players and scheduling matches based on seeding of players.
- Learn how to maximise and minimise scores to qualify for the finals/semi-finals etc.
- Learn how to solve sets based on rules defined in the question.

❏ Introduction

Games and tournaments is an area which has appeared quite a few times in the past few years, predominantly in the CAT and XAT exams as a part of the Logical Reasoning and the Data Interpretation section. The challenge that students face in these questions is that there is no standard method to approach every question and there can also be various formats in which the questions can be asked.

However, some standard models that one can expect in a games and tournament set are:

(i) **Knockout tournaments:** In this format, the winner of a match advances to the next round while the loser is eliminated from the tournament. Also, there can be a scenario where some of the players are given a bye and constraints like seed numbers, upsets are introduced to add complexity to the questions.

(ii) **Round robin tournaments:** In these questions certain number of teams participate in a tournament, where every team plays against every other team in the pool stage of the tournament. There is a certain rule for distributing points among the teams based on the result of a match i.e. win, loss or a tie. From the pool stage, based on the rankings certain number of teams are selected for the further rounds.

(iii) **Interpret the points table:** The third type of question is the one in which the final points table for a tournament is given along with some supporting data, the student is expected to identify facts like the teams and their opponents, on which day a match was played, the grouping of teams etc.

(iv) **Miscellaneous** Apart from the types mentioned above the examiner is free to mix and match rules of a particular tournament be it cricket, football, tennis or any other sport and ask questions.

Directions for questions 6.01 to 6.05: These questions are based on the information given below.

A total of 64 players are scheduled to take part in a tennis tournament. The players are seeded from 1 to 64 with seed 1 being the top seed and seed 64 being the last seeded player. The tournament takes place in a knockout format with different rounds. In each round the winner of a match between two players advances to the next round while the loser is eliminated. This process is repeated till the finals. In the first-round player seeded 1 plays the player seeded 64, the player seeded 2 plays the player seeded 63 and so on. An upset is said to happen if a lower seeded player beats a higher seeded player. The matches are scheduled such that, in case of no upsets, in each round, the highest seeded player plays the lowest seeded player left in the tournament, the second highest seeded player plays the second lowest seeded player left and so on.

6.01: What is the total number of rounds in the tournament?
(A) 5   (B) 6
(C) 7   (D) 8

Sol: As there are a total of 64 players, in the first round, 32 players would be eliminated and 32 players would be left. In the next round half of 32, i.e., 16 players would be eliminated. In this way after 6 rounds there will be only one player left who is the winner of the tournament.

Note: Number of rounds is a factor of the power of 2. For 2 players, the number of rounds required is 1 as $2^1 = 2$, for 3 or 4 players the number of rounds required is 2 as $2^2 = 4$, for 5, 6, 7 or 8 players the number of rounds is 3 as $2^3 = 8$ and so on.

6.02: How many matches are played in the tournament?
(A) 52   (B) 60
(C) 63   (D) 64

Sol: As the tournament stated with 64 players and in the end only one player was undefeated, a total of 63 matches are played as one player is eliminated per match.

6.03: Which player faced the player seeded 3 in the quarter finals (round of 8) if the tournament had no upsets?
(A) 6   (B) 9
(C) 11   (D) 5

Sol: In any round, in case of no upsets, the sum of the seedings of the players is one more than the number of players left in the tournament.
As the match happens in the quarterfinals, the number of players left = 8.
\ Sum of seedings of players = 8 + 1 = 9.
Since 9 – 3 = 6, player seeded 3 faced the player seeded 6 in the quarterfinals.

6.04: If the tournament had no upsets, in which round was the player seeded 15 eliminated?
(A) 6   (B) 5
(C) 4   (D) 3

Sol: In case of no upsets, the player seeded 15 would be in the pre-quarterfinals (round of 16). In the next round as 8 players are left he will be eliminated.
\ The player seeded 15 was eliminated in the 3rd round.

6.05: How many matches did the player who lost in the semi-finals, win in the tournament?
(A) 2   (B) 3
(C) 4   (D) 5

Sol: As the player reached the semi-finals, he was among the last 4 players.
\ He won four matches and reached the fifth round.

EXERCISE-1

Directions for questions 1 to 5: Answer these questions based on the information given below.

Ten teams compete in the Master's cup. Each team plays exactly one match against every other team. The following score-card, with some details missing was obtained at the end of the tournament.

Teams	Result of match played against									
Name	Germany	Argentina	Colombia	Belgium	Netherlands	Brazil	Portugal	France	Spain	Uruguay
Germany	X	D	L	W	D		W	D	L	
Argentina		X	D	D	D			W	W	
Colombia	W	D	X	L	L		D		D	L
Belgium		D		X				D	W	L
Netherlands				W	X		D	W	W	
Brazil	D	L	D	L	L	X		L	D	L
Portugal		D	D	W		D	X	D		
France	D	L	W	D		W		X	W	
Spain		L	D	L			D		X	D
Uruguay	D	D	W	W	W		L	L	D	X

W – Win (3 points) L – Loss (0 points) D – Draw (1 point)

The scorecard above gives the outcomes of some of the matches. For instance, Germany won the match against Belgium, winning 3 points while Colombia drew the match with Argentina and both got a point each.

At the end of the tournament, the teams are ranked from 1 to 10 based on the total points scored by them in the tournament. If two or more teams end up having the same total points, then the following tie-breaker rules are followed.

(a) Among any two teams having the same total score, the team which won the match played between the 2 teams is ranked higher.

(b) If (a) doesn't resolve the tie, the outcomes of the matches played by the two or more teams against the team ranked 1 are considered. A win is considered better than a draw, which is considered better than a loss.

(c) If (b) doesn't resolve a tie, the outcomes of the matches played by the two or more teams against the team ranked 2 are considered while everything else remaining the same.

1. Which team scored the highest points in the tournament?
   (A) Netherlands (B) Germany
   (C) Spain (D) Brazil

2. In which position did Colombia finish the tournament?
   (A) 7 (B) 8
   (C) 10 (D) 9

3. Which among the following teams drew the most number of matches?
   (A) Argentina (B) Colombia
   (C) Spain (D) Uruguay

4. How many points did Brazil score in the tournament?
   (A) 5 (B) 4
   (C) 6 (D) 8

5. To how many teams did Germany lose, which are ranked better than it at the end of the tournament?
   (A) 1 (B) 0
   (C) 2 (D) 3

Directions for questions 6 to 10: Answer these questions based on the information given below.

Teams A, B, C, D, E, F, G and H compete in a volleyball tournament. Teams A, B, C and D are in group 1 while teams E, F, G, and H are in group 2. In the group stage, every team plays a game of with every other team in its group. The winning team gets 2 points, the losing team gets no points and no game in the tournament ended in a tie. At the end of the group stage, the top two teams from each group reach the semi-final stage where the top team of group 1 plays against the top team of group 2 and the other two teams play against each other.

The winners of semi-finals clash in the finals and a winner is declared. When two or more teams have the same points in the group stage, the tie-breaker rules are applied.

6. How many games are played altogether in the tournament?
(A) 15   (B) 14
(C) 13   (D) 12

7. Team F can get at most how many points and still not reach the semi-finals?
(A) 2   (B) 4
(C) 6   (D) 8

8. If Team A won every game it played in the tournament and Team B won in the semi-finals, then what would be the highest possible total score of Team D at the end of the group stage?
(A) 6   (B) 4
(C) 0   (D) 2

9. The team which won the finals should have won at least how many games in the tournament?
(A) 3   (B) 4
(C) 5   (D) 2

10. What is the sum of the total points scored by teams A through H in the first stage of the tournament?
(A) 28   (B) 24
(C) 26   (D) Cannot be determined

Directions for questions 11 to 14: These questions are based on the following information.

The following is the table of points in the twenty club English premier league, which is played on a double round-robin basis. The points given below are after the clubs played around thirty games.

Club	Played	Won	Draw	Loss	Points
Chelsea	32	28	4	0	88
Arsenal	32	22	8	2	74
Manchester United	31	23	5	3	74
Liverpool	31	20	6	5	66
Newcastle United	32	18	8	6	62

Note: Only the top five clubs are shown in the table of points given.

Win → 3 points, Draw → 1 point, Loss → 0 points
In a double round-robin tournament, every team plays exactly two games with every other team.

11. What is the maximum points Arsenal can end up with?
(A) 88   (B) 92
(C) 93   (D) 95

12. If in the remaining matches Arsenal had at least three wins and at least two draws, Manchester United should

win at least how many of the remaining games to guarantee itself at least the second place?
(A) 3   (B) 5
(C) 6   (D) 4

13. A minimum of how many more points should Chelsea score in the remaining matches, to guarantee itself the top most position?
(A) 6   (B) 8
(C) 10   (D) 12

14. Of the top five teams, if each team had to play the other four teams once more before the season is over and in the remaining matches between these teams, Newcastle wins four, Liverpool wins three, Manchester United wins two and Arsenal drew with Chelsea, which team finished fourth at the end of the season?
(Assume that none of the other teams can catch up with these five teams)
(A) Arsenal
(B) Manchester United
(C) Newcastle United
(D) Cannot be determined

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

43	44	45	46	47	48	HOME 49
42	41	40	39	38	37	36
29	30	31	32	33	34	35
28	27	26	25	24	23	22
15	16	17	18	19	20	21
14	13	12	11	10	9	8
START 1	2	3	4	5	6	7

You are playing a board game in which you start at 1 (START) and you have to reach 49 (HOME) in the least number of rounds.

In each round you throw a die exactly once and advance as many places as the number on the face of the die.

The following conditions apply in the game:
(a) If in three successive rounds, you throw three 6's consecutively, you should advance 5 more places at the end of that third round, i.e., say you are at 10, and in the next 3 rounds you get all 6's, so you reach 10 + (6 + 6 + 6) + 5 = 33 at the end of the third round.
(b) If you reach 4 after any round, advance 13 places.
(c) If you reach 40 after any round, go back 12 places.
(d) If you reach 27 after any round, you can go to any number whose sum of digits is same as that of 27.
(e) If you reach 23, after any round, go to either the highest or the lowest number in that column.
(f) You can't reach home with a 1, 4 or 6 as the last try.

15. What is the least possible number of rounds required to reach 'HOME' from the start?
(A) 4   (B) 5
(C) 6   (D) 7

16. If your first try is 6, what is the least number of rounds in which you can hope to reach 'HOME'?
(A) 6   (B) 7
(C) 8   (D) 9

17. If condition (d) is removed, the minimum number of rounds required to reach 'HOME' from the start is
(A) 4   (B) 5
(C) 6   (D) 7

Directions for questions 18 to 22: Answer these questions based on the information given below.

A total of fifteen baseball teams compete in the Premier Baseball League (PBL), which is played on a double round-robin basis. In a double round-robin tournament each team plays exactly two games with every other team. The table of results below gives the updated results of the top 5 teams in the tournament at a point when some matches are still yet to happen.

Team	Played	Won	Draw
New York Yankees	23	21	1
Boston Red Sox	22	19	3
Chicago White Sox	24	19	1
Los Angeles Dodgers	22	17	2
San Francisco Giants	25	16	4

Win → 3 points, Draw → 1 point, Loss → 0 points

18. What is the highest number of points that New York Yankees can end the tournament with?
(A) 72   (B) 75
(C) 78   (D) 79

19. In the remaining matches, if Boston Red Sox won at least 2 matches and drew at least 2 matches, at least how many more matches should New York Yankees win in order to retain the top spot? Given that all the teams played at least 20 matches each currently.
(A) 2   (B) 5
(C) 3   (D) 4

20. If all the teams played at least 20 matches when the table of results was compiled, with a minimum of how many more matches should the Florida Cubs (currently outside the top five) win to reach the first place?
(A) 4
(B) 3
(C) 6
(D) Cannot be determined

21. With how many more wins can Los Angeles Dodgers be confident of second place in the final points tally?
(A) 4
(B) 5
(C) 6
(D) Cannot be determined

22. What is the best position in which San Francisco Giants can finish at the end of all the matches?
(A) First
(B) Second
(C) Third
(D) Cannot be determined

Directions for questions 23 to 26: These questions are based on the information given below.

The table given in below gives the listing of players, ranked from the highest (1) to the lowest (32), who are due to play in a Tennis Tournament. This tournament has four knockout rounds before the final, i.e., first round, second round, quarter-finals and semi-finals. In the first round, the highest ranked player plays with the lowest ranked player, which is designated as Match 1 of first round; the 2nd ranked player plays the 31st ranked player which is designated as Match 2 of first round and so on. Thus, for instance, Match 10 of first round is to be played between 10th ranked player and the 23rd ranked player.

Rank	Player	Rank	Player	Rank	Player	Rank	Player
1	Somdev	9	Anju	17	Peltsin	25	Nisha
2	Vijay	10	George	18	Peter	26	Murthy
3	Ramesh	11	Spassky	19	Sam	27	Swati
4	Prakash	12	Ramiz	20	Ramesh	28	Meenakshi
5	Anand	13	Sachin	21	Rajesh	29	Kapil
6	Mahesh	14	Amit	22	Rakesh	30	Arvind
7	Paes	15	Dibyendu	23	Roopesh	31	Niranjan
8	Sania	16	Stalin	24	Vidya	32	Sunil

In the second round, the winner of Match 1 of first round, plays the winner of Match 16 of the first round and is designated as Match 1 of the second round. Similarly, the winner of Match 2 of first round plays the winner of Match 15 of the first round and is designated Match 2 of the second round. Thus, for instance Match 5 of the second round is to be played between the winner of Match 5 of the first round and the winner of Match 12 of the first round. The same pattern is allowed for the next rounds as well. There is exactly one upset (a lower ranked player beating a higher ranked player) in each of the rounds, including the finals. Eventually, no match ended as a draw.

23. If Kapil reaches the final, then who will play with him in the finals if the number of upsets in the tournament is the minimum?
(A) Vijay   (B) Ramesh
(C) Somdev   (D) Anand

24. If Peter won the second round match, then who won the finals?
(A) Peter   (B) Dibyendu
(C) Kapil   (D) Cannot be determined

25. If Anand played the quarter-finals, then who amongst the following must not have played against him in quarter-finals?
(A) Ramesh   (B) Prakash
(C) Sachin   (D) Kapil

26. If Ramiz played the semi-finals, then who amongst the following could have played him in the semi-finals?
(A) Ramesh   (B) Sania
(C) Meenakshi   (D) Prakash

Directions for questions 27 to 31: Answer these questions based on the information given below.

A and B start playing a game in which a certain number of coins are placed on a table. Each player picks at least '*a*' and at most '*b*' coins in his/her turn unless there is less than '*a*' coins on the table in which case the player has to pick all those coins left. A and B play alternately and intelligently so as to win the game. The game has 2 formats.

(A) Finders – Winners: In this format, the person who picks the last coin wins.
(B) Keepers – Losers: In this format, the person w h o picks the last coin loses.

27. A and B play a game of Finders – Winners with $a = 2$ and $b = 6$. If A starts the game and there are 74 coins on the table initially, then how many coins should A pick?
(A) 2   (B) 4
(C) 5   (D) 3

28. In a game of Keepers – Losers, B started the game when there were N coins on the table. If B is confident of winning the game and $a = 3$, $b = 5$, which of the following cannot be a value of N?

(A) 94   (B) 92
(C) 76   (D) 66

29. A and B play Finders–Winners with 56 coins, where A played first and $a = 1$, $b = 6$. What should B pick immediately after A?
(A) 2   (B) 4
(C) 3   (D) Cannot be determined

30. In a game of Keepers–Losers played with 126 coins where A plays first and $a = 3$, $b = 6$, who is the winner?
(A) A
(B) B
(C) Depends on A's first pick
(D) Cannot be determined

31. In an interesting variant of the game, B gets to choose the number of coins on the table and A gets to choose which format of the game it will be as well as pick coins first. If B chooses 144 and $a = 1$, $b = 5$, which format should A choose to win?
(A) Finders–Winners
(B) Keepers–Losers
(C) A will lose either way
(D) A will win either way

Directions for questions 32 to 34: Answer these questions based on the information given below.

India, Pakistan, Malaysia, South Korea, Japan and China are to take part in the Asian Hockey Championship. In the first round, each team plays each of the other teams exactly once. At these stage two points are awarded for a win, one point for a draw and zero points for a loss. After all the matches are played, the top two teams, in terms of the points scored, advance to the finals. In case two or more teams end up with the same number of points, the team with a better goal difference is placed higher.

32. The total number of matches in the tournament is
(A) 21   (B) 22
(C) 15   (D) 16

33. What is the minimum number of points with which a team can advance to the finals?
(A) 6   (B) 5
(C) 4   (D) 3

34. What is the maximum number of points that can be scored by a team, which failed to advance to the finals?
(A) 8   (B) 9
(C) 6   (D) 7

Directions for questions 35 to 38: Answer these questions based on the information given below.

A total of 128 players take part in a Grand Slam tennis tournament. The tournament is scheduled to be held in seven rounds and in each round, in a match between two

players, the winner advances to the next round and the loser is eliminated. There are no draws or byes in the tournament. The players who take part in the tournament are seeded from 1 to 128, with seed 1 being the top seed, Seed 2 next and so on. The matches are scheduled in such a way that in any round, assuming there are no upsets, the highest seeded player plays against the lowest seeded player at that point, the next highest seeded player always plays against the next lowest seeded player and so on. An upset is said to happen when a lower seeded player beats a higher seeded player. The schedule of matches in the next round remains unchanged in case of an upset in a round, with the only difference that the player who caused the upset advances to the next round and takes the designated place of the player he upset.

35. In case of no upsets in the tournament, in which round would the player seeded 10 face a player seeded higher than him?
(A) 2nd round   (B) 3rd round
(C) 4th round   (D) 5th round

36. How many players in the tournament won exactly one match?
(A) 15   (B) 24
(C) 30   (D) None of these

37. Assuming no upsets, which player beat Seed 25?
(A) Seed 8   (B) Seed 6
(C) Seed 1   (D) Seed 14

38. If the player seeded 13 won the tournament, then what is the minimum number of upsets in the tournament?
(A) 2   (B) 3
(C) 4   (D) 5

Directions for questions 39 to 42: Answer these questions based on the information given below.

Geeta and Neeta are playing a game which involves picking up coins kept on a table. The players take turns alternately and each player in her turn has to pick at least two and at most five coins except when there is only one coin left on the table and the player has to pick that coin in her turn. Both players are equally intelligent and play to the best of their abilities to win the game.

Assume that the player who picks up the last coin loses the game.

39. During a game, when it was Geeta's turn to play, there were 32 coins left on the table. Which of the following can be the number of coins Geeta should pick up to win the game, no matter how Neeta plays?
(A) 1   (B) 2
(C) 4   (D) 5

40. During Neeta's turn if she removed four coins from the table which made sure that she won the game, then which of the following could have been the number of coins on the table before she removed the four coins?

(A) 45   (B) 52
(C) 76   (D) None of these

41. During a game when it was Neeta's turn to play, there were 28 coins left on the table. Which of the following is the number of coins she should pick up to ensure her win?
(A) 1   (B) 2
(C) 4   (D) Neeta cannot win

42. If during her turn Neeta had to remove two coins to ensure her win, then which of the following could have been the number of coins on the table before she removed the coins?
(A) 25
(B) 30
(C) 50
(D) More than one of the above

Directions for questions 43 to 46: Answer these questions based on the information given below.

Sixteen teams participating in a hockey tournament are divided into two pools, pool A and pool B, each having eight teams. In each pool, each team plays one match with every other team. Two points are awarded for a win, one point for a draw and zero points for a loss. At the end of the pool stage, the top two teams, in terms of the number of points scored advance to the semi-finals and the winners of the semi-finals play the finals. If two or more teams end up with the same number of points at the end of the pool stage, the team with the best goal difference is placed highest, the next one second and so on.

43. What is the total number of matches in the tournament?
(A) 51   (B) 56
(C) 58   (D) 59

44. What is the least number of points with which a team can advance to the semi-finals?
(A) 4   (B) 5
(C) 6   (D) 8

45. What is the maximum possible number of matches won by a team that was eliminated in the pool stage?
(A) 3   (B) 4
(C) 5   (D) 6

46. What is the minimum possible number of matches won by a team that reached the finals?
(A) 1   (B) 2
(C) 3   (D) 4

Directions for questions 47 to 50: Answer these questions on the basis of the information given below.

The World Chess Championship is conducted as an eight-player double round robin tournament, i.e., one in which each player plays every other player twice, they partake once with white and once with black pieces. One point is awarded

for a win, half point for a draw and zero points for a loss. At the end of the tournament, the players are ranked according to the total points they won and the player with the highest number of points is crowned the World Champion.

In case two or more players end up with the same number of points, tiebreak rules are applied to determine their placings.

47. The total number of matches in the tournament is
(A) 28   (B) 36
(C) 56   (D) 72

48. Which of the following cannot be the points scored by the winner of the tournament?
(A) 7.0   (C) 8.0
(C) 9.0   (D) None of these

49. If there is only one person who finished with the least number of points, then the minimum difference between him and the winner of the tournament is
(A) 0.5 points
(B) 1 point
(C) 1.5 points
(D) 2 points

50. At the end of the tournament, if the points scored by all the players is different, then the minimum number of wins for the person who scored the highest number of points is
(A) 6   (B) 5
(C) 4   (D) 2

Directions for questions 1 to 4: These questions are based on the following information.

For the first time in the history of the U.S. Open Men's Tennis Tournament, the organizers of the tournament decided to do away with the process of drawing lots for finalizing the fixtures. Instead, they seeded all the 128 players in the tournament, as per their present world ranking, given by the Association of Tennis Professionals (ATP), with Seed 1 being the highest seed and Seed 128 being the lowest seed. This tournament has six knockout rounds, i.e., first round, second round, third round, fourth round, quarter-finals and semi-finals, before the finals.

In the first round, the highest seeded player (i.e., Seed 1) plays the lowest seeded player (i.e., Seed 128) and this match is designated as Match 1 of the first round; the 2nd highest seeded player (i.e., Seed 2) plays the 2nd lowest seeded player (i.e., Seed 127) and this match is designated as Match 2 of the first round, and so on. Thus, for instance, Match 64 of the first round is played between the 64th seeded player and the 65th seeded player. In the second round, the winner of Match 1 of the first round plays the winner of Match 64 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 with the winner of Match 63 of the first round and this match is designated as Match 2 of the second round. Thus, for instance, Match 32 of the second round is played between the winner of Match 32 of the first round and the winner of Match 33 of the first round. The same pattern is followed for all the subsequent rounds as well.

A match in which a lower seeded player beats a higher seeded player is termed as an upset.

1. If it was known that the player seeded third was *upset* in the third round, which of the following is not the seeding of the player who *upset* him?

(A) 35   (B) 94
(C) 99   (D) 29

2. If there were no *upsets* in the first two rounds, the lowest seeded player who could have won the tournament, by himself causing exactly one *upset* is
(A) Seed 27   (B) Seed 32
(C) Seed 24   (D) Seed 17

3. If the tournament was won by a player who was not among the first 50 seeds, the minimum number of *upsets* in the tournament was
(A) 5   (B) 6
(C) 11   (D) 17

4. If there were no *upsets* in the first two rounds and only matches 5, 8, 12 and 14 of the third round resulted in *upsets*, then who among the following reached the quarterfinals, given that there were no *upsets* in the fourth round?
(A) Seed 9   (B) Seed 28
(C) Seed 12   (D) Seed 20

Directions for questions 5 to 9: These questions are based on the following information.

Eight players from A through H qualified for the final round of the World Snooker Championship which is a round robin competition, i.e., each player plays with every other player exactly once. At the start of the tournament, these eight players were seeded from 1 to 8, with Seed 1 being considered as the top seed. No match ended as a tie and after each match, the winner was awarded one point and the loser was not awarded any points. At the end of the tournament, it was found that each player scored exactly one point less than his seeding. The following table gives the results of some of the matches played.

Player	A	B	C	D	E	F	G	H
A				W	W			
B						W		
C								W
D			W					
E				W				
F								
G		W				W		
H						W		

W – Won

For example, in the match played between A and D, A won over D.

It was also known that C was seeded 3 and E was not among the top five seeds.

5. Which player was seeded 1 at the start of the tournament?

6. How many matches did B win?

7. How many points did A score?

8. At the end of the tournament, the eight players were ranked based on the number of points scored such that the person with the highest number of points is ranked 1, the one with the second highest number of points is ranked 2 and so on. For which player was his rank the same as the number of points he scored?

9. Who scored the maximum number of points in the tournament?

Directions for questions 10 to 14: Answer these questions based on the information given below.

Eight basketball teams P through W qualified for the final round of the state-level selections. The eight teams are seeded from 1 to 8, Seed 1 being the best team. Every team played match against every other team and no match ended in a draw. The winning team got 1 point and the losing team didn't get any points.

At the end of the 28 games, it was observed that each team got a total score which was one less than the initial seeding that the team was given. It was also known that:
- (a) Team P beat team T
- (b) Team Q beat team R
- (c) Team R beat team W
- (d) Team W beat team U
- (e) Team T beat team S
- (f) Team V beat teams P and T
- (g) Team S beat team Q

10. Which team was seeded fourth at the start of the tournament?

- (A) Q
- (B) S
- (C) T
- (D) V

11. How many matches did team R win?
- (A) 1
- (B) 2
- (C) 3
- (D) 4

12. How many points did team T score?
- (A) 4
- (B) 5
- (C) 6
- (D) 7

13. Which team scored the highest points in the tournament?
- (A) V
- (B) R
- (C) T
- (D) S

14. If, at the end of the tournament, the teams were ranked 1 to 8 based on their points, with the team scoring the highest points getting rank 1, which team got the same rank as the number of points it scored in the tournament?
- (A) R
- (B) T
- (C) S
- (D) Cannot be determined

Directions for questions 15 to 19: Answer these questions based on the information given below.

Eight teams L, M, N, O, P, Q, R and S participated in a district-level volleyball competition.

The teams are divided into Pool-A and Pool-B, both having equal number of teams.

In the pool stage, all the teams play a match against every other team in the pool. The pool stage takes place over 6 days with two matches on each day and on any given day not more than one match happens between teams belonging to the same pool. The teams are awarded 2 points for a win, 1 point each for a draw and no points for a loss. The table gives the–day-score score sheet.

Days	D_1	D_2	D_3	D_4	D_5	D_6
L	2	2	2	3	3	3
M	1	3	3	3	3	3
N	0	1	3	3	5	5
O	0	0	1	1	3	3
P	0	1	1	2	2	2
Q	0	0	0	0	0	2
R	1	1	1	3	3	4
S	0	0	1	1	1	2

It is known that team Q lost a match on Day 3.

15. Which of the following teams are in the same pool as L?
- (A) N, P
- (B) N, S
- (C) M, R
- (D) M, Q

16. Who won the match on Day 3?
- (A) M
- (B) N
- (C) O
- (D) S

17. How many teams played matches on consecutive days?
- (A) 3
- (B) 4
- (C) 5
- (D) 6

18. Which of the following pair of teams played a match on the same day?
- (A) L, Q and O, S
- (B) L, R and M, O
- (C) P, Q and R, S
- (D) P, N and O, S

19. The complete details, such as match date, teams, outcome are not available for how many matches?
- (A) 0
- (B) 1
- (C) 2
- (D) 3

Directions for questions 20 to 23: Answer these questions based on the information given below.

Ten teams that are to take part in the Champions Challenge were divided into two pools as Pool A and Pool B. Each team in a pool was to play every other team in that pool. Two points are awarded for a win and zero points for a loss with there being no draws or ties. The top three teams in each pool would advance to the next stage, it is called the super six stage and they would carry forward all points they scored in matches against the other two teams which advanced to the super six stages from its pool. In the super six stage all teams that advance from Pool A are to be in Group 1 and all teams that advanced from Pool B are to be in Group 2. Each team in Group 1 plays against every team in Group 2, with points awarded as in the pool stage. At the end of the super six stage, the top two teams in each group, according to their total points (super six points + carry forward points) advance to the semi-finals with the top team in Group 1 playing the second team from Group 2 and vice versa. The winners of the semi-finals advance to the finals. If two or more teams end up with the same number of points at the end of the pool or the super six stage, the tie is resolved using tie-break rules.

20. The total number of matches in the tournament is

21. The number of points scored by a team which advanced to the super six stage is at least

22. The total points (super six points + carry forward points) of a team that advanced to the semi-finals is at least

23. The maximum number of wins by a team that failed to advance to the semi-finals is

Directions for questions 24 to 28: Answer these questions based on the information given below.

A total of five teams, namely Japan, USA, Cuba, Taiwan and Netherlands participated in the World Baseball Championship. The teams play a match against every other teams and the winning team gets three points; the losing team gets no points and both teams get a point each in case of a draw. In the final points tally, Japan, USA and Cuba got 10, 9 and 6 points, respectively. It is also known that in the final points tally Taiwan did better than Netherlands and Taiwan did not draw any match.

24. The final score of Netherlands at the end of the tournament is
- (A) 1
- (B) 2
- (C) 3
- (D) 4

25. How many matches in the tournament ended in a draw?
- (A) 0
- (B) 1
- (C) 2
- (D) 3

26. The result of how many matches in the tournament is not known?
- (A) 0
- (B) 1
- (C) 2
- (D) 3

27. Taiwan's overall points are less than that of USA by
- (A) 3
- (B) 5
- (C) 4
- (D) 6

28. How many matches did Cuba draw?
- (A) 0
- (B) 1
- (C) 3
- (D) Cannot be determined

Directions for questions 29 to 33: These questions are based on the following information.

The International Rugby Union (IRU) World Cup tournament has 16 teams seeded from 1 to 16, taking part in the first stage called the pool stage. They are divided into four pools such that seeds 1, 2, 3 and 4 are in pools 1, 2, 3, 4, respectively; seeds 5, 6, 7, 8 in pools 4, 3, 2, 1, respectively; seeds 9, 10, 11, 12 in pools 1, 2, 3, 4, respectively and seeds 13, 14, 15, 16 in pools 4, 3, 2 and 1, respectively. Each team in a pool plays all the other teams in the pool exactly once.

For the next stage called the Super Eight stage, the top two teams from each pool, based on their number of points, would qualify from each of the four pools. If at any stage, two or more teams end up with the same number of points, complex rules are applied to determine their placing. In the Super Eight stage, each team plays every other team except the team that qualified from its own pool. A team qualifying for the Super Eight stage carries forward only those points that it gained in its pool stage match against the other team that qualified from its pool. The top four teams in terms of points at the end of the Super Eight stage would qualify for the semi-finals, with the losers of the semi-finals playing for the third place and the winners of the semi-finals playing the final.

In the pool stage or in the Super Eight stage, a team is awarded two points for a win and zero points for a loss. An *upset* is caused when, in any match, a lower seeded team beats a higher seeded team. In any match, in case the scores are equal at the end of the normal duration of play, the teams play extra time till the winner is decided.

29. What is the number of matches in the Super Eight stage?

30. If the pool stage had only a single *upset*, then which is the lowest seeded team which can win the tournament?

31. What is the minimum number of points required for a team to reach the semi-finals?

32. For a team that has reached the Super Eight stage, what is the minimum total number of points required (including the points that it carried forward from the pool stage) such that it can guarantee itself a place in the semi-finals?

33. What is the total number of matches in the tournament?

Directions for questions 34 to 38: Answer these questions based on the information given below.

Sixteen teams qualified for the World Cup Cricket tournament. In the first stage called the pool stage, there are 16 teams, which are divided into two pools of eight teams each. In each pool, every team plays with every other team exactly once. Two points are awarded for a win and zero points for a loss with no match at any stage of the tournament ending in a tie.

At the end of the pool stage, the top three teams in each group, in terms of the points scored, advance to the next stage called the super six stage. The teams that advance to the super six stage also carry forward with them the points they scored against the other teams that advanced with them to the super six stage. In the super six stage, each of the three teams which advanced from a stage play a match with each of the other three teams which advanced from the other pool. The points for the matches are awarded as in the pool stage. At the end of all the matches in the super six stage, the four teams with the highest number of points advance to the semi-finals and the winners of the semi-finals play the finals. If at any stage of the tournament two or more teams end up with the same number of points, the team with better net run rate is placed higher.

34. What is the total number of matches in the tournament?
(A) 64   (B) 68
(C) 70   (D) 71

35. What is the minimum number of wins required for a team to reach the super six stage?
(A) 1   (B) 2
(C) 3   (D) 4

36. If Team X won the tournament, then the number of matches won by it is at least
(A) 5   (B) 6
(C) 7   (D) 8

37. If Team Y did not reach the semi-finals of the tournament, the number of matches won by it is at most
(A) 5   (B) 6
(C) 7   (D) 8

38. Which of the following statements is/are true?
(a) A team can advance to the semi-finals without winning a single match in the super six.

(b) The winner of the tournament won at least half of the matches it played.
(c) A team can fail to reach the semi-finals even after winning all the matches in the super six stage.
(A) Only (b)   (B) Only (a)
(C) Only (c)   (D) Both (a) and (c)

Directions for questions 39 to 41: Answer these questions based on the information given below.

The world series of poker had reached the final stage when the top eight players are left. The ranking of the players and the points they scored till the beginning of the final stage are as follows:

Player	Rank	Points
A	1	128
B	2	124
C	3	119
D	4	115
E	5	109
F	6	102
G	7	98
H	8	98

In the final stage, each of the players play exactly once with every other player. The points for the matches are awarded as follows. A maximum of 2 points will be awarded if one beats a player ranked higher than oneself and 1 point if one beats a player ranked lower than oneself. In the same way, points are deducted from the loser such that the net effect of a match is zero points. The points are computed after each match and the player with the higher number of points is ranked higher. If two players have the same number of points, the player who has played fewer number of matches in the final stage till that point would be ranked higher. If two players are still evenly matched, then the player who was ranked higher at the start of the final stage would be ranked higher. After all the matches are over, the player with the highest number of points is ranked first, the next one second and so on. No match in the tournament ends in a draw.

Note: The matches between the players can take place in any order.

39. What are the minimum points that player B could end up with at the end of all his matches?
(A) 112   (B) 111
(C) 110   (D) 113

40. What are the maximum points that player A could end up with at the end of all his matches?
(A) 142   (B) 135
(C) 136   (D) 137

41. How many of the given players has a chance of ending up as ranked first at the end of all the matches?

(A) 3   (B) 6

(C) 4   (D) 5

Directions for questions 42 to 46: Answer these questions based on the information given below.

75 tennis players who took part in an invitational tournament is seeded from 1 to 75. The tournament is played on a knockout basis such that a player once when he loses a match gets eliminated while the winner advances to the next round. In the first round, players seeded 1 to n were given byes such that there were no byes from the second round till the end of the tournament. A player is said to have received a bye when he advances to the next round, say the 2nd round, without playing a match in the previous round, i.e., the 1st round in this case. A match is said to be an upset if a lower seeded player, say seed 5, beats a higher seeded player, say seed 1.

The matches are scheduled such that, in any round, assuming there are no upsets, the highest seeded player plays the lowest seeded player left, the next highest seeded player plays the second lowest seeded player left and so on. In case of an upset, say Seed 25 beating Seed 5 in a round, the matches would proceed as usual with the only difference being Seed 25 advancing to the next round and meeting the opponent the player seeded 5 would have faced. No change happens in the seeding of a player because he causes an upset.

42. What is the total number of rounds in the tournament?

(A) 8   (B) 7

(C) 6   (D) 5

43. What is the total number of matches in the tournament?

(A) 68   (B) 71

(C) 72   (D) 74

44. How many players were given a bye in the first round?

(A) 6   (B) 13

(C) 11   (D) None of these

45. If the player seeded 1 was upset in the quarter-finals (round of eight), then what could be the seeding of the player who caused that upset?

(A) 6

(B) 8

(C) 9

(D) More than one of the above

46. If the player seeded 15 won the tournament, then what would be the minimum number of upsets in the tournament?

(A) 15   (B) 14

(C) 4   (D) 9

Directions for questions 47 to 50: Answer these questions based on the information given below.

The following table gives details about the performance of six tennis players in three Grand Slam tournaments, namely in The Australian Open, Wimbledon and The US Open.

Name	Total matches played	Matches played at the Australian Open	Matches played at Wimbledon	Matches played at the US Open	Total sets played
Federer	105	40	35	30	390
Nadal	93	35	28	30	362
Djokovic	80	35	25	20	337
Graf	115	33	40	42	260
Seles	60	21	20	19	198
Serena	140	25	70	45	325

(I) Nadal, Djokovic and Federer are male players while Graf, Seles, and Serena are female players.

(II) In the men's tournament, a player must win 3 sets to win a match.

(III) In the women's tournament, a player who wins 2 sets is the winner of the match.

(IV) Every year 128 participants take part in both the men's as well as women's section in each of the Grand Slams.

(V) All the matches are played between players of the same gender only, i.e., men play against men and women play against women.

(VI) Each tournament is played once in a year.

(VII) All the tournaments are played in the knockout format, i.e., the loser gets eliminated and the winner advances to the next round.

47. If Nadal and Djokovic never lost in the semi-finals, then what is the difference between the number of Grand Slams they participated, if they participated in the least possible number of tournaments?

48. What is the minimum number of matches that Federer lost in all the Grand Slams together?

49. If Serena never lost a match without winning a set, then what is the number of matches in which she won losing a set, if she lost the least possible number of matches in Grand Slams?

50. If Graf and Seles participated in all the three Grand Slams between the years 1990-95 and 1993-95, respectively, then what is the minimum number of matches they played against each other in these Grand Slams?

EXERCISE-3

Directions for questions 1 to 3: Answer these questions on the basis of the information given below.

A cricket tournament had three teams, such as India, Australia and Sri Lanka taking part in it. The format of the tournament was such that in the preliminary stage each of these teams would play the other teams four times. Four points are awarded for a win and in case a team beats another team by a huge margin, it is given a bonus point in addition to the four points. At the end of the preliminary stage, the top two teams, in terms of the points scored reaches the finals. No match in the tournament ends in a tie and if two teams end up with the same number of points at the end of the preliminary stage, the team with the better net run rate is placed higher.

1. If India reached the finals, then what is the minimum number of points it would have scored in the preliminary stage?

2. If Sri Lanka was eliminated in the preliminary stage, then what is the maximum number of points it could have scored?

3. If Australia had the highest number of points at the end of the preliminary stage, then at least how many points did it have?

Directions for questions 4 to 7: Answer these questions on the basis of the information given below.

A total of 128 players participate in each of the four Grand Slam tennis tournaments that take place in a year. Each tournament is played on a knockout basis such that in each round, the player who loses a match is eliminated from the tournament, while the player who wins, advances to the next round. No player receives a walkover/bye in any round in any of the Grand Slams.

For the questions below, assume that the same set of 128 players played in each of the four Grand Slams.

4. Player X had an overall win-loss record of 21-3 in the Grand Slams in a year. What is the earliest round in which he could have lost in a Grand Slam tournament in that year?

5. If the win-loss record in the Grand Slams in a year for the players ranked 1, 2, 3 and 4 in the world is 15-3, 17-3, 12-3 and 15-3, respectively, then what is the highest ratio of wins to losses for any player in the four Grand Slams in that year?

6. What could be the minimum number of matches won by player Y, if he had the best win and loss ratio among all the players in the four Grand Slams in a year?

7. At the end of four Grand Slams in a year, the top six players, in terms of the number of matches won in Grand Slams in that year qualify for the slam of champions. What could be the maximum number of matches won, in all the four Grand Slams put together, by a player who did not qualify for the slam of champions?

Directions for questions 8 to 12: Answer these questions on the basis of the information given below.

A total of 512 players participated in a knockout tournament with different rounds. Players are seeded from Seed 1 to Seed 512 such that Seed 1 is the top Seed while Seed 512 is the last seeded player. Matches are held in such a manner such that in the first round the 1st seeded player plays the last seeded player, similarly the 2nd seeded player plays the second last seeded player and so on. In each round, the winner of any match advances to the next round while the loser is knocked out of the tournament. This process is repeated till the finals when two players play amongst themselves to decide the winner. If at any point of time, a lower seeded player beats a higher seeded player, that match is defined as an upset. The matches are scheduled such that, in case of no upsets in each round, the highest seeded player plays the lowest seeded player left in the tournament, the second highest seeded player plays the second lowest seeded player left and so on. In case of an upset, the player who caused the upset (the lowest seeded player) would take the designated place of the player he upset (the highest seeded player) in the next round.

8. The player ranked 480 won the tournament. With which of the following seeded players, he must have not played in the semi-finals?
(A) Seed 100   (B) Seed 109
(C) Seed 93   (D) Seed 83

9. If player seeded 403 won the tournament, he must not have played with which of the following players in the finals?
(A) Seed 94   (B) Seed 84
(C) Seed 40   (D) Seed 93

10. Seed 100 must not have played with which of the following players in either the finals or the semi-finals?
(A) Seed 97   (B) Seed 83
(C) Seed 92   (D) Seed 88

11. Player ranked 200 won the tournament. With which of the following seeded players, he must have not played in the quarter-finals?
(A) Seed 18   (B) Seed 17
(C) Seed 113   (D) Seed 16

12. Seed 12 must not have played with which of the following players in the finals?
(A) Seed 91   (B) Seed 92
(C) Seed 98   (D) Seed 94

Directions for questions 13 to 16: Answer these questions on the basis of the information given below.

The following are the points scored by all the six teams. The points scored are P, Q, R, S, T and U at the end of a round robin tournament. Each team played five matches, one each with each of the other teams. Three points are awarded for a win, one point for a draw and zero points for a loss.

Team	Points scored
P	13
Q	7
R	9
S	--
T	1
U	6

The points scored by S is left blank.

13. How many matches did Q win?
(A) 1   (B) 2
(C) 3   (D) Cannot be determined

14. At most how may points did team 'S' score?
(A) 4   (B) 5
(C) 6   (D) 7

15. What is the maximum possible number of draws in the tournament?
(A) 5   (B) 6
(C) 7   (D) 8

16. At least how many points did team 'S' score?
(A) 0   (B) 1
(C) 2   (D) 3

Directions for questions 17 to 20: These questions are based on the following data.

Twelve teams took part in a football tournament, which is conducted in three stages. In the first stage, the teams are divided into two groups of six teams each. The teams within a group play with each other once and the top three teams of each group, in terms of the number of wins, go to the second stage. In the second stage, the three teams of each group play with each other once and the top two teams from each group then go to the third stage. In this stage, the two teams in each group play with each other and the winners from each group play with each other to decide the winner of the tournament. All games produce results. In case of a draw, a penalty shootout is used to decide the winner. In case of a tie, at the end of any of the first two stages the winner is decided by a set of complex tie breaking rules to ensure that only one team goes into the next round.

17. What is the minimum number of games a team should win to ensure that it goes into the second stage?

18. Of all the teams that reached the second stage, what is the minimum number of games a team could have won?

19. If a team gets `50,000 for each win in the first stage, `1,00,000 in the second stage and `1,50,000 in the third stage, find the maximum amount that any team can win.

20. What is the total number of matches in the tournament?

ANSWER KEYS

Exercise-1

1. (A)	10. (B)	19. (C)	28. (D)	37. (A)	46. (A)
2. (D)	11. (B)	20. (B)	29. (D)	38. (C)	47. (C)
3. (A)	12. (D)	21. (D)	30. (B)	39. (B)	48. (D)
4. (B)	13. (B)	22. (B)	31. (B)	40. (C)	49. (B)
5. (B)	14. (D)	23. (A)	32. (B)	41. (D)	50. (C)
6. (A)	15. (B)	24. (D)	33. (C)	42. (D)	
7. (B)	16. (B)	25. (A)	34. (A)	43. (D)	
8. (D)	17. (D)	26. (B)	35. (C)	44. (C)	
9. (A)	18. (D)	27. (A)	36. (D)	45. (D)	

Exercise-2

1. (D)	10. (A)	19. (A)	28. (A)	37. (D)	46. (C)
2. (C)	11. (B)	20. 32	29. 24	38. (C)	47. 1
3. (B)	12. (B)	21. 2	30. 16	39. (C)	48. 2
4. (A)	13. (A)	22. 2	31. 4	40. (C)	49. 43
5. F	14. (C)	23. 6s	32. 12	41. (B)	50. 1
6. 3	15. (A)	24. (A)	33. 52	42. (B)	
7. 6	16. (B)	25. (B)	34. (C)	43. (D)	
8. (D)	17. (C)	26. (A)	35. (B)	44. (D)	
9. G	18. (C)	27. (D)	36. (D)	45. (D)	

Exercise-3

1. 8	5. 6	9. (A)	13. (D)	17. 4
2. 20	6. 8	10. (C)	14. (D)	18. 2
3. 17	7. 20	11. (A)	15. (C)	19. 7,50,000
4. 3	8. (D)	12. (B)	16. (C)	20. 39

SOLUTIONS

EXERCISE-1

Solutions for questions 1 to 5: By filling the table, we get the following table:

Teams	Result of match played against
	Germany	Argentina	Colombia	Belgium	Netherlands	Brazil	Portugal	France	Spain	Uruguay	Total
---	---	---	---	---	---	---	---	---	---	---	---
Germany	X	1	0	3	1	1	3	1	0	1	11
Argentina	1	X	1	1	1	3	1	3	3	1	15
Colombia	3	1	X	0	0	1	1	0	1	0	7
Belgium	0	1	3	X	0	3	0	1	3	0	11
Netherlands	1	1	3	3	X	3	1	3	3	0	18
Brazil	1	0	1	0	0	X	1	0	1	0	4
Portugal	0	1	1	3	1	1	X	1	1	3	12
France	1	0	3	1	0	3	1	X	3	3	15
Spain	3	0	1	0	0	1	1	0	X	1	7
Uruguay	1	1	3	3	3	3	0	0	1	X	15

1. Netherlands scored the highest points.

2. Colombia and Spain are tied for 7 points and they also drew the game between them. Both also lost to the team ranked 1 (Netherlands). Therefore, their outcomes against the team ranked 2 should be considered.
Argentina, France and Uruguay are tied for the 2nd rank with equal points and they also won against each other in a cyclic fashion.
Therefore, applying the breaker rules,
Uruguay is 2nd (Since it beat Netherlands).
Argentina is 3rd (Since it drew against Netherlands).
And France is 4th (Since it lost to Netherlands).
Now, among Colombia and Spain, Spain Uruguay (Rank 2) and is therefore ranked higher.
Colombia's rank = 9, Spain's rank = 8.

3. Argentina drew 6 matches which is the highest.

4. Brazil scored 4 points in the tournament.

5. Germany lost only to Colombia and Spain, both of whom are ranked lower than Germany.

6. Group stage = 6 + 6 = 12
Semi-finals = 2
Final = 1
There are 15 matches.

7. Teams E, F and G can win 2 matches each, getting 4 points each and still Team F might be left out because of tie breaker rules.

8. As teams A, B, C and D are in one group, the Team D could have won at most one game.
∴ It scored only two points.

9. The team which goes to the semi-final stage has to win at least one game in the group stage. After winning semi-final and final, the team wins at least three games.

10. Total matches = 6 + 6 = 12
Total points = 12 × 2 = 24

11. Since Arsenal has six more games left to play, it can score a maximum of 6 × 3 = 18 points more
∴ Maximum points = 74 + 18 = 92

12. Since there are 20 teams and it is a double round-robin, each team plays 38 matches.
Arsenal has six games left. At most it could have had four wins and two draws getting 14 points.
Manchester united must get at least 15 points to guarantee itself the second place from seven matches. The minimum number of wins required is 4.
4 wins and 3 draws will give it 15 points.

13. Manchester united has seven games left and can score a maximum of 21 points. It can reach 95 points.
∴ Chelsea should get at least 96 points to be guaranteed of the title. It has to get a minimum of 8 more points.

14. Since the results of the remaining matches for these teams are not known, we can't determine who finishes third.

Solutions for questions 15 to 17: Since one can't reach home with 1, 4 or 6, one has to be at 44, 46 or 47 just before the last round.
Since, if one advance 13 places when you reach 4, always opt for that condition whenever possible.

15. The shortest route to 'HOME' would be as follows:
1st round 1 → 4 → 17 (Advance 13)
2nd round 17 → 22 (can't go to 23 since we reach 48 and get stuck there)
3rd round 22 → 7 (Go to 45, because 2 + 7 and 4 + 5 are equal)
4th round 45 → 46 or 47 and
5th round 46 or 47 → 49

16. 1st round → 1 → 6
2nd round → 6 → 12 (maximum possible)
3rd round → 12 → 17 (can't go to 18 because 3 consecutive 6's takes you to 23 and then to 48).
4th round → 17 → 22 (can't go to 23 since we reach 48 and get stuck there).
5th round → 22 → 27 (go to 45) then 2 more rounds as in the previous question.

17. 1st round 1 → 4 → 17
2nd round 17 → 22 (can't go to 23 since we reach 48 and get stuck there).
3rd round 22 → 28
4th round 28 → 34
5th round 34 → 39 (condition (a) or 31 to (40 + 5) and then two more rounds, as in the previous question)
6th round 39 → 44
7th round 44 → 49

18. If New York Yankees wins the remaining 5 matches, they will have 26 wins and 1 draw.
26(3) + 1(1) = 79 points

19. Boston Red Sox could at most win 4 and draw 2 matches, increasing their points to 74. New York Yankees have win at least 3 more matches and draw the remaining two.

20. As San Francisco Giants had a score of 52, Florida Cubs could've had a score of 51 at the most, with 17 wins and 3 losses. Assuming no one else in the top 5 wins any more points, Florida Cubs can win three more matches and draw five and reach the first place.

21. Cannot be determined as we have no data on the number of matches played by those teams which are not in top 5.

22. If San Francisco Giants wins the next three matches, they get 61 points, which is at best only 2nd position.

Solutions for questions 23 to 26:

Round	Number of Matches
I →	16
II →	8
Quarter-finals	4
Semi-finals	2
Finals	1

Round I:
Each match is played between the players, for whom the sum of the ranks = 33.
{(1, 32), (2, 31), (3, 30), (4, 29), (5, 28), (6, 27), (7, 26), (8, 25), (9, 24), (10, 23), (11, 22), (12, 21), (13, 20), (14, 19), (15, 18), (16, 17)}

Round II:
Exactly seven matches (since there was one upset in round I) are played between players (for whom sum of ranks is 17).

23. Kapil is ranked 29th, exactly one upset was there in every round. This was created by Kapil.
In the semi-finals, (1, 29) and (2, 3) matches were played. The finals held will be between Kapil and Vijay.

24. Peter created upset in the first round. But, he may or may not have created an upset in the other rounds. We cannot determine the winner.

25. Ist round: (5, 28)
IInd round: (5, 12) or (5, 21)
QF: (5, 4)
or   (5, 29)
or   (5, 13)
Anand must not have played against Ramesh.

26. Ramiz reached the semi-finals.
1st round:
(12, 21)
2nd round:
(12, 5) or (12, 28)
Quarterfinals:
(12, 4) or (12, 29) or (12, 13) or (12, 20)
Semi-finals:
(12, 1) or (12, 32) or (12, 16) or (12, 8)

27. If A picks 2, B will be left with 72 and no matter how many B picks, A can always pick (8 – x) and complete the 72.

28. In Keepers – Losers, the objective should be to give $8k + 1$ coins to the opponent to win for sure. With 66 wins, no matter what B does, he cannot give 65 coins to A. Therefore, B can't win.

29. Irrespective of what A picks, he will lose. However, what B picks first will depend on how many A picks. Hence, it cannot be determined.

30. To win, A should leave B, $9K + 1$ coins on the table, since it can't do that, he will definitely lose.

31. A should choose Keepers – Losers and pick 5 coins from the table, leaving 139 coins for B. As we get, $139 = 6K + 1$, A will win.

32. The total number of matches in the tournament
= 5 + 4 + 3 + 2 + 1 + 1 (finals) = 16

33. The minimum number of points would be required when one of the teams scored the maximum points and the remaining teams equally shared all the remaining points.
Total points available = $15 \times 2 = 30$
Maximum points for a team = $5 \times 2 = 10$
The remaining 20 points can be shared by all the five teams and one of those teams with four points would advance to the finals based on the goal difference.

34. The worst case for a team happens when three teams score the highest points and one of those teams is eliminated.
Points scored by the last three teams (points only among themselves) = 6
Remaining points = 24
These points can be shared by the teams and one of the teams with 8 points could be eliminated based on goal difference.

35. A player seeded 10, assuming no upsets is expected to reach the last 16 stage, i.e., the fourth round. In this round he would face the player seeded 7 and would be eliminated.

36. The players who won exactly one match are those who won the first round but lost in the second round, i.e., 64 – 32 = 32 players.

37. The player seeded 25 would have lost to the player seeded 8.

38. The minimum number of upsets happen when the player seeded 13 caused all the upsets, i.e., in the fourth and fifth rounds, the semi-finals and the finals, a total of four upsets.

39. To ensure her win, Geeta must make sure that there is one or two coins left when it is Neeta's turn to play. In each round Geeta can make sure that seven coins (2 + 5) leave the table.
\ The number of coins left on the table before Neeta's turn has to be of the form $7n + 1$ or $7n + 2$, where n is an integer. As there are 32 coins left on the table, she must remove two or three coins, so that the coins left over is of the form $7n + 1$ or $7n + 2$.

40. The number of coins left after Neeta's turn must be of the form $7n + 1$ or $7n + 2$. As she removed four coins, the number of coins would have been of the form $7n + 5$ or $7n + 6$. Only Choice (C) satisfies this condition.

41. When the person who picks up the last coin wins the game, one must make sure that when it is the other person's turn to play there are six or seven coins left on the table so that whatever the other person plays, one can pick the last coin in his/her turn.

\ The number of coins left on the table before Geeta's turn must be of the form $7n$ or $7n - 1$. As there are 28 coins left on the table, which is of the form 7n, whatever Neeta plays, the number of coins left will not be of the form '$7n$ or $7n - 1$' before Geeta's turn, i.e., Neeta cannot win no matter what she does.

42. As Neeta removed 2 coins, the number of coins was of the form $7n + 2$ or $7n + 1$. Choices (B) and (C) satisfy this condition.

43. The number of matches in the tournament is 28 + 28 (pool stage) + 2 (semi-finals) + 1 (final) = 59.

44. The least number of points required happens when one of the teams in a pool wins all the matches and the remaining seven teams evenly share the remaining points, i.e., $\dfrac{42}{7} = 6$.

45. A team can be eliminated with the maximum number of wins when three teams evenly share maximum points and the remaining teams only win points in matches among themselves, i.e., the top three teams end up with 12 points each and one of them would be eliminated.

46. A team can reach the finals with just six points in the pool stage, i.e., with only six draws and no wins. Therefore, just by a single win in the semi-finals a team can reach the finals.

47. As each player plays two matches, the total number of matches = $7 \times 8 = 56$.

48. As there is a total of 56 games, the total points available is 56. Even if all the players score the same number of points, each player would end up with seven points and one of them would end up as the winner.

\The winner can have any score from 7 to 14.

49. If only one person finished with the least number of points, then the minimum difference comes when he scores 6.5 points, the winner scores 7.5 points and all other players score 7 points each.

\The difference in points would be at least one.

50. If the number of wins of the winner of the tournament must be minimum, the points he scored must be minimum. If the scores of all players are distinct and the score of the winner is to be the minimum possible, the scores of the players are 9, 8.5, 8.0, 7.5, 6.5, 6.0, 5.5 and 5.0. If a player must score 9 points from 14 games, then he must have at least 4 wins, i.e., 4 wins and 10 draws.

EXERCISE-2

1. In the first round, the third seeded player would have beaten the player seeded 126. In the second round, he would have beaten the player seeded 62 or 67. In the third round, the third seeded player would have played against the player seeded 30 (in case of no *upset*) or player seeded 35 (potential opponent of player seeded 30 in the second round) or player seeded 99 (opponent of player seeded 30 in the first round) or player seeded 94 (opponent of player seeded 35 in the first round).

\ Any of these players could have beaten seed 3 in the third round.

2. If there are no *upsets* in the first two rounds, the top 32 players will reach the third round. Now, we need to find the lowest seeded player who could have won the tournament by himself causing just a single *upset*. Now assume that the single *upset* happened in the third round, and along with the match, all other matches in the third round resulted in *upsets*. This would mean that players seeded from 17 to 32 would reach the fourth round. Now, Seed 32 would play Seed 17 (originally scheduled Seed 1 and Seed 16), Seed 31 would play Seed 18 and so on. As the only *upset* of the player who won the tournament already happened in the previous round, the low-est seed player who can reach the next round without an *upset* is Seed 24 (who plays Seed 25). Assume that all the matches in this round, except that involving Seed 24, also resulted in *upsets*. In that case, Seed 24 becomes the highest seeded player left and he can win without any further *upsets*.

3. For minimum number of *upsets*, we assume that only the matches of the winner of the tournament were *upsets*. If the winner of the tournament was any person with a seeding of 51 to 64, then he can win the tournament with six *upsets* (all rounds except the first round).

4. Had there been *upsets* in matches 5, 8, 12 and 14 of the third round, players seeded 28, 25, 21 and 19 would have reached the fourth round, instead of seeds 5, 8, 12 and 14. As there are no *upsets* in the fourth round, the quarterfinal line up would be Seed 1 Vs Seed 9, Seed 2 Vs Seed 7, Seed 3 Vs Seed 6 and Seed 4 Vs Seed 21.

5. It is given that each player scored exactly one point less than its seeding, i.e., seed 1 scored 0 points, seed 2 scored 1 point and so on such that the Seed 8 scored 7 points, which is possible only if he beats all the other teams in the tournament, the player seeded seventh won 6 points

or he must have won against all the other players and so on and this can be tabulated as follows:

Seed	Won against	Lost to	Points
8	7, 6, 5, 4, 3, 2, 1	–	**7**
7	6, 5, 4, 3, 2, 1	8	**6**
6	5, 4, 3, 2, 1	8, 7	**5**
5	4, 3, 2, 1	8, 7,6	**4**
4	3, 2, 1	8, 7, 6, 5	**3**
3	2, 1	8, 7, 6, 5, 4	**2**
2	1	8, 7, 6, 5, 4, 3	**1**
1	–	8, 7, 6, 5, 4, 3, 2	**0**

From the tables it is clear that
A beats D and E, D beats B and B beats F. So also, G beats E and A, E beats C, C beats H and H beats F. All the other players except F has won at least one match.
\ F must be Seed 1.

6. F lost against all other persons.
H lost against C.
C won against F and H.
Now, we have to find Seed 2, who has won only one match. But among the given person only H can win one match, as all others have at least two wins already. Similarly, we can find out the number of the wins of the other persons and we can tabulate the information as follows:

1) G		2) A	
3) E		4) D	
5) B		6) C	
7) H		8) F	

B won three points or he won three matches.

7. From the arrangement, it is clear that A scored 6 points.

8. D won 4 points and his rank was 4.

9. G who won all his matches scored the maximum number of matches in the tournament.

10. As each team scored one points less than it's seeding, therefore Seed 1 scored 0, Seed 2 scored 1 point and so on.

Seed	Won against	Lost to	Points
8	7,6,5,4,3,2,1	–	7
7	6,5,4,3,2,1	8	6
6	5,4,3,2,1	8,7	5
5	4,3,2,1	8,7,6	4
4	3,2,1	8,7,6,5	3
3	2,1	8,7,6,5,4	2
2	1	8,7,6,5,4,3	1
1	–	8,7,6,5,4,3,2	0

Since all players except U win a match, U is Seed 1. Among the other players, only W can win one match exactly, hence, W is Seed 2. Similarly, the others can be found out.

Seed	Team
1	U
2	W
3	R
4	Q
5	S
6	T
7	P
8	V

Seed 4 is team Q.

11. Team R is seeded 3, therefore, it won 2 matches.

12. Team T is seeded 6, so it scored 5 points.

13. Team V scored 7 points.

14. S won 4 points and its rank is 4.

15. We can see that the –day-wise matches are as follows:

	✓	
D_1	L × Q	$\overline{M} \times \overline{R}$
		✓
D_2	$\overline{N} \times \overline{P}$	M × S
	✓	
D_3	N × Q	$\overline{O} \times \overline{S}$
		✓
D_4	$\overline{L} \times \overline{P}$	O × R
	✓	✓
D_5	L × N	M × O
	✓	
D_6	P × Q	$\overline{R} \times \overline{S}$

Here ✓ denote win and
— denote draw.
\ Pool A → L, N, P, Q
Pool B → M, O, R, S

16. N won the match on day 3.

17. L, M, N, O, S played matches on consecutive days.

18. P, Q and R, S played on Day 6.

19. Complete details are available.

Solutions for questions 20 to 23: In the pool stage, as each team plays every other team once, the total matches in each pool is 10. In the super six stage, the total matches are 9.

\The total matches = 20 + 9 + 2 + 1 = 32

In the pool stage, the total number of points available in each pool is $10 \times 2 = 20$.

As there are five teams, each team can end with four points and two of the teams can be eliminated (or)

one team can win all matches and get 8 points, another team 6 points and the three other teams 2 points each and one of them can advance to the super six.

20. The total number of matches in the tournament is 32.

21. The number of points scored by a team which advanced to the super six stage is at least 2.

22. Among the top three teams advancing to the super six stage from each group either all of them would carry forward 2 points each (or) one team would carry forward 4 points, second team 2 points and the third team zero points. Even if all the three teams lose all their super six matches, two teams would advance from this group and so a team with a total of 2 points can advance to the semi-finals.

23. Three teams can end up with 6 points each at the end of the pool stage, i.e., three wins each. Now these teams can win all their matches in the super six stage, but one of these teams would be eliminated.

\A team with 3 (in the pool stage) + 3 (in the super six stage) wins can be eliminated.

24. 10 points ⇒ 3 wins, 1 draw (Japan)

9 points ⇒ 3 wins, 1 loss (USA)

Cuba's 6 points can be 1 win and 3 draws or 2 wins and 2 losses. As 3 draws are not possible, because USA did not have any draw, Cuba won 2 matches and lost 2 matches.

✓	✓	✓
J – U	U – C	C – T
✓	✓	✓
J – C	U – T	C –N
✓	✓	✓
J –T	U – N	T – N
$\overline{J} - \overline{N}$		

As Taiwan did better than Netherlands, Taiwan won against Netherlands.

J – 10, U – 9, C – 6, T – 3 , N – 1

Netherland's scored is 1 point.

25. Only one match was drawn.

27. 9 – 3 = 6 points.

28. Cuba did not draw any match.

Solutions for questions 29 to 33: The teams in the four pools are as follows:

Pool 1	Pool 2	Pool 3	Pool 4
Seed 1	Seed 2	Seed 3	Seed 4
Seed 8	Seed 7	Seed 6	Seed 5
Seed 9	Seed 10	Seed 11	Seed 12
Seed 16	Seed 15	Seed 14	Seed 13

29. There are 8 teams in the Super Eight stage. If each team plays all other teams, there must be 7 + 6 + 5 + 4 + 3 + 2 + 1 = 28 matches. Since teams from the same pool don't play again in the Super Eight, the four matches between these teams must be deducted.

\Total matches = 28 – 4 = 24

30. In any pool, out of the four teams, the best seed; 2nd best seed, 3rd best seed and worst seed, even the worst seed can reach the next round by causing only one upset, i.e., by beating the 2nd best seed. In this case, the 2nd best, 3rd best and the worst seed will have one win, i.e., 2 points each. Hence, the worst seed can move to the next round.

If this happens in pool 1, all of the seeds 8, 9 and 16 would have one win each and seed 16 can enter the Super Eight stage and go on to win the tournament.

31. Since all teams that reach the Super Eight stage carry forward the points gained in the pool stage against the other qualifier in the group, for calculating the points it can be taken that all teams play every other team once.

\Total points in the Super Eight stage = $28 \times 2 = 56$.

As there are no ties, let us assume that the top three teams have won the maximum number of points, i.e., 14, 12 and 10, respectively and the remaining points are equally distributed, i.e., remaining five teams would have won 4 points each.

\A team that scores only four points in total can possibly advance to the semi-finals.

32. To find the maximum points a team can score and still be left out of the semi-finals, assume that five teams score evenly and the remaining three score points only in matches between themselves.

Total points = 56

Points scored by the bottom three teams = 6

All the five teams can score 10 points each and one of the teams is eliminated.

\To guarantee itself a place in the semi-finals, a team has to score 12 points (as there are no ties in the tournament, the team can't score 11)

33. Number of matches in the pool stage = 6 × 4 = 24.
Number of matches in the super six stage = 24
Then, semi-finals (2) + finals (1) + 3rd place match (1)
\ Total = 24 + 24 + 2 + 1 + 1 = 52 matches

34. The number of matches in the tournament is 127 as 128 players take part in the tournament and in each match a player who is defeated is eliminated. As there is only a single player left undefeated in the tournament, 127 matches have to take place.

35. As there are 128 players the tournament has seven rounds. Therefore, the winner of the tournament won seven matches.

36. The player seeded fifth could have faced Seed 7 (in case of no upset till that round and seed 10 had he upset seed 7 in the round of 16.

37. All players who would have faced the player seeded 8 would have been eliminated, i.e., Seed 57, Seed 25, Seed 9, Seed 1 and Seed 4.

38. There are three players seeded above the player seeded 4. Of these, Seed 3 could have been eliminated by Seed 2 and so at least two players were upset, namely Seed 1 and Seed 2.

39. Assume that before B plays his first match, A had played and lost against F, G and H. Now B would have more points than any other player and if he loses all his matches, he could end up with 124 – 14 = 110 points.

40. As two points are awarded for a win against a player ranked higher, for A to get maximum points, player A should win all his matches and should face the maximum possible number of opponents when they are ranked higher than him. It can be seen that player C cannot be ranked higher than player A before they play each other.
\ Only player B can be ranked above player A before they play.
The maximum points player A can have at the end of all his matches = 128 + 2 + 6 = 136

41. The minimum points for A at the end of all the matches would be 114.
Therefore, the only players who can score more than 114 points can end up being ranked as number 1.
Hence, all the players up to F can possibly end up as being ranked first at the end of all the matches.

42. As the number of players is 75 which lies between 2^6 and 2^7, there are seven rounds in the tournament.

43. As there are 75 players and only one player is undefeated, there are 74 matches in the tournament.

44. As there are no byes from the second round, there must be 64 players at the beginning of the second round. Therefore, only 11 players were eliminated in the first round, i.e., 11 matches. Thus, 75 – 22 = 53 players were given a bye.

45. Had there been no upsets till the quarter-finals, the player seeded 1 would have faced the player seeded 8th. The player seeded 8th would have faced the player seeded 9th in the round of 16, the player seeded 25 in the round of 32 and the player seeded 57 in the round of 64. Had the player seeded 8th been upset by any of these players in an earlier round, the player who caused the upset would have come in place of the player seeded 8th in the next round.
\ Any of the given players could have faced the player seeded 1 in the quarter-finals.

46. For the minimum number of upsets, we have to assume that all the upsets were caused by the winner himself. The player seeded 15 can advance to the round of 16 without any upset. After that he need to cause four upsets to win the tournament.

47. If they participated in the least number of Grand Slams, they should have played the maximum number of matches in each tournament.
⇒ In a tournament containing 128 players, a player can play at most 7 matches.
Minimum number of tournaments in which Djokovic took part

$= \dfrac{35}{7} + \dfrac{25}{7} + \dfrac{20}{7} = 5 + 4 + 4 = 13$

For playing 25 matches he has to play at least four tournaments and for playing 20 matches again he has to play at least four (if he plays only three, it means that he lost in the semi-finals of one tournament).
Minimum number of Grand Slams in which Nadal took part

$= \dfrac{35}{7} + \dfrac{28}{7} + \dfrac{30}{7} = 5 + 4 + 5 = 14$

⇒ Difference = 14 – 13 = 1

48. To calculate the minimum number of matches lost by Federer, we must make his number of wins the maximum. He won 5 Australian opens, 5 Wimbledon Opens, and 4 US Opens.
⇒ He lost at least 1 match each in the US Open and the Australian Open.
⇒ Minimum number of matches which Federer lost
= 1 + 1 = 2

49. Serena lost a minimum number of matches.
⇒ She won maximum number of matches.
She lost in the 4th round in one Australian Open and in the third round in one US Open.
⇒ 2 matches she lost, where she won 2 sets and lost 4 sets.
She won 138 matches ⇒ 138 × 2 = 276 sets
But she played 325 sets.
She lost the 2 matches by playing 6 sets.
⇒ (325 − 6) – 276 = 43 sets were lost in the matches she won.

50. To calculate the minimum number of matches they played against each other, we must assume that they met only in the finals.

Since we must calculate the minimum number of meetings, we have to make minimum possible appearances for both the players in the finals between 1993–95, for which one arrangement can be as follows.

Player	Year	Australian Open	Wimbledon	US Open
Graf	1990	7	7	7
	1991	7	7	7
	1992	7	7	7
	1993	5	7	7
	1994	4	6	7
	1995	3	6	7
Seles	1993	7	6	6
	1994	7	7	6
	1995	7	7	7

So, they will meet at least once in the final of the US Open.

EXERCISE-3

1. For India to reach the finals with the minimum number of points, one of the teams, say Australia should have won all the matches and India and Sri Lanka should have won two matches each in the four matches they played. So, India would have scored eight points, the same as Sri Lanka and can still advance to the finals on the basis of better net run rate.

2. This scenario happens when each team wins four matches that too all of them with bonus points, such that each team ends up with 20 points and one of the teams would be eliminated.

3. To top the preliminary stage with the least number of points, all teams should have the same number of wins, i.e., 4 and as Australia had the highest, it could have won one of the matches with a bonus point to have a total of 17 points.

4. As there are 128 players taking part in the game, each Grand Slam would have seven rounds. As it is said that player X has a 21-3 win – loss record, he lost three matches and so the maximum number of matches he could have won in the Grand Slam with the best performances are 7, 6 and 6.

∴ He won only two matches in the fourth Grand Slam and he reached at least the third round of each Grand Slam.

5. As all the top four players have only three losses each, they won a Grand Slam each. Therefore, the best record a player can have is if he has reached the finals of the four Grand Slams, for a win – loss record of 24-4, i.e., 6.

6. All the four Grand Slams would have exactly one winner, a player winning all the seven matches. As we need the minimum win – loss record for the player with the best record in all the four Grand Slam combined, it is to be assumed that the maximum number of matches won by these players is only seven each, except for one person who won one more match for a total of eight wins.

7. We have to find the highest number of wins possible for the player with the seventh highest number of wins. In any Grand slam, the winner wins seven matches, the losing finalist, six matches, the semi-finalists, five matches each and the quarter finalists, four matches each. If we consider that the top seven players reached the quarter finals or higher at each of the four Grand Slams and that they won the same number of matches in the four Grand Slams combined, they would have 20 wins each and one of the players would be eliminated.

8. Seed 480 is in the form of 8K. He would have played with any person whose seeding is of the form 8K + 4 or 8K + 5. Seed 100 is in the form of 8K + 4. Seed 109 is in the form of 8K + 5. Seed 93 can be represented in the form of 8K + 5. However, Seed 83 cannot be represented in any of the two forms → 8K + 4 or 8K + 5.

9. Any player with seeding $4x + 2$ or $4x + 3$ must have played with the player with seeding $4x$ or $4x +1$ in the finals. So, the player seeded 403 can play with Seed 84, Seed 40 and Seed 93 (in the form of $4x +1$) but Seed 403 must not have played with Seed 94 (in the form of $4x +2$) in the finals.

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10. In the finals, Seed 100 could have played with any player whose seeding is in the form of $4x + 2$ or $4x + 3$. Further, in the semi-finals, Seed 100 could have played with any person whose seeding is in the form of $8x$ or $8x + 1$. Seed 92 cannot be represented in any of the four forms → $4x + 2$, $4x + 3$, $8x$ and $8x + 1$.

11. Seed 200 is in the form of $16K + 8$. He would have played with any person whose seeding is of the form $16K$ or $16K + 1$. Seed 18 cannot be represented in any of the two forms → $16K$ or $16K + 1$.

12. Seed 12 is of the form $4x$. He could have played with any player with Seed in the form of $4x + 2$ or $4x + 3$ in the finals. Seed 94 is of the form $4x + 2$. Seed 91 is of the form $4x + 3$. Seed 98 is of the form $4x + 2$. However, Seed 92 cannot be represented in any of the form $4x + 2$ or $4x + 3$.

Solutions for questions 13 to 16: As then are six terms in total, each team would play 5 matches. The total number of matches is 15. The points available in each match are either two or three. So, if all the matches end in draws, the total points would be 30 and if each match produces a decisive result, the total points of all the teams would be 45. For each draw, the total number of points would reduce by 1.

13. As Q had 7 points, it could have had two wins and one draw or one win and four draws. So, we cannot determine exactly how many matches it won.

14. The minimum number of draws in the tournament would be 1(P) + 1(Q) + 1(T) + 1(S) as the number of draws must be even. If two matches (4 draw counts) are drawn, the total points would be 43. Therefore, S can score at most 43 (13 + 7 + 9 + 1 + 6) = 7 points.

15. The minimum number of decisive matches in the tournament would be 4(P) + 1(Q) + 2(R) + 1(U) = 8
As there are 15 matches in total, 15 – 8 = 7 matches would end in draws as given in the table:

Team	Points scored	Wins	Loss	Draws
P	13	4	0	1
Q	7	1	0	4
R	9	2	0	3
S	2	0	3	2
T	1	0	4	1
U	6	1	1	3
Total	38	8	8	14

16. The number of points scored by S would be minimum when the number of draws is maximum so that the total points is minimum. As seen from the previous questions, these can be at most 7 draws and so at least 38 points were scored.
\ Points scored by S = 38 – (13 + 7 + 9 + 1 + 6)
= 38 – 36 = 2

17. The wins of different teams can be as follows. The teams are arranged in descending order of the number of wins. If a team wins 4 matches, there can't be 3 other teams with a better performance.

5	4	2	2	2	0
5	4	3	2	1	0
4	4	4	2	1	0
4	4	3	2	2	0
4	4	3	2	1	1
4	4	2	2	2	1
4	3	3	3	2	0
4	3	3	3	1	1
4	3	3	2	2	1
4	3	2	2	2	2
3	3	3	3	3	0
3	3	3	3	2	1

From the last row we see that there can be five teams with three wins each. So, two teams with three wins will get eliminated. So, three wins are not enough.

18. If the top two teams win 5 and 4 matches, then out of the remaining 6 match results, a team which wins 2 matches can reach the second stage.

19. The top team can win at most 5 games in the first stage, 2 in the second and 2 in the third.
\ The amount won by the top team in rupees
= (5 × 50,000) + (2 × 1,00,000) + (2 × 1,50,000)
= 7,50,000

20. The number of matches in the first stage is
$$15 \times 2 = 30$$
The number of matches in the second state is
$$3 \times 2 = 6$$
The number of matches is the third stage is
$$2 \times 1 + 1 \text{ (finals)} = 3$$
\ Total number of matches = 30 + 6 + 3 = 39

7 Networks and 3D Diagrams

Chapter

Learning Objectives

In this chapter, you will:

- Learn how to interpret and understand networks, routes, triangular graphs and spider charts
- Get exposed to different question types based on the same
- Learn to solve questions involving more than one way of representing data
- Learn how to optimize movement of goods in a network of pipelines, minimize slack, etc.
- Learn how to calculate shortest/most cost-effective path to take, balancing load in different branches of a network

❒ Introduction

This chapter covers two topics – 3D Diagrams and Routes and networks. In the past, there have been questions in various entrance exams like CAT, XAT, NMAT, SNAP etc. from these chapters.

3D Diagram

A 3D diagram is a graph used to represent data with multiple parameters. In cases were a bar graph or a pie chart does not suffice or may complicate the data rep-presentation, a 3D graph comes handy.

An example of a 3D graph showing the sales (in 1000's units) of Maruti Suzuki Ltd. is given below:
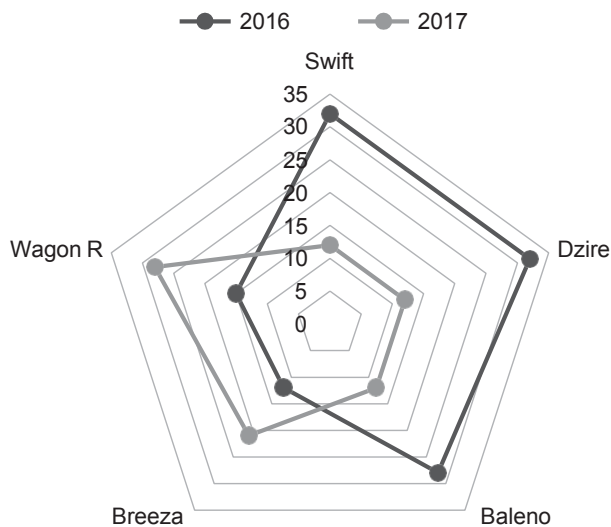
Routes and Network

A network diagram is given with nodes connected to each other by certain routes which are represented by either one-way or two-way arrows with constraints. The constraints can be capacity in case the arrows represent pipes or distance/toll rates in case the arrows represent roads. The diagram is such that the capacity of all the nodes needs to be fulfilled. In general, the network diagram represents a network of pipes supplying water/oil to cities, network of roads connecting various cities or a drainage system of a city. The questions in the solved examples section give a good idea of kind of question you can expect from this section.

❏ Three-Dimensional Graph

The data (parameters) in a triangular graph are given on each side of the triangle. Each point represents a particular parameter in terms of the percentage, the same represents.
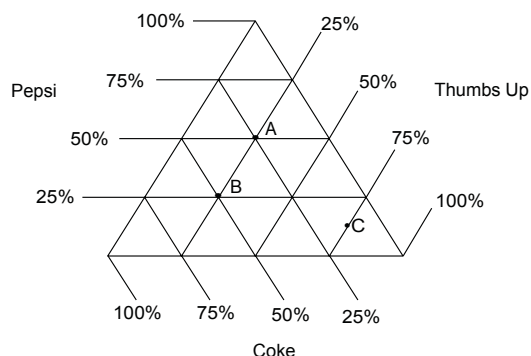
This graph represents the percentage of students who like the three colas, such as Pepsi, Thumbs Up and Coke in three colleges A, B and C.

Solved Examples

Directions for questions 7.01 to 7.05: These questions are based on the information given below.
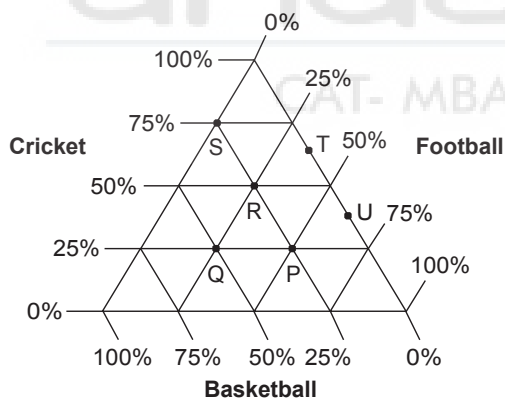
The above diagram shows the percentage of students in six classes, namely from P, Q, R, S, T and U and whose favourite game is cricket, football or basketball. The total number of students in these classes are P – 80, Q – 96, R – 120, S – 100, T – 80 and U – 120.

7.01: Find the number of students in classes R and S together whose favourite game is cricket?

(A) 95   (B) 110
(C) 125   (D) 135

Sol: Number of students in class R whose favourite

game is cricket $= \dfrac{50}{100}(120) = 60$

Number of students in class S whose favourite

game is cricket $= \dfrac{75}{100}(100) = 75$

∴ Required number = 135

7.02: How many more students in class Q had basketball as their favourite sport when compared to the number of students in class P whose favourite sport is football?

(A) 6   (B) 7
(C) 8   (D) 10

Sol: Number of students in class P whose favourite

sport is football $= \dfrac{50}{100}(80) = 40$

Number of students in class Q whose favourite

sport is basketball $= \dfrac{50}{100}(96) = 48$

∴ Required number = 8

7.03: The number of students in class Q whose favourite sport is cricket formed what percentage of the students in class R whose favourite sport is football?

(A) 60   (B) 75
(C) 84   (D) None of these

Sol: Number of students in Q whose favourite sport

is cricket $=\dfrac{25}{100}(96)$

Number of students in R whose favourite sport

is football $=\dfrac{25}{100}(120)$

Required percentage $=\dfrac{\dfrac{25}{100}(96)}{\dfrac{25}{100}(120)}(100) = 80\%$

7.04: Find the total number of students in the given six classes whose favourite sport is football.
(A) 208   (B) 199
(C) 196   (D) 191

Sol: Number of students in P whose favourite sport

is football $=\dfrac{50}{100}(80) = 40$

Number of students in Q whose favourite sport

is football $=\dfrac{25}{100}(96) = 24$

Number of students in R whose favourite sport

is football $=\dfrac{25}{100}(120) = 30$

Number of students in S whose favourite sport is

football $=\dfrac{0}{100}(100) = 0$

Number of students in T whose favourite sport

is football $= \dfrac{37.5}{100}(80) = 30$

Number of students in U whose favourite sport

is football $= \dfrac{62.5}{100}(120) = 75$

$\backslash$ Required number = 199

7.05: In the class if the percentage of students whose favourite sport is cricket was the highest, then what is the number of students whose favourite sport was not cricket?
(A) 50   (B) 40
(C) 35   (D) 25

Sol: Class S had the maximum percentage of students whose favourite sport is cricket. In this class for 25% of the students, the favourite sport was not cricket.

$\backslash$ Required value $=\dfrac{25}{100}(100) = 25$

Directions for questions 1 to 5: These questions are based on the following data.
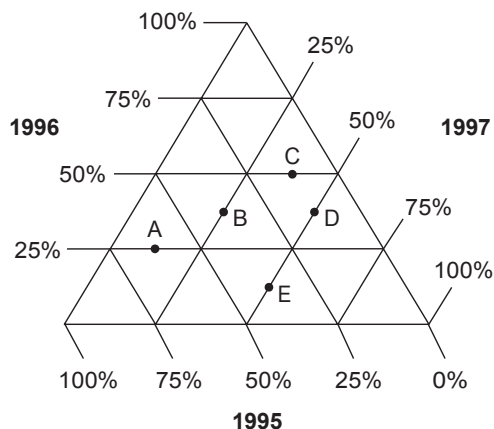
The above triangular chart represents the profit percentages earned by five companies A, B, C, D and E across three years.

Note: (1) Profit percentage is calculated on sales revenue.
(2) Profit = Sales revenue – Expenditure

Sales revenue of the five companies across three years
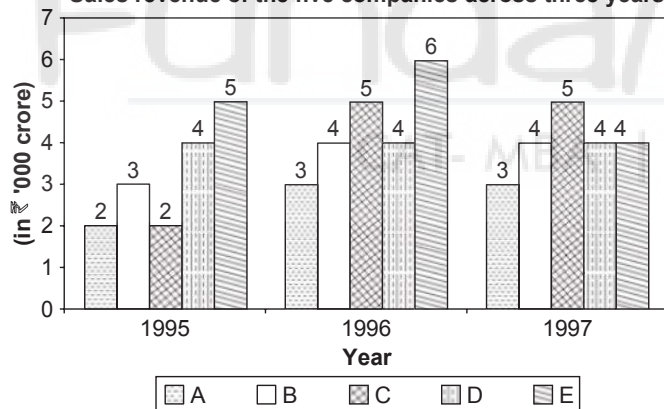
1. Which of the following companies has earned maximum profit during the year 1997?

2. What is the total profit earned (in crore) by company A during the given years?

3. What is the highest profit earned (in crore) by any of the companies in any year?

4. What is the ratio of the expenditure of C to that of D during the year 1995?

5. During the year 1998, if the sales revenue of B increases by 25% and the expenditure decreases by 20%, then the profit percentage of B in 1998 is more (in percentage points) than that of 1997 by

Directions for questions 6 to 10: These questions are based on the following diagrams.
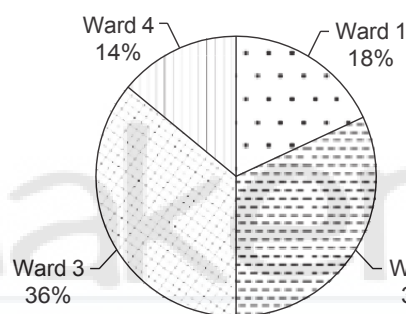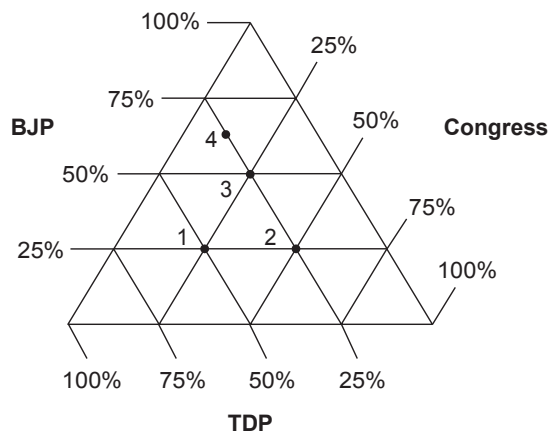
The numbers 1, 2, 3 and 4 in the triangle indicates the four wards, ward 1, ward 2, ward 3 and ward 4, respectively. The above triangle depicts the performance of three parties in the municipal elections of Hyderabad in four different wards. The pie diagram shows the distribution of total votes polled for these parties in the four wards. Total votes polled in all the four wards is 5 lakh. The number given in the pie chart indicates the ward number.

6. The number of votes polled for TDP in ward 1 is
   (A) 4,50,000   (B) 45,000
   (C) 67,500   (D) 72,500

7. In which ward did Congress secure the maximum number of votes?
   (A) Ward 4   (B) Ward 3
   (C) Ward 2   (D) Ward 1

8. How many votes did BJP secure in wards 3 and 4 together?
   (A) 94375   (B) 137350
   (C) 133750   (D) 157350

9. By what majority did Congress win over TDP in ward 2?
   (A) 80000   (B) 20000
   (C) 60000   (D) 40000

10. Which party secured a majority in ward 4?
- (A) BJP
- (B) TDP
- (C) Congress
- (D) BJP and Congress secured the same number of votes.

Directions for questions 11 to 15: These questions are based on the following diagrams.
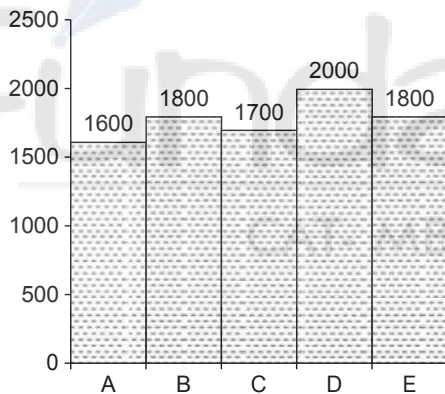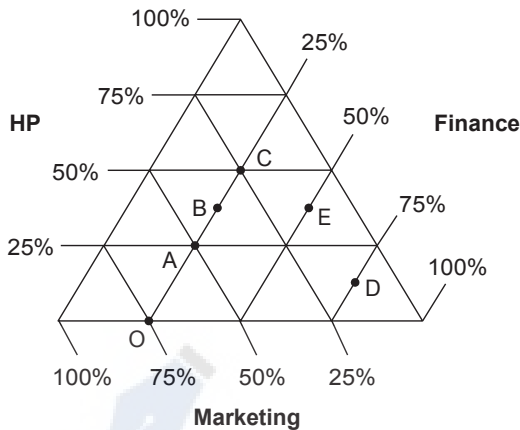
Marketing

The above diagram represents the composition of professionals in three departments, such as HR, Finance and Marketing of five different firms, A, B, C, D and E. Each of these firms consists of only these three departments. The bar chart shows the number of employees in each of these five firms.

11. The number of HR professionals in firm A is
- (A) 1200
- (B) 800
- (C) 400
- (D) 350

12. The difference in the number of Marketing professionals in firm B and that in firm C is
- (A) 250
- (B) 500
- (C) 750
- (D) 600

13. In the next year, in firm D the number of finance professionals increased by 30% while the increase in the number of HR and Marketing professionals is 10% and 20%, respectively. By what percentage does the total number of professionals in firm D increase?

- (A) 26.25%
- (B) 52.5%
- (C) 20.79%
- (D) 12.625%

14. If the Marketing professionals earn `7000/month on an average and the Finance and the HR professionals earn `6000/month and `5000/month, respectively in firm A, then the average monthly salary of all the professionals in firm A is
- (A) `6250
- (B) `6000
- (C) `5250
- (D) `4500

15. The ratio of HR professionals in firm B to that in firm E is
- (A) 1 : 1
- (B) 2 : 3
- (C) 3 : 2
- (D) 3 : 4

Directions for questions 16 to 19: Answer these questions on the basis of the information given below:

The diagram given below is the network for transporting oil from refinery A to depots B, C, D, E, F and G. The arrows indicate the direction in which oil flows and the value above each depot denotes its capacity (in thousand litres). The supply is arranged such that only after a depot is full will the excess oil be transferred to the depots next in the supply line. The maximum capacity (in thousands of litres) of the pipeline connecting the refinery with the depots is 1500 and those connecting the depots is 750. The slack in a pipeline is defined as the extra flow required to bring the pipeline to full capacity. The flow in the pipeline is such that the demand at each depot is completely met.
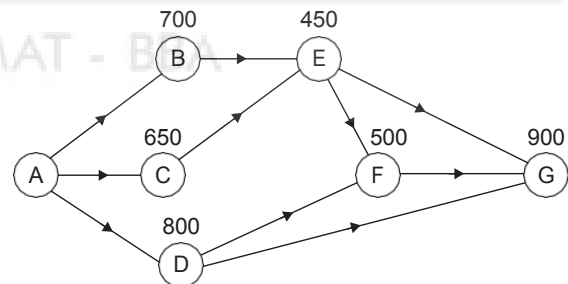
Note: All capacities mentioned are in thousand litres.

16. What is the minimum flow (in thousand litres) in the pipeline connecting A and D?

17. If the pipeline connecting A and B is under repair as a result of which its maximum capacity is reduced by 20%, what is the minimum flow (in thousand litres) in the pipeline connecting D and F?

18. What is the maximum value (in thousand litres) of the sum of the slacks in all the pipeline supplying oil to depot E?

19. If the slack in the pipeline connecting D and G is 50, then what is the minimum slack (in thousand litres) in the pipeline connecting E and F?

Directions for questions 20 to 24: Answer these questions on the basis of the information given below.

The following diagram gives the network used for supplying oil from a refinery X to depots A, B, C, D, E, F and G.
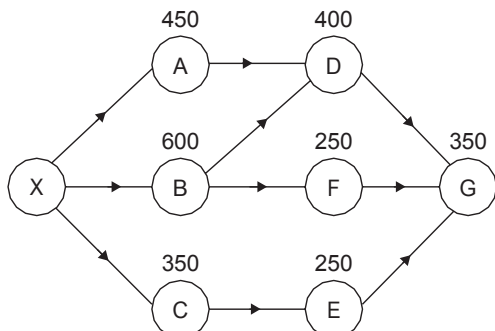
The flow of oil is in the direction shown and is such that only after the demand at an intermediate depot is completely met, oil is passed on to the next depot in the network. The values alongside the depots represent the demand (in units) at each depot. It is also known that the flow of oil is such that the demand at all the depots is exactly met and that the capacity of each pipeline is 1000 units.

Note: The slack in a pipeline is the excess flow that is required in the pipeline to bring it to full capacity.

20. What is the maximum slack in the pipeline connecting X and B?
(A) 100 units   (B) 150 units
(C) 200 units   (D) 250 units

21. What is the maximum flow in the pipeline connecting C and E?
(A) 750 units   (B) 650 units
(C) 600 units   (D) 550 units

22. What is the sum of the slacks in all the pipelines put together?
(A) 5750 units   (B) 5950 units
(C) 6100 units   (D) 7350 units

23. What is the maximum flow in the pipeline connecting D and G?
(A) 350 units   (B) 300 units
(C) 250 units   (D) 200 units

24. If another depot H, located after G is connected to the network, then what is the maximum quantity of oil that can be supplied to H, all other values remaining the same?
(A) 500 units   (B) 450 units
(C) 400 units   (D) 350 units

Directions for questions 25 to 28: These questions are based on the following data.

The network shows the water pipelines connecting the 6 cities (A, B, C, D, E, F).

Through a pipeline, water can flow only in one direction as indicated by the arrow in the diagram.
- The maximum carrying capacity of any of the pipelines is 1000 m^3 per day.
- The daily requirement at C is 400 m^3.
- The slack in the pipeline is the difference between its maximum carrying capacity and the actual load carried by the pipeline.
- The slack in pipeline CE is 100 m^3 less than the slack in pipeline CF. The slack in pipeline AD is 300 m^3.
- The daily requirement at D = 100 m^3.
- The amount of water that flows through pipeline BC is twice the daily requirement at C.
- Slack in pipeline AB = 200 m^3.
- The ratio of the requirement at B to the slack in pipeline CE is 1 : 2.
- The ratio of the slacks in pipelines CE and CF is 6 : 7. The quantity of water flowing through the pipeline DB is the same as that flowing through pipeline DC.

25. Find the daily requirement (in m^3) at E, if it is known that its requirement is exactly met by the water flowing through the pipelines shown.
(A) 300   (B) 400
(C) 600   (D) 700

26. Find the daily requirement (in m^3) at F, if it is known that its requirement is exactly met by the water flowing through the pipelines shown.
(A) 300   (B) 400
(C) 800   (D) 900

27. If there exists a larger external pipeline of capacity 5000 m^3 that supplies water to city such that the requirements of all the 6 cities are met by the water supplied by it, then what is the slack in the external pipeline? It is given that the daily requirement at A = 500 m^3.
(A) 2500 m^3 (B) 3000 m^3
(C) 3500 m^3 (D) 2000 m^3

28. If on a particular day, the pipeline joining cities D and B is damaged and the amount of water that is intended to flow through pipeline DB gets wasted in the process, then find how much water is wasted on that day?

(A) 200 m³   (B) 100 m³
(C) 300 m³   (D) 340 m³

Directions for questions 29 to 31: Answer the questions on the basis of the information given below.
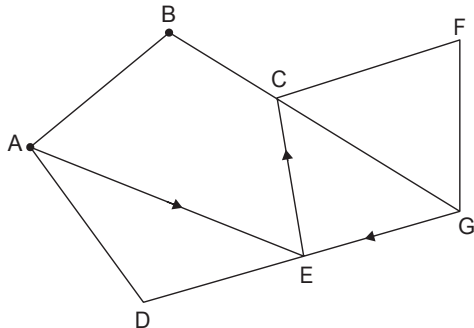
The above network shows 7 cities, such as A, B, C, D, E, F and G connected via two-way roads and one-way roads. For the one-way roads, the direction of travel is as indicated by the arrows in the diagram. Roads which do not contain any arrows are two-way roads.

29. The number of distinct paths from city A to city G without going through any city more than once is
    (A) 3   (B) 4
    (C) 5   (D) 6

30. If the road connecting cities C and G is damaged and traffic cannot go along that road, then the number of distinct ways in which city G can be reached from city E without going through any city more than once is
    (A) 3   (B) 1
    (C) 4   (D) 2

31. In the previous question, if it is assumed that all the roads other than the damaged road allow two-way traffic, then the number of distinct ways of reaching city G from city E without going through any city more than once is
    (A) 3   (B) 2
    (C) 4   (D) 5

Directions for questions 32 to 36: These questions are based on the following data.
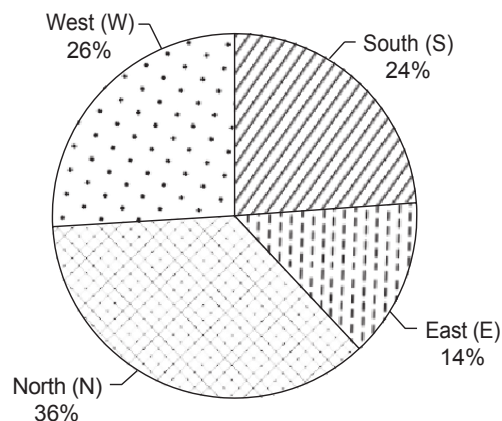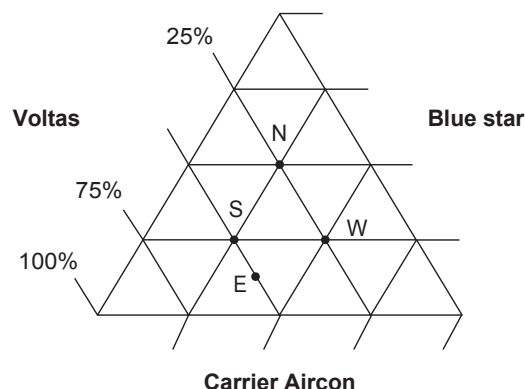
Carrier Aircon

The above triangular chart depicts the split up of various data of companies and the sales of ACs, namely Voltas, Bluestar and Carrier Aircon, in the four regions of India in North (N), South (S), East (E) and West (W). The total number of ACs sold is 10 lakh and the pie chart indicates the split up of sale of ACs by different regions.

32. In which region did Voltas sell the maximum number of ACs?
    (A) North   (B) South
    (C) East   (D) West

33. What is the total number of ACs sold by Carrier Aircon in the given four regions?
    (A) 3,22,500   (B) 3,32,500
    (C) 3,45,000   (D) None of these

34. How many ACs did Blue Star sell in East and North regions, put together?
    (A) 77,500   (B) 82,500
    (C) 1,97,500   (D) 2,45,000

35. By what per cent is the number of ACs sold by Voltas in the South region more than Blue Star?
    (A) 50%   (B) 100%
    (C) 200%   (D) None of these

36. What is the ratio of the number of ACs sold by Voltas in East region to the total number of ACs sold in the North region by the three companies put together approximately?
    (A) 1 : 2   (B) 1 : 6
    (C) 2 : 7   (D) 1 : 5

Directions for questions 37 to 40: Answer these questions on the basis of the information given below.

The following figure gives the percentage of seats secured by Congress and its allies (CA), BJP and its allies (BA) and Others (O) in the assembly elections held in the four states, namely in Uttar Pradesh (U.P.), Jammu and Kashmir (J & K), Gujarat (GUJ) and Tamil Nadu (T.N.).

100% — 20%

80% — J & K — 40%

CA 60% — 60%

40% — T.N.

20% — GUJ

U.P.

100% 80% 60% 40% 20%

Others
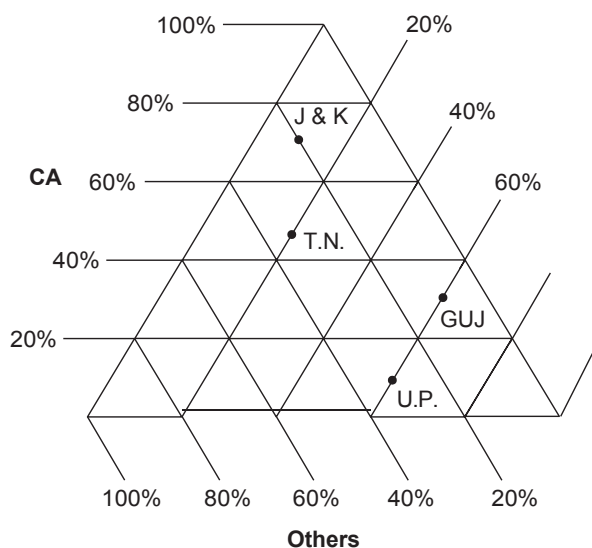
37. If the total number of seats won by CA in Gujarat and BA in Tamil Nadu are 54 and 48, respectively, then how many more seats were left in Tamil Nadu assembly than those in Gujarat? (Assume that elections were held in all the constituencies in both the states)

38. If the total number of seats in Uttar Pradesh is 330, then what is the number of seats won by CA in that state?

39. If the total number of seats won by Others in Uttar Pradesh assembly is 69, then how many seats are there in the Uttar Pradesh assembly, assuming that elections are held in all the constituencies?

40. Which of the following statements is/are definitely true?
 (a) In Uttar Pradesh, the number of seats won by BA is more than that won by CA and Others together.
 (b) BA has won an equal number of seats in both Gujarat and Uttar Pradesh.
 (c) In Tamil Nadu, Others have won more number of seats than BA.
 (A) Only a and c
 (B) Only b and c
 (C) Only a and b
 (D) None of these

Directions for questions 41 to 45: Answer the questions on the basis of the information given below.

The following diagram shows the network of pipelines carrying the industrial waste from Puranapool to five recycling plants located at Adikonam, Madhyakonam, Kumbakonam, Anthakonam and Nayapool, respectively. Each recycling plant has a certain capacity for recycling of industrial waste, which is exactly met. The capacity at Adikonam is 600 units, at Madhyakonam 800 units, at Kumbakonam 500 units,

at Anthakonam 900 units and at Nayapool 450 units. The arrow heads indicate the direction of flow of the industrial waste through the pipelines. The maximum capacity of each pipeline is 2000 units.

Adikonam

Puranapool   Madhyakonam

Anthakonam

Nayapool
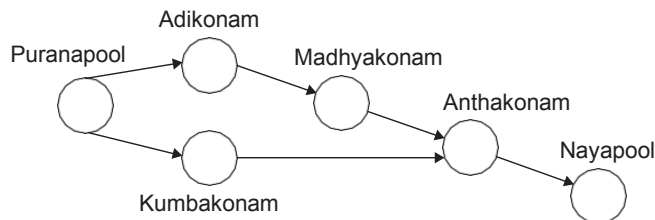
Kumbakonam

Note: The slack in a pipeline is defined as the extra flow that is required in the pipeline to bring it to its full capacity.

41. What is the maximum possible slack in the pipeline connecting Kumbakonam and Anthakonam?
 (A) 1500 units (B) 600 units
 (C) 1250 units (D) 1150 units

42. If the pipeline connecting Kumbakonam and Anthakonam has a slack of 800 units, then what is the supply of waste from Puranapool to Adikonam?
 (A) 350 units (B) 1,200 units
 (C) 450 units (D) None of these

43. What is the minimum slack in the pipeline connecting Madhyakonam and Anthakonam?
 (A) 850 units (B) 1100 units
 (C) 1250 units (D) 1400 units

44. If the capacity at Nayapool alone is increased such that the total slack in all the pipelines is minimum, then what is the sum of the slacks in all the pipelines combined?
 (A) 2700 units (B) 1100 units
 (C) 3300 units (D) 2950 units

45. Due to a snag that developed in the pipeline from Puranapool to Adikonam, the maximum capacity of that pipeline fell by 20%. What is the slack in the pipeline connecting Kumbakonam and Anthakonam?
 (A) 1200 units
 (B) 800 units
 (C) 850 units
 (D) Cannot be determined

Directions for questions 46 to 50: Answer the questions on the basis of the information given below.

The data points in the given graph represent the monthly incomes and expenditures of the members belonging to four families, namely Arthur family (□), Menon family (•), Kaur family (∗) and Ambuja family (..&). Each symbol represents the income and the expenditure of a particular family member.
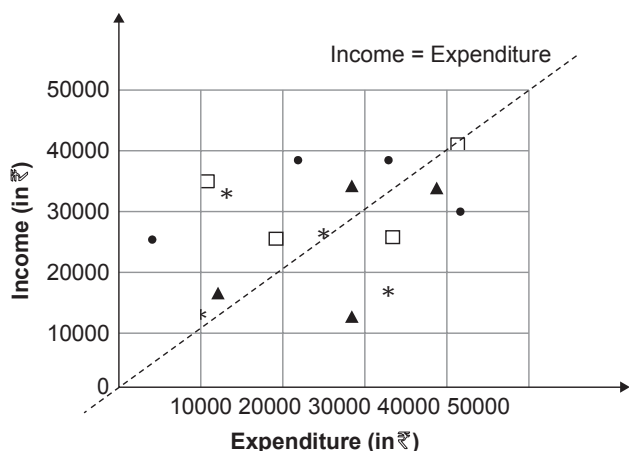
Note: Savings = Income – Expenditure.

46. Which family has the highest average income?
   (A) Kaur
   (B) Arthur
   (C) Menon
   (D) Ambuja

47. Which family has the lowest average expenditure?
   (A) Arthur
   (B) Ambuja
   (C) Kaur
   (D) Menon

48. For which family, is the income of any individual member more than the combined incomes of the other members of the family?
   (A) Arthur
   (B) Menon
   (C) Ambuja
   (D) None of the families

49. For how many families is the total income more than the total expenditure?
   (A) 0
   (B) 1
   (C) 2
   (D) 3

50. If the income of each member of the Menon family is increased by 20% and all other values remain the same, then which family has the highest savings?
   (A) Menon
   (B) Kaur
   (C) Arthur
   (D) Ambuja

EXERCISE-2

Directions for questions 1 to 5: Answer the questions based on the information given below.

The following diagram shows the flow of water from a reservoir X to seven water tanks. Water flows only in the direction of the arrows given and only after an intermediate tank is full, does the water flow to the next tank in the pipeline. The capacity of each tank (in kl) is given alongside it. The slack in a pipeline is the excess flow required to bring the pipeline to full capacity.
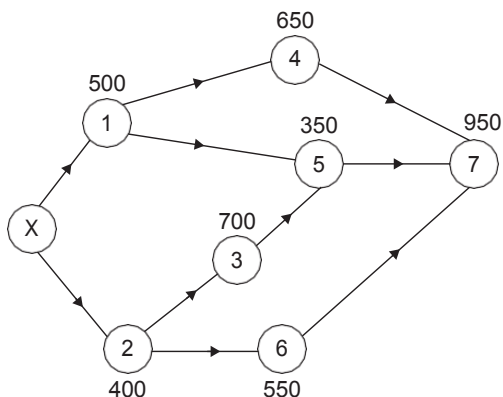
1. If the pipelines connecting the reservoir X to water tanks 1 and 2 have the same capacity, then what is the minimum capacity of each pipeline if the demand at all the tanks is met?

   (A) 1850 kl
   (B) 1950 kl
   (C) 2000 kl
   (D) 2050 kl

Additions information for questions 2 to 5: It is given that the capacity of the pipelines connecting X to 1 and 2 is 2500 kl and that of all other pipelines is 1500 kl.

2. What is the maximum flow in the pipeline connecting tanks 1 and 5?
   (A) 900 kl
   (B) 1200 kl
   (C) 1300 kl
   (D) 1350 kl

3. What is the minimum slack in the pipeline connecting tanks 2 and 6?
   (A) 0 kl
   (B) 100 kl
   (C) 200 kl
   (D) None of these

4. What is the maximum number of pipelines that can be shut down simultaneously without affecting the supply at any of the tanks?
   (A) 1
   B) 3
   (C) 2
   D) 4

5. What is the sum of the slacks in all the pipelines connected to tank 7?
   (A) 3100 kl
   (B) 3300 kl
   (C) 3450 kl
   (D) 3550 kl

Directions for questions 6 to 10: Answer the questions based on the information given below.

The graph gives the change in sales and profit of seven companies from 2013 to 2014.

Expenses = Sales – Profits
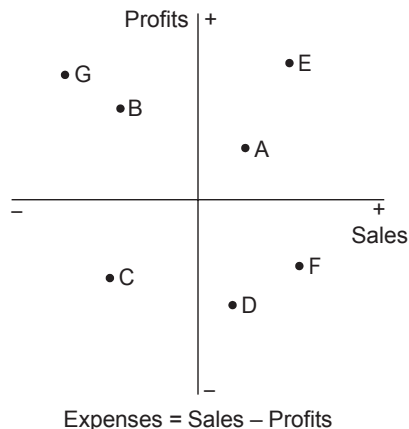
6. For how many companies did the expenses definitely increase from 2013 to 2014?
(A) 1 (B) 2
(C) 3 (D) 4

7. If the expenses of company E in 2013 were `165 crore, then the expenses incurred by it in the year 2014 could be
(A) `152 crore (B) `170 crore
(C) `175 crore (D) Any of the above

8. How many companies definitely had a decrease in expenses from 2013 to 2014?
(A) 2 (B) 1
(C) 3 (D) 4

9. If the expenses of companies B and F were the same in 2013, then what can be said about their expenses in 2014? (E_B – expenses of B, E_F – expenses of F)
(A) $E_B > E_F$ (B) $E_B < E_F$
(C) $E_B = E_F$ (D) Either (B) or (C)

10. If profitability = $\dfrac{\text{Profit}}{\text{Sales}}$ × 100, then at most how many companies had an increase in profitability from 2013 to 2014?
(A) 3 (B) 5
(C) 6 (D) 7

Directions for questions 11 to 15: Answer the following questions based on the information given below.

The diagram shows the interconnections between a refinery A and eight depots. Oil from the refinery is to be transported to these depots using tankers. The capacity of the depots (in '000 litres) are given. The distance from the refinery to the depots and between two neighbouring depots are also given. Oil can be transported only in the direction in which the arrows point. So also, at each depot, only if it is filled to full capacity, the remaining quantity can be passed on to any of the next depots. Irrespective of the quantity transported, the cost of transportation is `.150/km. Oil can be transmitted only in quantities which are integral multiples of 50,000 litres. All depots currently hold 50% of their capacities.
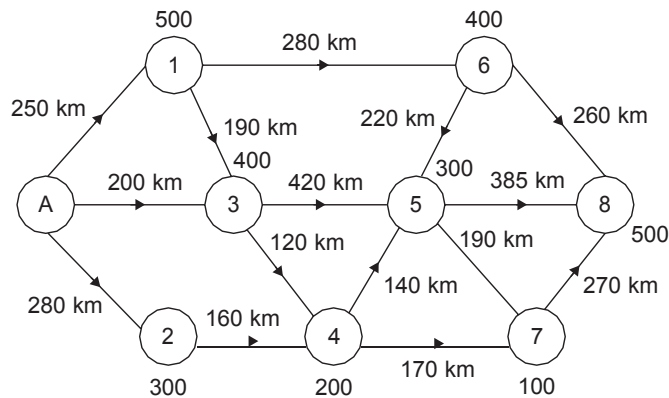
11. What can be the minimum quantity (in litres) that is sent from A, for part of it to reach depot 8?

12. What is the maximum quantity (in litres) that can be sent from A, with a possibility that no part of it still reaches depot 8?

13. What is the minimum cost of transporting the required oil from A to depot 8?

14. If the pipelines between depots 1 and 3 and depots 4 and 7 are closed for repairs, what will be the minimum cost of transporting oil from the refinery to depot 8?

15. What should be the minimum quantity of oil at refinery A, such that all the depots can be filled from their existing level to their capacities?

Directions for questions 16 to 20: These questions are based on the following data.

	A	B	C	D
Roadways	250	400	350	200
Railways	400	200	250	300
Airways	350	400	100	400

The table and 3D chart alongside give the details of the total number of passengers travelling using different means in four different countries A, B, C and D and the distribution of passengers, among those using airways, using the three different airlines, namely P, Q and R airlines in those countries. There are only 3 airlines operating in these countries.

16. The difference between the number of passengers using Q airlines in country D and those using P airlines in country B is
(A) 300 (B) 80
(C) 50 (D) 20

17. The number of passengers using R airlines in country A is what percentage of those using the roadways in the same country?
(A) 70
(B) 20
(C) 17.5
(D) None of these

18. If all the passengers of country C travelling by rail start travelling in Q and P airlines equally, then in country C, the number of passengers using R airlines is approximately what percentage of the number of passengers using Q airlines? (Given that all other factors remain constant)
(A) 25%
(B) $33\frac{1}{3}$ %
(C) 12%
(D) 50%

19. The passengers using R airlines is what percentage of the total passengers in all the countries?
(A) 10%
(B) 16.60%
(C) 8.75%
(D) $33\frac{1}{3}$ %

20. If P and Q airlines of countries B and D are merged together, then what percentage of the total passengers travelling in those countries will they carry?
(A) 25%
(B) 50%
(C) 75%
(D) 35.7%

Directions for questions 21 to 24: Answer the questions on the basis of the information given below.

The network shows the water pipelines connecting the 6 major cities of India (A, B, C, D, E, F).

- Through a pipeline, water can flow only in one direction as indicated by the arrow in the diagram.
- The maximum carrying capacity of any of the pipelines is 1000 m^3 per day.
- The daily requirement at C is 400 m^3.
- The slack in the pipeline is the difference between its maximum carrying capacity and the actual load carried by the pipeline.
- The slack in pipeline CE is 100 m^3 less than the slack in pipeline CF. The slack in pipeline AD is 300 m^3.
- The daily requirement at D = 100 m^3.
- The amount of water that flows through pipeline BC is twice the daily requirement at C.

- Slack in pipeline AB = 200 m^3.
- The ratio of the requirement at B to the slack in pipeline CE is 1 : 2.
- The ratio of the slacks in pipelines CE and CF is 6 : 7. The quantity of water flowing through the pipeline DB is the same as that flowing through pipeline DC.

21. Find the daily requirement (in m^3) at E, if it is known that its requirement is exactly met by the water flowing through the pipelines shown.

22. Find the daily requirement (in m^3) at F, if it is known that its requirement is exactly met by the water flowing through the pipelines shown.

23. If there exists a larger external pipeline of capacity 5000 m^3 that supplies water to city A such that the requirements of all the 6 cities are met by the water supplied by it, then what is the slack (in m^3) in the external pipeline? It is given that the daily requirement at A = 500 m^3.

24. If on a particular day, the pipeline joining cities D and B is damaged and the amount of water that is intended to flow through pipeline DB gets wasted in the process, then find how much water (in m^3) is wasted on that day?

Directions for questions 25 to 29: Answer the questions as based on the information given below.

The following table gives the processes involved and the time taken for each process for the completion of a task. The task is said to be completed when all the processes are completed. Some of the processes can be executed simultaneously as long as the conditions are met.

Process	Time taken (in mins)	Processes to be completed before starting this
A	10	None
B	12	None
C	15	A
D	17	B, G, H
E	8	A, B
F	7	C
G	18	C
H	12	B
I	13	A, D
J	15	A, B
K	6	C
L	12	B, D

25. Which of the following processes must be completed before starting process I?

(A) C   (B) E
(C) F   (D) K

26. What is the earliest time by which process D can be started if the work stated at 10 a.m.?
(A) 10.24 a.m.   (B) 10.43 a.m.
(C) 10.58 a.m.   (D) None of these

27. How many processes must be necessarily completed before starting process L?
(A) 4   (B) 5
(C) 6   (D) 7

28. At most how many processes can be completed within 35 minutes of starting the task?
(A) 5   (B) 7
(C) 8   (D) 9

29. What is the minimum time taken to finish the entire task?
(A) 56 minutes
(B) 68 minutes
(C) 72 minutes
(D) None of these

Directions for questions 30 to 32: These questions are based on the information given below.

A person has to go from station 1 to station 7. The arrows indicate the direction in which the person can travel. The number given along the arrow represents the distance (in kms) between the two connected stations.
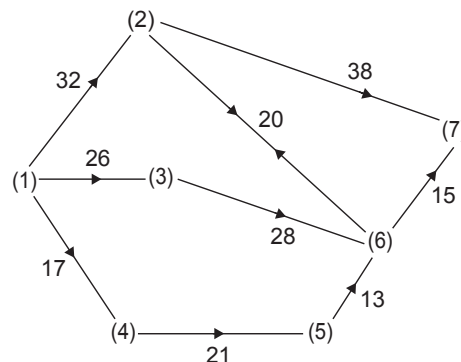
30. The length (in kms) of the longest path connecting stations 1 and 7 is

31. The number of different paths between station 1 and 7 is

32. What is the difference (in Kms) between the longest and the shortest path between stations 1 and 7?

Directions for questions 33 to 37: Answer these questions on the basis of the information given below.

The location of several important cities, their relative distances from and their bearing with respect to Delhi are represented in the figure given below. Each unit on the scale indicates a distance of 500 miles.
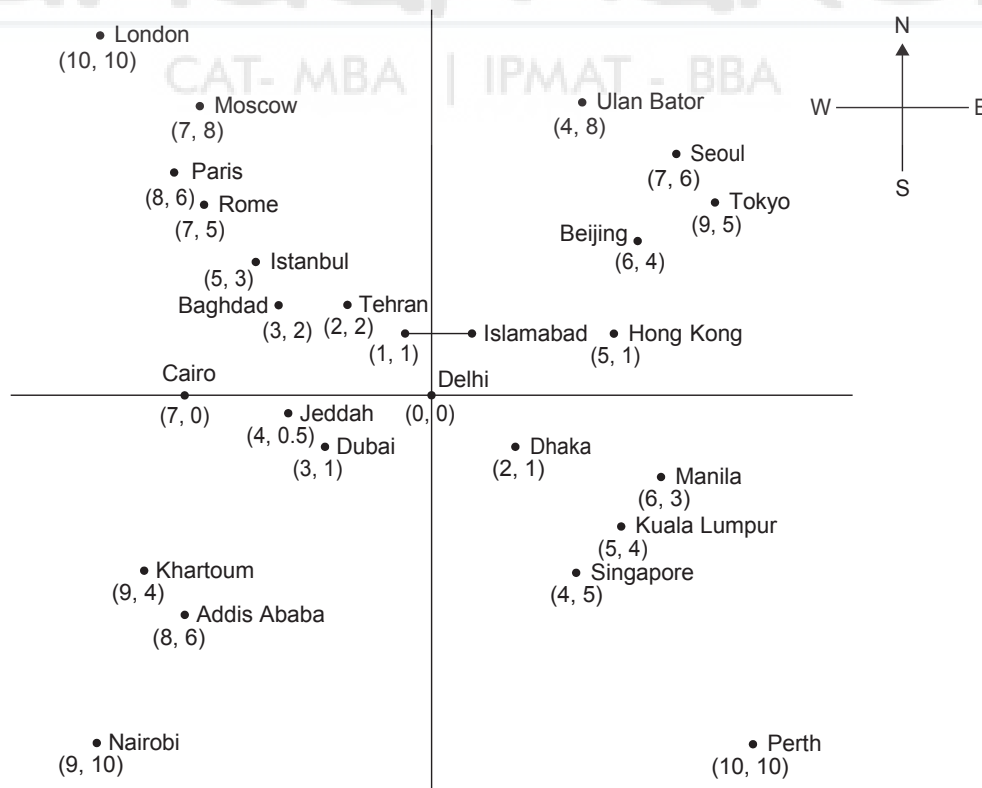
Air India operates three types of aircrafts in order to reach the indicated destinations. The aircrafts are Airbus A–340, Boeing 737 and Airbus A–3XX having ranges of 1500 miles, 2000 miles and 4500 miles, respectively on a single refueling. In all the questions that follow, every flight is assumed to start from Delhi, unless specified and flies in a straight-line path.

33. How many cities shown on the chart above cannot be reached by an Airbus A–340 on a single refueling?
(A) 22   (B) 21
(C) 23   (D) None of these

34. What is the ratio of the number of cities that cannot be reached by Airbus A–3XX on a single refueling to that of the number of cities that cannot be reached by an Airbus AAA–340, whose range is thrice that of an Airbus A–340?
(A) 2 : 9   (B) 10 : 13
(C) 3 : 1   (D) None of these

35. What is the ratio of the cities to the North of Delhi that cannot be reached by Boeing 737 to those to the South of Delhi that can be reached by Airbus A–3XX on a single refueling?
(A) 5 : 3   (B) 2 : 5
(C) 3 : 5   (D) None of these

36. If after some technical improvements, Airbus A–3XX is upgraded to Airbus A–4XX, which has a range of 500 miles more than that of Airbus A–3XX, then of the cities shown, how many can be reached by an Airbus A–4XX in single refuelling?
(A) 18   (B) 20
(C) 21   (D) None of these

37. What is the number of refuellings, required for an Airbus A–3XX flight from London to Perth via Delhi?
(A) 1   (B) 2
(C) 3   (D) 4

Directions for questions 38 to 41: These questions are based on the information given below.

The network below represents a busy one-way street network starting at U and ending at V. Points W, X, Y and Z are junctions in the network and the arrows mark the direction of traffic flow. The time taken (in minutes) to travel between the points is indicated by the number adjacent to the arrow representing the street.
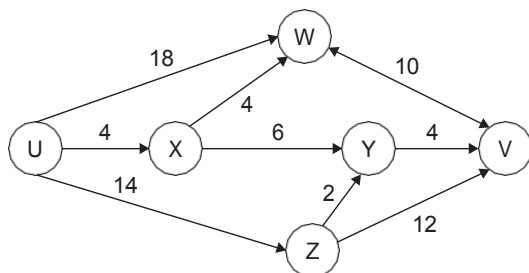
Motorists travelling from U to V would take the route for which the total time of travelling is the minimum. If two or more routes have the same least time of travel, then motorists are indifferent between them. Hence, the traffic gets evenly distributed among all these routes.

The flow of traffic can be controlled only by having a checking point before a junction which would lead to a delay (of the traffic). For example, if a motorist takes the route U-W-V (using junction W alone), then the total time of travel would be 28 mins (i.e., 18 + 10) plus the delay at junction W.

38. If no traffic is to flow on the street from Z to V due to some repair work and equal amount of traffic is to flow through the junctions W and Y to avoid traffic jams, a feasible set of delay times (in mins) at junctions W, X, Y and Z, respectively would be
(A) 2, 10, 6, 6
(B) 2, 8, 8, 6
(C) 2, 10, 8, 4
(D) 0, 10, 4, 4

39. To ensure that all motorists travelling from U to V take the same time, (travelling and checking delays combined) regardless of the route they choose when the street from X to Y is under repair (and hence unusable), a feasible set of time delays (in mins) at junctions W, X, Y and Z, respectively would be
(A) 4, 10, 6, 4
(B) 0, 10, 6, 4
(C) 2, 10, 6, 4
(D) 4, 6, 10, 2

40. To ensure that the traffic at U gets evenly distributed along streets from U to W, from U to X and from U to Z, a feasible set of delays (in mins.) at junctions W, X, Y and Z, respectively would be
(A) 0, 10, 8, 2
(B) 0, 10, 4, 4
(C) 2, 10, 6, 6
(D) 2, 10, 6, 4

41. To ensure that all routes from U to V get the same amounts of traffic, then a feasible set of delay times (in mins) at junctions W, X, Y and Z, respectively would be
(A) 0, 10, 4, 4
(B) 0, 10, 8, 2
(C) 2, 10, 6, 6
(D) 2, 10, 6, 4

Directions for questions 42 to 45: Answer these questions on the basis of the information given below.

The following diagram gives the market share of the top two companies, for each of the years from 2010 to 2015, for a product for which there were four companies A, B, C and D in the market. No two companies had the same market share (in percentage) in a year other than companies A and B in

2011 and in none of the years did any company have a sales more than four times that of any other company.
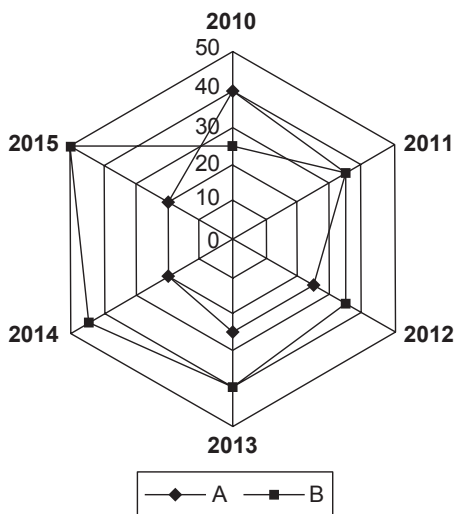
2010

Total sales of the product in different years

(in ` crore)

Year	2010	2011	2012	2013	2014	2015
Total product sales	1200	1400	1800	2000	2600	3000

Assume that market share (in percentage) of each of the companies in each of the given years was an integer.

42. What is the percentage increase in the sales for company B from 2010 to 2015?
(A) 100   (B) 250
(C) 400   (D) 500

43. The percentage increase in the market share of any company in a year, when compared to the previous year is at most
(A) 100   (B) 166.67
(C) 50   (D) None of these

44. If company C had the maximum percentage increase in the sales from 2013 to 2014, the increase in sales was
(A) `200 crore      (B) `208 crore
(C) `274 crore      (D) `294 crore

45. If company D had a decrease in sales from 2010 to 2011, the percentage decrease in its sales was at most
(A) 50   (B) 56.25
(C) 60   (D) 66.67

Directions for the questions 46 to 50: Answer these questions based on the information given below.

The following diagram gives the percentage of males, females and children who came for buffet at a restaurant on six consecutive days I to VI. The buffet charges for males, females and children are `500, `400 and `300, respectively and the restaurant only serves buffet.
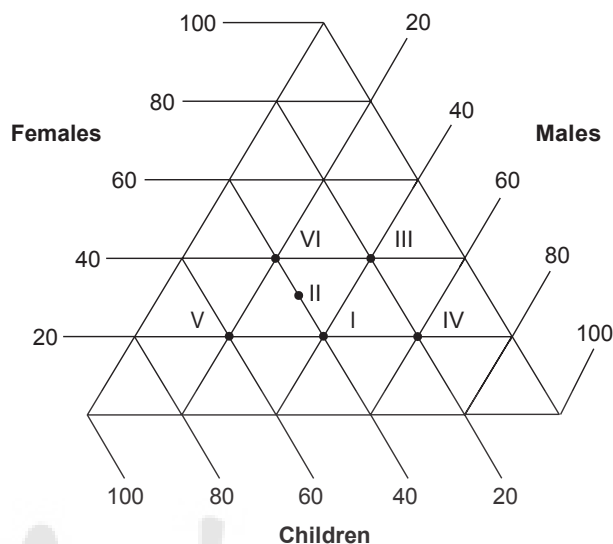
The total number of people, who came for the buffet during the six days is as follows:

Day	Total people
I	460
II	520
III	540
IV	480
V	420
VI	380

46. What was the total number of males who came to the restaurant in these six days?

47. Children form what percentage of the people who visited the restaurant in these six days?

48. What was the revenue (in `) of the restaurant on day V?

49. What was the highest revenue (in `) of the restaurant on any of the six days?

50. What is the average number of females (approximated to the closest integer) who visited the restaurant during these six days?

Directions for questions 1 to 4: Answer these questions on the basis of the information given below.

The following figure gives the network connecting a main water supply tank to six smaller tanks via pipelines. The values given alongside the tanks give their capacity (in kl). The capacity of each pipeline is 1200 kl. Only after a tank is completely full, the water will be passed on to the next tank in the network. The arrows give the direction of water flow. The slack in a pipeline is the excess flow required to bring it to full capacity. The flow in the pipelines is such that each tank is completely filled.

Directions for questions 5 to 8: Answer these questions on the basis of the information given below.

Flow of water through a network of irrigation canals
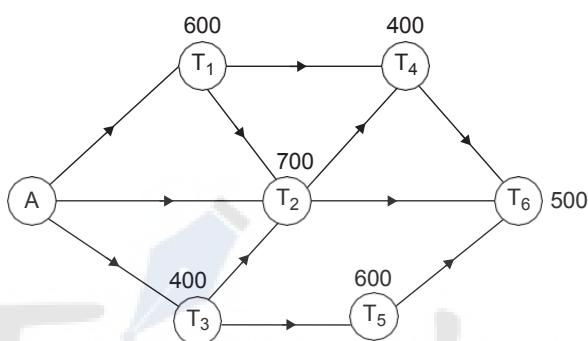
1. What is the maximum slack in the pipeline connecting A and T_2?
   (A) 600
   (B) 700
   (C) 500
   (D) None of these

2. If there is no flow in the pipeline connecting T_1 and T_4, then what is the minimum flow in the pipeline connecting A and T_3?
   (A) 700 kls
   (B) 800 kls
   (C) 600 kls
   (D) None of these

3. What is the maximum sum of the slacks (in kls) in all the pipelines combined?
   (A) 6200
   (B) 6800
   (C) 8500
   (D) None of these

4. What is the minimum sum of the slacks (in kls) in all the pipelines combined?
   (A) 6900
   (B) 7200
   (C) 7800
   (D) None of these

There is a group of four canals, namely *a, b, c* and *d* through which water flows for the purpose of irrigation. The water flows into the canals at points A, B, C and D, and is discharged at the points A_1, B_1, C_1 and D_1, respectively. There are three sets of four pipes each, namely p_1, p_2, p_3, p_4; q_1, q_2, q_3, q_4 and r_1, r_2, r_3, r_4 through which water flows from *a* to *b*, *b* to *c* and *c* to *d*, respectively.

The rates of flow of water (in units of water flowing per unit time) flowing through the pipes and canals are given at their respective positions. For example, 300 units of water enters canal *a* per unit time, 80 units of which enters into

canal *b* per unit time through pipe p_1 and 60 units of water enters into canal *b* per unit time through pipe p_2 and so on. For each of the three canals *a*, *b* and *c*, the quantity of water flowing can never exceed 1.5 times the total quantity of water entering into the respective canal. Assume that in any canal, water flows in only one direction, i.e., from left to right and at any junction, outflow precedes the inflow.

5. What is the minimum value of *x* (in units of water flowing per unit time)?
   (A) 10
   (B) 20
   (C) 30
   (D) 40

6. If pipes p_1 and q_2 are closed (blocked), what is the total quantity of water that flows per unit time out of canal c at point C_1?
(A) 140 (B) 180
(C) 220 (D) 240

7. What is the maximum possible amount of water that can flow per unit time between the points X and Y (shown in the diagram)?
(A) 330 units (B) 320 units
(C) 350 units (D) 360 units

8. If $x = 40$ units, from which of the following points is the rate of outflow of water the least?
(A) A_1 (B) B_1
(C) C_1 (D) D_1

Directions for questions 9 to 12: Answer these questions on the basis of the information given below.

The following diagram represents the network supplying water in a locality. Water flows from the main tank A and is supplied to the secondary tanks B through G by pipelines as indicated in the figure. The direction of flow of water is indicated by arrows. The requirement at subsidiary tanks (in kls) is indicated by the values inside the box above the tank. The flow of water in the pipelines (in kls) is given above the pipeline. At any subsidiary tank, water is passed on to the next tank in the network only after the requirement at that place is completely met. The requirement at all subsidiary tanks are positive integral multiples of 100.

The capacity of each pipeline is 1000 kls. The slack in a pipeline is the extra flow required to bring the flow in it to full capacity.
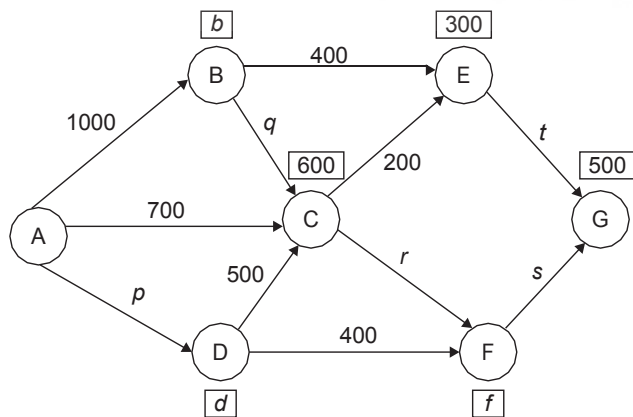
The flow in the pipelines is such that the requirement at all the places is exactly met.

9. What is the difference (in kls) between f and r?

10. What is the least possible value of 'f' in (kls)?

11. What is the value (in kls) of $p - s$?

12. What is the minimum slack (in kls) in all the pipelines together?

Directions for questions 13 to 16: Answer these questions on the basis of the information given below.

The following table gives the various tasks involved in completing a project. The project is complete when all the tasks are done. The tasks can be done in any order as long as the tasks to be done before it is completed.

Task	Time taken (hrs)	Other tasks to be completed before starting this
A	4	
B	7	D, G
C	2	
D	5	A, E
E	11	C
F	6	B
G	8	A, H
H	3	E
I	4	H
J	10	D

13. There are two persons to do the project such that each person can do any of the tasks but each one can do only one task at a time. What is the shortest time (in hrs) in which the project can be completed?

14. If there is no constraint on the number of people available to do the tasks, then what is the shortest time (in hrs) in which the project can be completed?

15. If the project is to be completed in at most 45 hours, then what can be the maximum time gap (in hrs) between the completion of task I and task J?

16. If a person can do only one task at a time, then what is the difference in the time taken (in hrs) to complete the project if there is only one person and when there are two persons, in both cases the project being done in the shortest possible time?

Directions for questions 17 to 20: Answer these questions on the basis of the information given below.

The following diagram gives the relation between the average billing rate per hour for six companies S, T, U, V, W and X which take up outsourcing jobs and the revenue from such jobs as a percentage of the total revenue for these companies.

Billing rate/hour (in dollar)

(A) 14   (B) 16
(C) 25   (D) 31

18. If the number of hours of outsourcing jobs taken up by all the six companies is the same, then which company had the highest total revenue?
(A) V   (B) W
(C) T   (D) X

19. Had the billing rate of company W for outsourcing jobs undertaken been 20% less and the quantity of outsourcing and non-outsourcing jobs and billing rate of non-outsourcing jobs done been the same as before, then what would be the percentage reduction in the total revenue of the company?
(A) 2   (B) 4
(C) 5   (D) 6

20. If the ratio of the number of hours spent in taking up outsourcing jobs for companies U and V is 2 : 3, then what is the approximate ratio of the total revenue of U and V?
(A) 1 : 5   (B) 2 : 7
(C) 1 : 10   (D) 3 : 13

17. If the total value of outsourcing jobs taken up by company T is $125 million and the average billing rate for jobs other than outsourcing jobs done by the company is $19 per hour, then what percentage of the volume of the work done by the company is outsourced work?

ANSWER KEYS

Exercise-1

1. (D)	10. (A)	19. 50	28. (C)	37. 60	46. (C)
2. 2375	11. (C)	20. (B)	29. (D)	38. 3	47. (B)
3. 2500	12. (A)	21. (C)	30. (D)	39. 230	48. (D)
4. 1 : 2	13. (A)	22. (A)	31. (C)	40. (A)	49. (D)
5. 27	14. (A)	23. (B)	32. (B)	41. (C)	50. (A)
6. (B)	15. (A)	24. (D)	33. (B)	42. (D)	
7. (C)	16. 1150	25. (B)	34. (C)	43. (D)	
8. (C)	17. 0	26. (A)	35. (B)	44. (C)	
9. (D)	18. 3	27. (B)	36. (D)	45. (D)	

Exercise-2

1. (D)	10. (B)	19. (C)	28. (C)	37. (D)	46. 1004
2. (C)	11. 3,50,000	20. (D)	29. (D)	38. (D)	47. 35.7
3. (B)	12. 9,00,000	21. 400	30. 112	39. (C)	48. 1,51,200
4. (C)	13. 1,14,000	22. 300	31. 6	40. (A)	49. 2,26,800
5. (D)	14. 1,18,500	23. 3000	32. 46	41. (D)	50. 133
6. (B)	15. 13,50,00	24. 300	33. (B)	42. (C)	
7. (D)	16. (B)	25. (A)	34. (D)	43. (B)	
8. (A)	17. (A)	26. (B)	35. (A)	44. (C)	
9. (B)	18. (C)	27. (C)	36. (D)	45. (B)	

Exercise-3

1. (D)	4. (B)	7. (A)	10. 600	13. 37	16. 23	19. (B)
2. (B)	5. (D)	8. (A)	11. 800	14. 37	17. (C)	20. (C)
3. (C)	6. (C)	9. 200	12. 4900	15. 25	18. (A)	

SOLUTIONS

EXERCISE-I

1. During 1997, A's Profit = 12.5% of 3000 crore

$$= \frac{1}{8} \times 3000 = \text{₹}375 \text{ crore}$$

B's Profit = 25% of 4000 crore = ₹1000 crore

C's Profit = 37.5% of 5000 crore

$$= \frac{3}{8} \times 5000 = \text{₹}1875 \text{ crore}$$

D's Profit = 50% of 4000 crore = ₹2000 crore.

2. A's total profit = 62.5% of 2000 + 25% of 3000 + 12.5% of 3000= ₹2375 crore

3. From earlier solution, in 1997, D made a maximum profit of ₹2000 crore. Using this as reference, we see that in 1996 C exceeds this, C = ₹2500 crore and then in 1995 no company exceeds this.

4. Since the profit percentage of both C and D in 1995 are the same, the ratio of expenditure of C and D in 1995 will be same as that of their sales revenues.

$$\left(\text{Since expenditure} = \text{Revenue} \times \frac{(100 - \text{profit\%})}{100} \right)$$

5. During 1998, sales revenue of B = 125% of 4000 crore
= 5000 crore

Expenditure in 1998 = 80% of 0.75 of 4000 = 2400 crore

$$\text{Profit} = \left(\frac{5 - 2.4}{5} \right) \times 100 = 52\%$$

Actual profit of B in 1997 = 25%

52 − 25 = 27 % points

Solutions for questions 6 to 10: Votes polled in various wards are as follows:

Ward 1 – 18% of 5,00,000 = 90,000

Ward 2 – 32% of 5,00,000 = 1,60,000

Ward 3 – 36% of 5,00,000 = 1,80,000

Ward 4 – 14% of 5,00,000 = 70,000

The following table can now be drawn to show the votes polled by various parties in different wards.

Party	Wards			
	1	**2**	**3**	**4**
TDP	$\frac{50}{100} \times 90{,}000 = 45{,}000$	$\frac{25}{100} \times 1{,}60{,}000 = 40{,}000$	$\frac{25}{100} \times 1{,}80{,}000 = 45{,}000$	$\frac{25}{100} \times 70{,}000 = 17{,}500$
Congress	$\frac{25}{100} \times 90{,}000 = 22{,}500$	$\frac{50}{100} \times 1{,}60{,}000 = 80{,}000$	$\frac{25}{100} \times 1{,}80{,}000 = 45{,}000$	$\frac{12.5}{100} \times 70{,}000 = 8{,}750$
BJP	$\frac{25}{100} \times 90{,}000 = 22{,}500$	$\frac{25}{100} \times 1{,}60{,}000 = 40{,}000$	$\frac{50}{100} \times 1{,}80{,}000 = 90{,}000$	$\frac{62.5}{100} \times 70{,}000 = 43{,}750$

6. 45,000

7. The choice will be between ward 2 and ward 3, because these words got the maximum number of votes polled.

8. 90,000 + 43,750 = 1,33,750

9. The total number of votes secured by Congress and TDP in ward 2 are 50% and 25%, respectively. Therefore, Congress got a margin of 25% over TDP in ward 2, i.e., 25% of 1,60,000 = 40,000

10. BJP

Solutions for questions 11 to 15:

	HR	Finance	Marketing
A	25% × 1,600 = 400	25% × 1,600 = 400	50% × 1,600 = 800
B	37.5% × 1,800 = 675	25% × 1,800 = 450	37.5% × 1,800 = 675
C	50% × 1,700 = 850	25% × 1,700 = 425	25% × 1,700 = 425
D	12.5% × 2,000 = 250	75% × 2,000 = 1,500	12.5% × 2,000 = 250
E	37.5% × 1800 = 675	50% × 1800 = 900	12.5% × 1800 = 225

11. By observing the above table, We get the number of HR professionals in firm A as 400.

12. (Number of Marketing professionals in B) – (Number of Marketing professionals in C)
= 675 – 425 = 250

13. Finance professionals in firm D are 1500 (1.3) = 1950
HR professionals in firm D are 250 (1.1) = 275
Marketing professionals in firm D are 250 (1.2) = 300
\ Number of professionals are increased from 2000 to 2525.

% Increase = $\left|\left(\frac{2,525}{2,000} - 1\right)\right| 100 = 26.25\%$

14. Average monthly salary is the weighted average salary of the three departments, i.e., 50% of 7000 (for Marketing) + 25% of 6000 (for Finance) + 25% of 5000 (for HR)
= 3500 + 1500 + 1250 = `6250

15. By observing the table, it can be concluded that the number of professionals in firms B and E are the same.
\ Their ratio is 1 : 1

Solutions for questions 16 to 20: The capacities of the pipeline connecting A with B, C and D are 1500 each while the capacities of all other pipelines are 750 each.

16. To find the minimum flow in the pipeline connecting D and G, we have to maximize the flow in other pipelines. The maximum flow in the pipeline connecting A and B is 1450 (as 700 is stored at depot B and the remaining 750 is the maximum that can flow through pipeline connecting B and E).
Similarly, the maximum flow in the pipeline connecting A and C is 1400.
\ The minimum flow in the pipeline connecting A and D is 4000 – (1450 + 1400) = 1150.

17. The maximum flow in the pipeline connecting A and B is 1200, of which 500 litres will flow to E.
The flow through the pipeline connecting A and C can be at most 1400, of which 750 will flow to E.
Now E would receive 500 + 750 = 1250 of which 450 would be stored at E, 500 would be transferred to F and 300 to G, with G receiving the remaining 600 from D.
\The flow in the pipeline connecting D and F can be zero.

18. The slack in the pipeline supplying oil to depot E would be maximum, when pipeline connecting A and D carries the maximum oil, i.e., 1500 litres.
Without any flow in the pipeline supplying oil to depot E, a maximum of 700 (A – B) + 650 (A – C) + 1500 (A – D - F or G) = 2850 can be transported. Therefore, a further 4000 – 2850 = 1150 is required which is to be supplied through depot E.
\ Maximum slack = (750 + 750) – 1150 = 350

19. If the stack in the pipeline connecting D and G is 50, it means that oil flowing through the pipeline connecting D and G is 750 – 50 = 700. Of the 900 required at G, 700 is flowing through the pipeline connecting D and G. The stack in the pipeline connecting E and F is minimum, when the flow through it is the maximum.
The maximum flow through the pipeline connecting E and F is 500 (required at F) + 200 (further requirement at G), i.e., 700.
\ The minimum slack is 750 – 700 = 50.

20. Even though 1000 units can flow through each of the pipelines XA and XC, it can be seen that the entire supply to depots B and F is through the pipeline connecting X and B. Therefore, at least 600 + 250 = 850 units should flow through X – B.
\ The maximum slack is 150 units.

21. The pipeline connecting X and C supplies to depots C, E and G. Therefore, the maximum flow through it is 350 + 250 + 350 = 950 units. Thus, the maximum flow through the pipeline connecting C and E = 950 – 350 = 600 units.

22. The supply to each of A, B and C flows through only XA, XB and XC. The supply to each of D, F and E flows through two pipelines each, say XA and AD, XB and BF and XC and CE, respectively. The supply to G has to flow through three pipelines, i.e., EG or FG or DG.
\ The total slack in all the pipelines put together.
= 10 (number of pipelines) × 1000 – [1 (450 + 600 + 350) + 2 (400 + 250 + 250) + 3 (350)]
= 10,000 – (1400 + 1800 + 1050] = 5750

23. As the total demand is 2650 units, at least 650 units must flow through the pipelines connecting X and C. Therefore, at least 50 units of demand at G must be supplied from E and so the maximum flow through the pipeline connecting D and G is 350 – 50 = 300 units.

24. The maximum quantity of oil that can be supplied from the refinery is 1000 + 1000 + 1000 = 3000 units. As the current demand is 2650 units, a maximum of 3000 – 2650 = 350 units can be supplied to the new depot.

Solutions for questions 25 to 28:
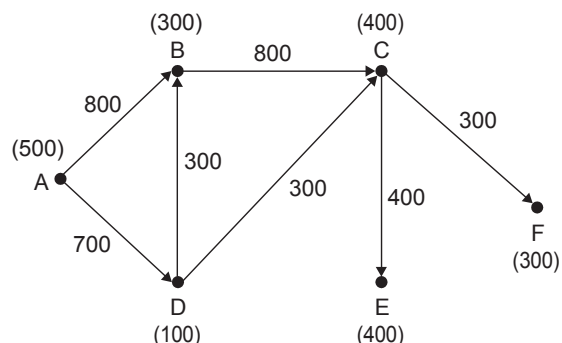
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⇒ Maximum capacity = 1000 m³ per day – (1)
⇒ Requirement at C = 400 – (2)
⇒ Slack in CE – Slack in CF = 100 – (2)
⇒ AD = 1000 – 300 = 700 – (4)
⇒ D = 100, C = 400 – (5)
⇒ BC = 800 – (6)
⇒ Slack in CE : Slack in CF = 6 : 7 – (7)
⇒ DB : DC = 1 : 1 ⎫
⇒ DB = 300, DC = 300 ⎬(8)
⇒ Slack in AB = 200 – (9)

25. From (3) and (7), we get:
Slack in CE = 600
Slack in CF = 700
⇒ Water flowing through CE = Requirement at city
E = 1000 – 600 = 400

26. Water flowing through CF = Requirement at city
F = 1000 – 700 = 300

27. By using the above 9 conditions and drawing the diagram again, we get:
Water that should flow through the pipeline
= 500 + 800 + 700 = 2000 m³
Slack = 5000 – 2000 = 3000 m³

28. In the above figure, if the pipeline joining D and B is damaged, then the amount of water wasted = 300 m³

29. Distinct paths from city A to city G are as follows:
A – B – C – F – G
A – B – C – G
A – E – C – G
A – D – E – C – G
A – E – C – F – G
A – D – E – C – F – G
\ A total of 6 ways.

30. City G can be reached from city E in the following ways:
E – C – F – G
E – D – A – B – C – F – G
\ A total of 2 ways.

31. If all the roads allow two-way traffic, then city G can be reached from city E in the following ways:
E – C – F – G
E – D – A – B – C – F – G
E – G
E – A – B – C – F – G
\ A total of 4 ways.

Solutions for questions 32 to 36: We can get the following table but it is suggested that only the required data be calculated, in order to save time.

| Company | Region | | | | |
	North	South	East	West	Total
Voltas	25% = 0.90	50% = 1.20	50% = 0.70	25% = 0.65	3.45L
Blue Star	50% = 1.80	25% = 0.60	12.5% = 0.175	25% = 0.65	3.225L
Carrier Aircon	25% = 0.90	25% = 0.60	37.5% = 0.525	50% = 1.30	3.325L
Total	**3.6L**	**2.4L**	**1.4L**	**2.6L**	**10L**

32. Voltas sold maximum number of ACs, i.e., 1.2 lakh in South region.

33. Total number of ACs sold by carrier Aircon in all four regions = 3,32,500

34. No. of ACs sold by Blue Star in East and North
= 17,500 + 1,80,000 = 1,97,500

35. Required percentage = $\dfrac{1.2 - 0.6}{0.6} \times 100 = 100\%$

36. Required Ratio is 70,000: 3,60,000
≃ 1 : 5 (approx)

37. In Tamil Nadu, BA won 20% of the total seats
⇒ 20% of total = 48

⇒ Total number of seats in Tamil Nadu = 240
In Gujarat, CA won 30% of the total seats.
⇒ 30% of total seats = 54
⇒ Total seats in Gujarat = 180
\ Assembly seats in Tamil Nadu are more than those in Gujarat by 60.

38. Number of seats won by CA in Uttar Pradesh = 10% of 330 = 33

39. In Uttar Pradesh assembly, Others won 30% of the total seats ⇒ 30% of the total = 69
⇒ Total number of seats = 230

40. Statement (c) is true. Statement (a) is also true as BA has won 60% of the seats. As we do not know the number of assembly seats in each of the states, we cannot verify the data given in the statement (b).

41. When we require maximum slack in a pipeline, the minimum should be carried through that pipeline and maximum should be carried through the other pipelines.

The total requirement at all the five places is 600 + 800 + 900 + 500 + 450, i.e., 3250 units, of which 2000 units can be supplied through the Puranapool to Adikonam pipeline.

\The remaining 1250 units should be sent through the Kumbakonam pipeline. The demand at Kumbakonam is 500 units.

\Slack in the Kumbakonam to Anthakonam pipeline is 20000 – (1250 – 500) = 1250 units.

42. The pipeline connecting Kumbakonam to Anthakonam has a slack of 800 units.

\The supply at Anthakonam 2000 – 800 = 1200 units.

The demand at Kumbakonam is 500 units.

\The supply from Puranapool to Kumbakonam = 1200 + 500 units = 1700 units.

As the total demand is 3250 units and the supply from Puranapool to Kumbakonam is 1700 units, the supply from Puranapool to Adikonam is 3250 – 1700 = 1550 units.

43. For minimum slack, the supply from Madhyakonam has to be maximum, i.e., 2000 – 600 – 800 = 600.

\Slack would be 2000 – 600 = 1400 units.

44. For slack to be minimum, slack in both the lines from Puranapool should be zero.

Now, from Adikonam to Madyakonam, there will be a slack of 600 units and that from Kumbakonam to Anthakonam it is 500 units. The maximum supply from Madhyakonam to Anthakonam is 600 units.

\The total supply at Anthakonam is 600 + 1500 = 2100 units. Since demand at Anthakonam is 900 units, maximum supply at Nayapool is 1200 units. If the demand at Nayapool is 1200 units, all these 1200 units can be supplied from Anthakonam.

\There will be a slack of 800 units from Anthakonam to Nayapool.

\The total slack is 600 + 500 + 1400 + 800 = 3300 units.

45. The total demand at all the plants put together is 3250 units. The maximum possible flows in the pipelines connecting Puranapool to Adikonam and Kumbakonan are 1600 (i.e., 80% of 2000) units and 2000 units, respectively. Hence, the flow in the pipeline connecting Puranapool to Adikonam can vary from 3250 – 2000 = 1250 units to 1600 units, while the flow in the pipeline connecting Puranapool to Kumbakonan can vary from 1650 units to 2000 units. Since the exact pattern of flow cannot be determined, the slack in the pipeline from Kumbakonam to Anthakonam cannot be determined.

46. As the total income of the Menon family is the maximum, their average income is the highest.

47. As the expenditure of the members of the Ambuja family has lower values, they have the lowest average expenditure.

48. By observing the data points, we can say that in no family the income of any individual member is more than the combined income of the others.

49. The total income is more than the total expenditure for the Arthur, Menon and the Ambuja families.

50. The income of the members of the Menon family already is on the higher side and it has further increased by 20%. Also, the expenditures of the top three spending families are very close. Hence, Income – Expenditure will be the highest for the Menon family itself.

EXERCISE-2

1. The total demand at all the tanks = 500+ 400 + 700+ 650 + 350 +550 + 950 = 4100

\The capacities of the two pipelines connected should be at least 2050 kl.

2. The maximum flow would be when the entire demand at 5 and 7 is met by the flow through (1).

\Maximum flow = 350 + 950 = 1300 kl

3. For minimum slack, the flow must be maximum. If the maximum possible water flow is pumped through the pipeline connecting X and 2, then flow through the pipeline connecting 2 and 6 would be 2500 – (400 + 700) = 1400. Thus, the slack would be 100 kl.

4. We should only consider pipelines connecting 5 and 7 as only they have multiple input sources. The following cases are possible.

(1) The pipeline connecting 4 and 7 can be shut down and the entire demand at 7 can be met from either 5 or 6.

(2) The pipeline connecting 5 and 7 can be shut down along with or without shutting down the pipeline connecting 3 and 5.

(3) The pipeline connecting 6 and 7 can be shut down.

\The maximum number of pipelines that can be simultaneously shut down without affecting the demand at any place is 2, i.e., 3 – 5 and 5 – 7 or 4 – 7 and 6 – 7.

5. The maximum capacity of all the pipelines connected to tank 7 = 4500 kl.
   The demand at 7 = 950 kl
   \ The slack = 4500 – 950 = 3550 kl.

6. For the expenses to definitely increase, the sales must have increased and the profit must have decreased. This happened only for companies D and F.

7. As the sales and profits of the company increased with respect to that in the previous year, we cannot say anything about its profit in 2014. Therefore, its profit can be any of the given values.

8. For a definite decrease in expenses, the sales should be less and the profits should be more when compared to the previous year. Only G and B satisfy the condition.

9. For B, the sales decreased and its profits increased.
   \ The expenses definitely decreased. For F, the sales increased and the profits decreased. The expenses definitely increased and we can say that the expenses of F would be more than that of B in 2014.

10. All companies except D and F could have had an increase in profitability.

11. All the refineries are currently filled to 50% of their capacity.
    By taking the route A – 2 – 4 – 7 – 8 we can ensure minimum quantity to be sent to reach 8. We need to send (in `000 litres)
    150 + 100+ 50 + 50 (for depot 8) = 350 (in `000 litres)

12. If we send through the route A – 1 – 3 – 4 – 5 – 6, we can send (in `000 litres)
    250 + 200 + 100 + 150 + 200 = 900,
    which will be consumed before reaching depot 8.

13. The shortest route is from A – 3 – 4 – 7 – 8, which is 760 km.
    \Cost = 760 × 150 = 1,14,000

14. Now the shortest route is A – 1 – 6 – 8, which is 790 km.
    \ Cost = 790 × 150 = 1,18,500

15. Total capacity of all depots (in `000) = 2700
    Capacity to be filled (in litres)
    = 50% of 2,700,000 = 13,50,000

16. In country D:
    The total number of passengers using airways = 400
    Passengers of country D using Q airlines = 30% = 120
    In country B:
    The total number of passengers using airways = 400
    Passengers using P airlines = 10% = 40
    ⇒ Difference = 120 – 40 = 80

17. The number of passengers using R airlines in country A
    = 50% of 350 = 175

The number of passengers using roadways = 250

$$\Rightarrow \frac{175}{250} \times 100 = 70\%$$

18. The passengers of country C using railways = 250
    Those using Q airlines currently = 40
    Those using P airlines currently = 40
    Those using R airlines currently = 20
    Now after the addition of the passengers,
    The number of passengers of Q airlines = 125 + 40 = 165
    The number of passengers of P airlines = 125 + 40 = 165

    $$\Rightarrow \text{Required \%} = \frac{20}{165} \times 100 = 12.1\%$$

19. The total number of passengers = 3600
    Those using R airlines in each countries is as follows:

    Country A $\Rightarrow \dfrac{50}{100} \times 350 = 175$

    Country B $\Rightarrow \dfrac{30}{100} \times 400 = 120$

    Country C $\Rightarrow \dfrac{20}{100} \times 100 = 20$

    Country D ⇒ 0, Total = 315

    $$\backslash \text{Required percentage} = \frac{315}{3600} \times 100 = 8.75\%$$

20.
	P	Q
B ⇒	40	240
D ⇒	280	120

    ⇒ Total = 680

    $$\text{Required \%} = \frac{680}{1900} \times 100 = 35.7\%$$

Solutions for questions 21 to 24:
⇒ Maximum capacity = 1000 m³ per day – (1)
⇒ Requirement at C= 400 – (2)
⇒ Slack in CE – Slack in CF = 100 – (2)
⇒ AD = 1000 – 300 = 700 – (4)
⇒ D = 100, C = 400 – (5)
⇒ BC = 800 – (6)
⇒ Slack in CE : Slack in CF = 6 : 7 – (7)
⇒ DB : DC = 1 : 1
⇒ DB = 300, DC = 300
⇒ Slack in AB = 200 – (9)

21. From (3) and (7), we get:
    Slack in CE = 600
    Slack in CF = 700
    ⇒ Water flowing through CE =
      Requirement at city E = 1000 – 600 = 400.

22. Water flowing through CF = Requirement at city F = 1000 – 700 = 300.

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23. By using the above 9 conditions and drawing the diagram again, we get:
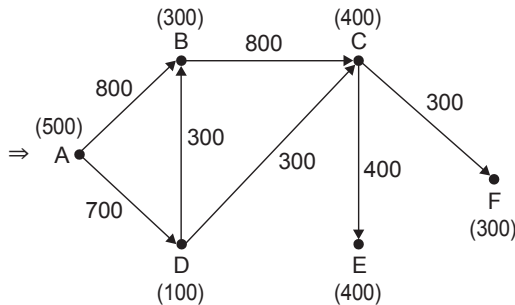
Water that should flow through the pipeline
= 500 + 800 + 700 = 2000 m³
Slack = 5000 – 2000 = 3000 m³

24. In the above figure if the pipeline joining D and B is damaged then the amount of water wasted = 300 m³.

Solutions for questions 25 to 29: The order and total time taken for the tasks are as follows:
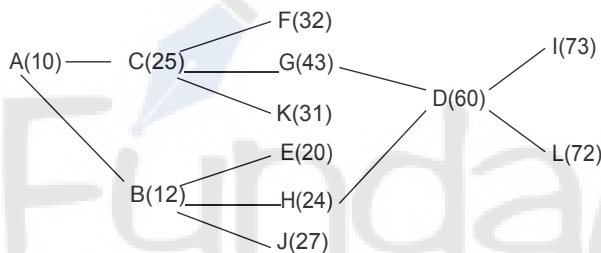
25. Before I, A and D must be completed. Before D is started B, G and H must be completed and before G, C must be completed.
\ C must be definitely completed before I is started.

26. Process D can be started at 10 + 15 + 18 = 43 minutes past 10 a.m.
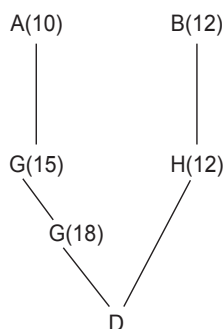
27. Before starting process L, the ones that have to be necessarily completed are A, B, C, D, G and H.

28. Eight processes, i.e., A, B, C, E, F, H, J and K can be completed within 35 minutes of starting the task. (As given in the time figure above).

29. The time taken to finish the entire task is 73 minutes (As given in the figure above Q. 25)

30. The length of the path is as follows:
1 – 3 – 6 – 2 – 7
26 + 28 + 20 + 38 = 112 kms.

31. Path:
(1) 1– 4 – 5 – 6 – 7
(2) 1– 3 – 6 – 7
(3) 1 – 2 – 7
(4) 1 – 2 – 6 – 7
(5) 1 – 3 – 6 – 2 – 7
(6) 1 – 4 – 5 – 6 – 2 – 7.

32. The longest path is 1 – 3 – 6 – 2 – 7 which is 112 kms.
The shortest path is 1 – 4 – 5 – 6 – 7 which is 66 kms.
The difference = 112 – 66 = 46 kms.

33. Since 1 unit represents 500 miles, it means that Airbus A-340 can travel 3 units in any direction on a single re-fuelling. Thus, the only cities it can reach are Islamabad and Dhaka, all the other cities cannot be reached, which is a total of 21 cities.

34. The range of A-3XX is thrice that of A-340 and given that the range of AAA-340 is also thrice of A-340 the range of A-3XX and AAA-340 is the same. Therefore, the number of cities that cannot be reached by these two should be the same. Hence, the ratio must be 1 : 1.

35. The cities to the North of Delhi that can be reached by Boeing 737-400 on a single refuelling are Baghdad, Tehran and Islamabad. Therefore, the number of cities to the North of Delhi that cannot be reached are 13 – 3 = 10. The cities to the South of Delhi that can be reached by A-3XX on a single refuelling are Jeddah, Dubai, Dhaka, Maila, Kaula Lumpur and Singapore (i.e., a total of 6 cities).
\ The ratio is 10 : 6 = 5 : 3.

36. The range of Airbus A-4XX = 4500 + 500 = 5000 km
⇒ 10 units = radial distance of any reachable city
= $r \leq 10 \Rightarrow r^2 \leq 100$
\ $x^2 + y^2 \leq 100$
Only London (10, 10), Perth (10,10), Nairobi (9, 10), Moscow (7, 8) and Tokyo (9, 5) is $x^2 + y^2 > 100$.
\ 5 out of 24 cities cannot be reached.
⇒ 24 – 5 = 19 cities can be reached.

37. The distance between London to Perth via Delhi is
$20\sqrt{2}$ × 500 = 10,000 × 1.41 ≅ 14100
Number of refuellings = $\dfrac{14100}{4500}$ = 4
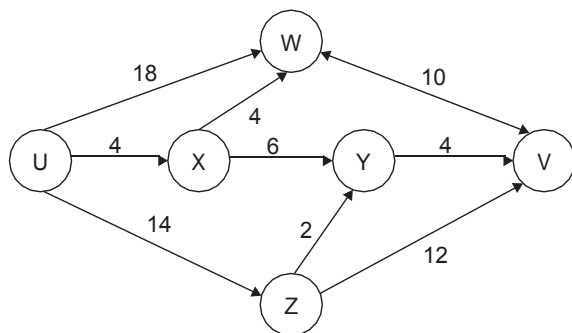
The possible routes are:

Route	Total time	Junction
U – W – V	28	W
U – X – W – V	18	X, W
U – X – Y – V	14	X, Y
U – Z – Y – V	20	Z, Y
U – Z – V	26	Z

It is given that, for each of the routes, the only way to increase the total time is to impose checking delays at junctions. Let the time delay due to checking at junctions W, X, Y and Z be w, x, y and z, respectively. Now the total time for each of the five routes will be as follows:

Route	Total time
U – W – V	$28 + w$
U – X – W – V	$18 + (x + w)$
U – X – Y – V	$14 + (x + y)$
U – Z – Y – V	$20 + (z + y)$
U – Z – V	$26 + z$

38. No traffic flows, from Z – V. Now applying each of the options, the total time would be as follows:

Route	Option A	Option B	Option C	Option D
U – W – V	30	30	30	28
U – X – W – V	30	28	30	28
U – Z – V	32	32	30	30

Route	Option A	Option B	Option C	Option D
U – X – Y – V	30	30	32	28
U – Z – Y – V	32	34	32	28
U – Z – V	32	32	30	30

As it is given that the traffic flow at junction W is the same as that at junction Y.

\ Number of routes involving W that can be used must be the same as that involving Y.

Further only the routes with minimum time duration can be used.

This happens in only (D) as in the routes that can be used, the number of routes involving W is two (U – W – V) and (U – X – W – V) and that involving Y is also two (U – X – Y – V) and (U – Z – U – V).

39. As X – Y is unusable, U – X – Y – V is not possible. From the remaining, if we apply all the options:

Route	Option A	Option B	Option C	Option D
U – W – V	32	28	30	32
U – X – W – V	32	28	30	28
U – Z – Y – V	30	30	30	32
U – Z – V	30	30	30	28

Only in option (C), the total time taken is the same for each of the four routes.

40. From the given options:

Route	Option A	Option B	Option C	Option D
U – W – V	28	28	30	30
U – X – W – V	28	28	30	30
U – X – Y – V	32	28	30	30
U – Z – Y – V	30	28	32	30
U – Z – V	28	30	32	30

It is very likely that option (D) is selected. But if all the four routes take the same time, there will be an equal traffic in all the five routes, i.e., 20% in each route. But then the percentage of traffic in V – W = 20%, U – X = 40% as these are two routes involving U – X, U – Z = 40% (for the same reason as above).

But here the given condition is that time taken in U – W is equal to U – X, which in turn is equal to U – Z.

As V – W = U – Z

Of the routes, that can be used the number of routes involving U – W must be same as U – X, which in turn is same as U – Z. It happened in only option (A).

41. From the given options:

Route	Option A	Option B	Option C	Option D
U – W – V	28	28	30	30
U – X – W – V	28	28	30	30
U – X – Y – V	28	32	30	30
U – Z – Y – V	28	30	32	30
U – Z – V	30	28	32	30

As the time must be the same for all the routes, it must be option (D).

Solutions from questions 42 to 45: The percentage share in the market for the companies, (the range in case of companies C and D) in the different years are as follows:

Year	2010	2011	2012	2013	2014	2015
A	40	35	25	25	20	20
B	25	35	35	40	45	50
C	11-24	9-21	16-24	11-24	16-19	11-19
D	11-24	9-21	16-24	11-24	16-19	11-19

42. Sales of company B in 2010 = $\dfrac{25}{100}$ × 1200 = 300 crore

Sales of company B in 2015 = $\dfrac{50}{100}$ × 3000 = 1500 crore

Percentage increase = $\dfrac{1200}{300}$ ×100 = 400%

43. The percentage increase in market share is maximum if company C or D had the minimum possible market share in 2011 (i.e., 9%) and the same company had the maximum possible market share in 2012 (i.e., 24%)

\ The percentage increase = $\dfrac{15}{9}$ × 100 = 166.67

44. If company C had the maximum percentage increase in sales from 2013 to 2014.

Its sales in 2013 = $\dfrac{11}{100}$ × 2000 = 220 (minimum possible)

Its sales in 2014 = $\dfrac{19}{100}$ × 2600 = 494 (maximum possible)

\ Increase in sales = `274 crore

45. Maximum value of company D's sales in 2010

= $\dfrac{24}{100}$ × 1200 = 288 crore

Minimum value of company D's sales in 2011

= $\dfrac{9}{100}$ × 1400 = 126 crore

Percentage decrease = $\dfrac{162}{288}$ × 100 = 56.25%

Solutions for questions 46 to 50: The number of males, females and children who visited the restaurant and the total collection each day is as follows:

Day	Males	Females	Children	Total Revenue
I	184	92	184	92,000 + 36, 800 + 55200 = 1, 84,000
II	156	156	208	78,000 + 62, 400 + 62, 400 = 2, 02, 800
III	216	216	108	1, 08,000 + 86, 400 + 32, 400 = 2, 26, 800
IV	288	96	96	1, 44, 000 + 38, 400 + 28, 800 = 2, 11, 200
V	84	84	252	42, 000 + 33, 600 + 75, 600 = 1, 51, 200
VI	76	152	152	38, 000 + 60, 800 + 45, 600 = 1, 44, 400
Total	1004	796	1000	

46. The total number of males who came to the restaurant on these six days = 1004

47. The required percentage = $\dfrac{1000}{2800}$ × 100 = 35.7%

48. The revenue was `1,51,200.

49. The highest revenue was on day III and it was `2,26,800.

50. The average number of females = $\dfrac{796}{6}$ = 132.87.

EXERCISE-3

1. The total requirement at all the tanks – 3200 kls. As 2400 kls can flow through A – T_1, and A – T_3, at least 800 kl must flow through A –T_2. $\searrow$slack = 1200 – 800 = 400.

2. If there is no flow in the pipeline connecting T_1 and T_4, the maximum flow in A – T_1, and A – T_2 can still be 1200 each.
$\backslash$ The minimum flow in the pipeline connecting A – T_3 would be 3200 – 2400 = 800 kl.

3. Let us assume that 1000 kls flow through A –T_1, and A – T_3, and 1200 kls through A – T_2.
From A → T_1, T_2, T_3 → Total capacity = 3600. Total flow = 3200 $\backslash$ slack = 400 kls
From T_1, T_3 → T_2 → Total capacity = 2400.
Total flow = 0. Slack = 2400 kls
Similarly, slacks in T_1 – T_4, T_3 – T_5 and T_2 – T_6 are 800, 600 and 700, respectively. That in T_4 – T_6, T_5 – T_6 and T_2 – T_4 would be 1200 kls each.
$\backslash$ Slack = 400 + 2400 + 600 + 800 + 700 + 1200 + 1200 + 1200 = 8500 kls.
Alternate method:
Total capacity of all pipelines = 13,200 kls
The shortest path to reach T_4, T_5 and T_6, is through 2 pipelines and T_1, T_2, and T_3 is through one pipeline.
$\backslash$Total flow = (600 + 700 + 400) × 1+ (400 + 500 + 600) × 2 = 1700 + 3000 = 4700
Slack = 13,200 – 4700 = 8500 kls.

4. For minimum total slack, the water has to flow through the longest path. The longest route to reach the different tanks are as follows:
$T_1 → A – T_1$, $T_2 → A – T_2$, $T_3 → A – T_3$
$T_4 → A – T_1 – T_2 – T_4$
$T_5 → A – T_3 – T_5$
$T_6 → A – T_1 – T_2 – T_4 – T_6$ (200 kl)
$→ A – T_3 – T_2 – T_4 – T_6$ (200 kl)
$→ A – T_2 – T_4 – T_6$ (100 kl)
Total flow = (600 + 700 + 400) × 1 + (600 × 2) + (400 + 100) × 3 + 400 × 4 = 1700 + 1200 + 1500 + 1600 = 6000 kl
Slack = 13,200 – 6000 = 7200 kls.

5. Since the maximum quantity of water flowing through a pipe is 1.5 times the total quantity of water entering into each pipe, the maximum quantity of water that can flow through pipe B = 1.5 × 120 = 180.
Quantity of net flow of water flowing through pipe B = 120 + 80 – 40 + 60 + x = 180
$\Rightarrow x = 40$

6. Since point P_1 is closed 80 units of water does not flow into pipe B from pipe A. Similarly, no water flows into pipe C from pipe B from Q_2. The quantity of water flowing through C at the point C_1 = 240 + (40 – 50) + (–40) + (50 – 20) + (10 – 10) = 220 units of water per unit of time.

7. The maximum flow at C_1 = 240 × 15
    = 360 units/unit time
$\backslash$ The maximum flow between r_3 and r_4
    = 360 – (10 – 10) = 360
The maximum flow between r_2 and r_3
    = 360 – (50 – 20) = 330
$\backslash$ The maximum flow between X and Y can be 330 units per unit of time.

8. Quantity of water flown through point A_1
    = 300 – (80 + 60 + 40 + 20) = 100 units.
Through B_1
    = (120 + 80 – 40 + 60 – 40 + 40 – 50 + 20 – 10) = 180
Through C_1
    = 240 + 40 – 50 + 40 – 40 + 50 – 20 + 10 – 10 = 260
Through D_1
    = 90 + 50 + 40 + 20 + 10 = 210

Solutions for questions 9 to 12: As the minimum requirement at D is at least 100 kls, the value of p is 1000 kls. Similarly, as the value of 'b' lies between 100 and 600, 'q' can be from 500 to 0 kls.
Similarly, r = 400 + q and
F = r + 200 (as s = 500 – t = 500 – 300 = 200)

9. The difference between 'f' and 'r' is 200 kls.

10. The least possible value of 'f' would be when q = 0 and r = 400.
$\backslash$ 'f' = 400 + 400 – 200 = 600 kls

11. As the value of 'p' is 1000 kls and the value of 's' is 200 kls, p – s would be 1000 – 200 = 800 kls

12. The slack would be minimum when the requirement at B is minimum so that requirement at F would be maximum. So also, water should reach the subsidiary tanks after passing through maximum number of pipelines.
The total capacity = 11 × 1000 = 11,000 kls
The maximum flow ((100 + 600 + 100) × 1 + 300 (E) × 2 + 400(F) × 2 + 700 (F) × 3 + 200 (G) × 3 + 300 (G) × 4)
= 800 + 600 + 800 + 2100 + 600 + 1200
= 6100 kls
The slack = 11000 – 6100 = 4900 kls

Solutions for questions 13 to 16: The order of doing the tasks can be diagrammatically represented as follows.
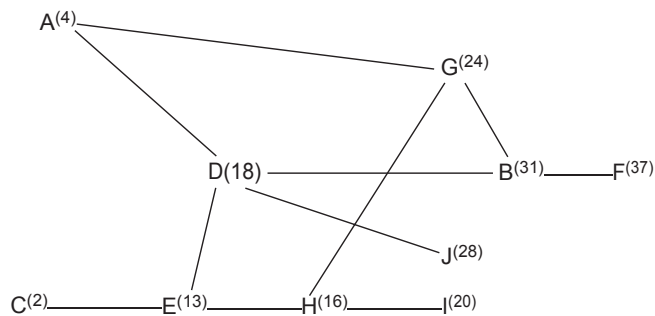
13. One-person can-do tasks A, D, J, and I while the other person can do C – E – H – G – B – F.
The first person will finish his task in 32 hours while the second person will finish his task in 37 hours.

14. The shortest time would be 37 hours as in the diagram given above.

15. Task I can be completed in 20 hours and task J can be completed in 45 hours. The maximum time gap is 25 hours.

16. If there are two persons, all the tasks can be completed in 37 hours. If it is only one person, it will take him 4 + 7 + 2 + 5 + 11 + 6 + 8 + 3 + 4 + 10 = 60 hours
The difference 60 – 37 = 23 hours.

17. It is given that outsourcing job's contribution is 14% of the total revenue of the company. As the billing rate for other jobs, $19 is double that for outsourcing jobs, the volume of outsourcing jobs should be nearly double the percentage revenue contribution, i.e., 25%.

18. Assume that the number of hours of outsourcing work done by each company is 1. The outsourcing revenue and total revenue of the six companies would be as follows:

Company	Outsourcing revenue	Total revenue
S	5.5	61
T	9.5	68
U	4.5	27
V	14.5	181
W	17	85
X	7.5	30

Company V would have the highest total revenue.

19. As outsourcing revenue is 20% of the total revenue of company W, a 20% reduction in this would lead to a 4% reduction in the total revenue of the company.

20. Let us assume that the number of hours spent on doing outsourcing jobs by companies U and V is 2 and 3, respectively.
\Their outsourcing and total revenue would be as follows:

Company	Outsourcing revenue	Total revenue
U	9	53
V	43.5	544

\The ratio of their total revenue is approximately 1 : 10.

8 Reasoning – Based DI

Chapter

Learning Objectives

In this chapter, you will:
- Learn how to solve questions involving both DI and LR
- Learn how to solve unconventional sets, venn-diagram based sets
- Learn maximisation and minimisation techniques
- Learn how to represent data in a systematic form, especially when it is fragmented and in bits and pieces

❑ Introduction

In the past few years especially CAT 15, 16 and 17, the difficulty level of the DI section had increased drastically. One of the noticeable characteristics of these papers was that most of the questions were a combination of different types. A major chunk of the papers were reasoning-based DI sets where concepts of logical reasoning and data interpretation were combined. This chapter gives a good exposure to a variety of reasoning-based DI sets.

Solved Examples

Directions for questions 8.01 to 8.05: These questions are based on the following information.

The following table shows the number of flights expected to fly between various cities in the month of Jan 2016.

From City	To City						
	A	B	C	D	E	F	Total
A	–	680	450			240	1970
B	380	–		480		640	2430
C	420		–		720		1840

From City	To City						
	A	B	C	D	E	F	Total
D		560	280	–			1960
E	680		440		–	320	
F	320			560		–	
Total	1860		1640		1520	2420	10,000

At least 10 flights are expected to travel from each city to any other city in Jan 2016.

City from	City to						
	A	B	C	D	E	F	Total
A	–	680	450	a	b	240	1970
B	380	–	c	480	d	640	2430
C	420	E	–	f	720	g	1840
D	h	560	280	–	i	j	1960
E	680	k	440	1	–	320	n
F	320	v	p	560	q	–	r
Total	1860	s	1640	t	1520	2420	10,000

$a + b = 1970 – (680 + 450 + 240) = 600$
$c + d = 2430 – (380 + 480 + 640) = 930$
$e + f + g = 1840 – (420 + 720) = 700$
$h + i + j = 1960 – (560 + 280) = 1,120$
$k + l = n – (680 + 440 + 320) = n – 1440$
$v + p + q = r – (320 + 560) = r – 880$
$h = 1860 – (380 + 420 + 680 + 320) = 60$
$e + k + v = s – (680 + 560) = s – 1240$
$c + p = 1640 – (450 + 280 + 440) = 470$
$a + f + l = t – (480 +560) = t – 1040$
$b + d + i + q = 1520 – 720 = 800$
$g + j + m = 2420 – (240 + 640) = 1,540$
$n + r = 10,000 – (1970 + 2430 + 1840 + 1960) = 1800$

8.01: What is the maximum number of flights expected to fly from city C to city D?
(A) 640   (B) 680
(C) 720   (D) 760

Sol: Maximum number of flights expected to fly from city C to city D
$= f_{max} = (700 – e_{min} – g_{min}) = 700 – 10 – 10 = 680$

8.02: What is the maximum number of flights expected to fly from city B to city E?

(A) 920   (B) 940
(C) 960   (D) 980

Sol: The maximum number of flights expected to fly from city B to city E = d_{max} = 930 – C_{min}
= 930 – 10 = 920

8.03: What is the minimum number of flights that are expected to land in city D?
(A) 920   (B) 970
(C) 1020   (D) 1070

Sol: The minimum number of flights that are expected to land in city D

$= t_{min} = (a_{min} + 480 + f_{min} + l_{min} + 560)$
$= 10 + 480 + 10 + 10 + 560 = 1070$

8.04: If it is planned that 320 flights will leave from city E to city C, then what could be the minimum number of flights that would leave from city E?
(A) 1380   (B) 1420
(C) 1460   (D) 1500

Sol: The minimum number of flights that could leave from city E = (680 + 10 + 440 + 320 + 10) = 1460

8.05: What could be the ratio of the minimum number of flights that will go to city B to the minimum number of flights that will leave from city F?
(A) 97 : 61   (B) 107 : 71
(C) 117 : 81   (D) 127 : 91

Sol: The minimum number of flights that will go to city B = S_{min} = 680 + 10 + 560 + 10 + 10 = 1270.
Minimum number of flights that will leave from city F = 320 + 10 + 10 + 560 + 10 = 910.
\ The required ratio = 1270 : 910 = 127 : 91.

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Directions for questions 1 to 5: These questions are based on the following pie chart which shows the population-wise categorization of villages of a district into six groups A, B, C, D, E and F.
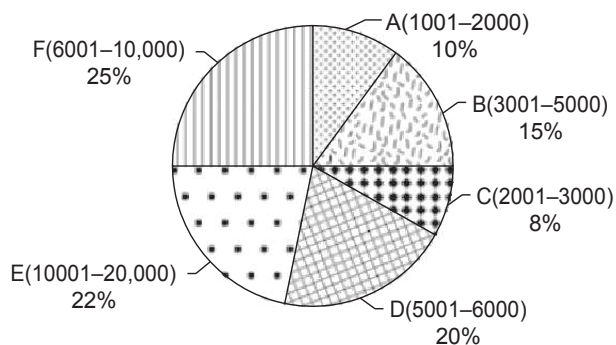
1. What is the ratio of the number of villages having a population in the range of 3001-5000 to the number of villages having a population in the range of 6001 – 10,000?

2. By what per cent is the number of villages having a population of at least 1001 but at most 3000 more than the number of villages having a population of more than 3000 but at most 5000?

3. If the number of villages having a population in the range of 5001 to 6000 is 60, then what is the total number of villages having a population of more than 6000?

4. If the total number of villages in the district is 500, then how many villages have a population of at least 3001?

5. If the total population of all the villages in group-B is 45,000, then what is the minimum number of villages in group-B?

Directions for questions 6 to 10: Answer the questions based on the information given below.

The given figure provides the details of the number of students in a school who play any of the four games, such as cricket, basketball, football and hockey.
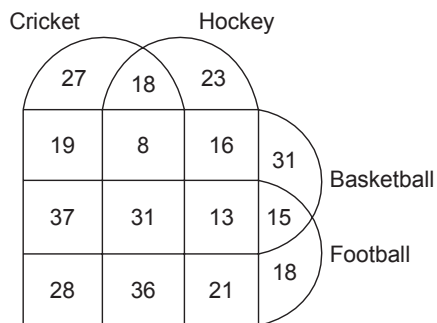
The total number of students in the class is 500.

6. How many of the students play at most one game?
   (A) 99   (B) 60
   (C) 159   (D) 258

7. The number of students who play either cricket or basketball but not football is
   (A) 142   (B) 119
   (C) 215   (D) None of these

8. How many students play at least three games?
   (A) 125   (B) 57
   (C) 98   (D) 112

9. The number of students playing at most one game exceeds those playing at least two games by
   (A) 8   (B) 16
   (C) 38   (D) None of these

10. How many students do not play Cricket, Football or Hockey?
    (A) 178   (B) 190
    (C) 196   (D) None of these

Directions for questions 11 to 13: Answer these questions based on the information given below.

These questions are based on the following table which gives the percentage distribution of the cars purchased in a city for the year 2006. The first table gives the company-wise distribution of the cars purchased for each category and the second table gives the category-wise distribution of cars for each company.

Company-wise distribution for each category

	Small	Economy	Mid size	Comfort	Luxury
Maruti	20%	10%	7.5%	25%	5%
Hyundai	16%	12%	22.5%	7.5%	35%
Ford	30%	40%	15%	7.5%	10%
Fiat	24%	18%	45%	22.5%	30%
Toyota	10%	20%	10%	37.5%	20%

Category-wise distribution for each company

	Maruti	Hyundai	Ford	Fiat	Toyota
Small	45%	24%	45%	24%	18%
Economy	7.5%	6%	20%	6%	12%
Mid-size	15%	30%	20%	40%	16%
Comfort	25%	5%	5%	10%	30%
Luxury	7.5%	35%	10%	20%	24%

11. What is the ratio of the number of luxury cars purchased to the number of Fiat cars purchased?
(A) 3 : 2 (B) 2 : 3
(C) 4 : 5 (D) 5 : 4

12. Of the total cars purchased in 2006, if the number of Luxury Fords were 150, then how many cars were either Hyundai or economy cars?
(A) 1480 (B) 1750
(C) 2250 (D) 2160

13. Of the Toyota cars purchased, the number of small cars is 10 more than the number of mid-size cars. How many cars were purchased in the city in 2006?
(A) 1000 (B) 12,000
(C) 3000 (D) Cannot be determined

Directions for questions 14 to 18: These questions are based on the following table, which gives the distribution of marks of 160 students in five subjects. The maximum marks in each subject is 100.

Subject	Marks			
	70 and above	60 and above	50 and above	40 and above
Maths	83	108	127	143
Marathi	91	113	139	151
Social	103	104	131	149
Statistics	108	139	149	156
English	93	105	117	139

14. How many students scored 50 marks or more but less than 60 marks in Social?
(A) 29 (B) 27
(C) 131 (D) 104

15. How many students scored less than 50% marks in English?
(A) 32 (B) 43
(C) 67 (D) 117

16. In which of the following subjects is the number of students who scored 50 or more but less than 70, the highest?
(A) English (B) Maths
(C) Social (D) Marathi

17. The number of students who scored more than 60 marks in all the given subjects is
(A) 104 (B) 105
(C) 113 (D) Cannot be determined

18. How many students scored less than 60 marks in Marathi?
(A) 56 (B) 68
(C) 108 (D) 47

Directions for questions 19 to 22: Answer the questions based on the information given.

The graphs give the trends of sales and expenses of ABC Corporation for the years 2010 to 2015. Both sales and expenses of the year 2010 are indexed to 100 and there was a profit in each of the given years.
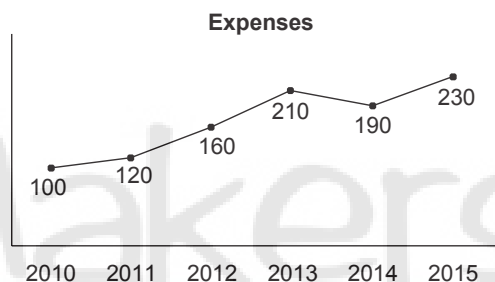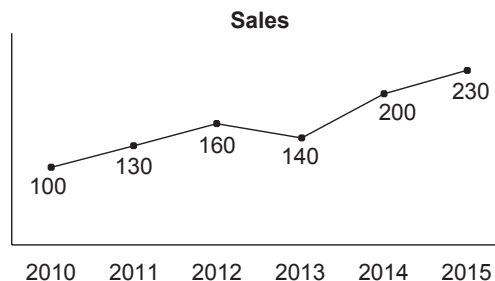
Sales

Expenses

Profit = Sales − Expenses

Profitability (%) = $\dfrac{\text{Profit}}{\text{Sales}} \times 100$

19. At least in how many of the given years did all of sales, expenses and profit increase or decrease in unison?
(A) 2 (B) 3
(C) 1 (D) 4

20. At least in how many of the given years did the profits of ABC Corporation increase, when compared to the previous year?
(A) 4 (B) 3
(C) 2 (D) 1

21. If profitability in the year 2012 was 50%, then what was the profitability in the year 2014?
(A) 47% (B) 52.5%
(C) 60% (D) Cannot be determined

22. In which of the following years did ABC Corporation make the highest profit?
(A) 2011 (B) 2012
(C) 2015 (D) Cannot be determined

Directions for questions 23 to 27: These questions are based on the table below which gives the distribution of revenues generated by movies in different languages.

Language	Collection (`)				
	` 100 cr and above	` 80 cr and above	` 60 cr and above	` 40 cr and above	` 20 cr and above
Hindi	63	88	107	123	145
Tamil	71	93	119	131	152
Telugu	83	84	111	129	143
Kannada	88	119	129	136	157
English	73	85	97	119	132

23. How many Tamil movies collected ` 40 crore or more but less than ` 80 cr?
(A) 28   (B) 36
(C) 38   (D) 46

24. How many English movies collected less than ` 40 crore?
(A) 21   (B) 13
(C) 11   (D) Cannot be determined

25. In which language is the number of movies which collected ` 60 crore or more but less than ` 100 crore, the highest?
(A) Hindi   (B) Tamil
(C) Telugu   (D) English

26. If each movie was released in only one language, then the number of movies which collected ` 60 crore or more but less than ` 100 crore in any of the given languages is
(A) 88   (B) 142
(C) 163   (D) None of these

27. If 170 movies were released in Hindi during the given period and no movie collected more than ` 140 crore, then the total collection (in `) of all the Hindi movies cannot be more than
(A) ` 11160 crore      (B) ` 12730 crore
(C) ` 14180 crore      (D) ` 15180 crore

Directions for questions 28 to 31: These questions are based on the following information.

The following table gives the number of students in Class I to IV in a school in two consecutive academic years, such as in year I and year II. New students join the school only in Class I and students leave the school only after passing out of Class IV. Each year, students who pass the annual exams are promoted to the next class while students who fail, have to stay in the same class the next year also and are joined by students who get promoted. It is known that 35 students passed out of Class IV at the end of year I.

Class	Year I	Year II
I	36	34
II	42	38
III	31	39
IV	38	32

28. How many students joined the school in year II?
(A) 23   (B) 26
(C) 29   (D) 31

29. How many students failed in Class I in year I?
(A) 1   (B) 2
(C) 3   (D) 4

30. How many students were promoted from Class III at the end of year I?
(A) 21   (B) 29
(C) 30   (D) 31

31. How many students in the school failed in the annual exams in year I?
(A) 5   (B) 8
(C) 10   (D) None of these

Directions for questions 32 to 35: These questions are based on the following information.

The table gives the partial data on the expected number of emails to be sent from one email account to another email account (in billion) in the year 2020.

Expected number of emails to be sent and received (in billions).

Server	Yahoo	Mailcity	Hotmail	Msn	Eudora	Rediff	Total sent
Yahoo	180	200				115	1182
Mailcity	100		137				1784
Hotmail		300		317			2074
Msn			386		198		
Eudora	85				372		
Rediff		215		273			1818
Total received	2183				1800	1000	10,000

It is expected that in the year 2020, any email account (out of the six given) will receive at least 1 billion emails from each of the six email accounts. Also, any email account will send at least 1 billion emails to each of the six email accounts.

32. Find the maximum number of emails (in billion) which is expected to be sent from Hotmail to Hotmail in the year 2020?
(A) 1454
(B) 1457
(C) 1400
(D) 1386

33. Find the minimum number of emails (in billion) expected to be sent from either msn or Hotmail to either Eudora or Msn.
(A) 515
(B) 520
(C) 517
(D) 508

34. Find the maximum number of emails (in billion) which is expected to be sent from Hotmail to yahoo in the year 2020.
(A) 1816
(B) 1454
(C) 1284
(D) 1586

35. Find the maximum number of emails expected to be sent from any email account to any other email account.
(A) 2072
(B) 3805
(C) 2554
(D) None of these

Directions for questions 36 to 40: Answer the questions based on the following information.

The following pie charts give the break-up of the income of all the five members, namely Varun, Tarun, Arvind, Karan and Charan of family XYZ and the break-up of the total family expenditure under different heads.

Split of total income of family XYZ

Tarun 108°
Varun 162°
Arun 36°
Charan 21.6°
Karan 32.4°
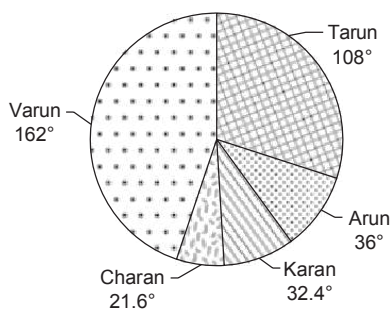
Split of total expenditure of family XYZ

Food 30%
Clothing 25%
Others 7%
Phone and Electricity bill 10%
Fuel 8%
Rent 20%
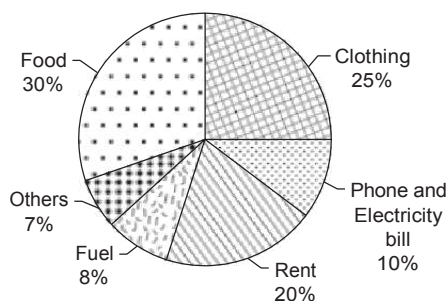
Note: The total income of the family is equal to the total expenditure and the family has no other sources of income.

36. If Varun did not pay for 'Others', then his income can fully account for expenses under at most how many heads?
(A) 2
(B) 3
(C) 4
(D) 5

37. Whenever possible, if all the expenses under one head are paid for by a single person, then the number of heads under which more than one person shared the expenses is at least
(A) 1
(B) 2
(C) 3
(D) 4

38. If Varun does not spend any amount on food, then the expenditure of Varun on clothing and rent as a percentage of the total expenditure on rent and clothing cannot be less than
(A) 33.33%
(B) 44.44%
(C) 25%
(D) 66.66%

39. If at most 40% of the income of each person is paid for food, then the number of persons who did not pay for food is at most
(A) 1
(B) 2
(C) 3
(D) 4

40. If at least 5% of the total expenses under each head are paid from Karan's income, then the percentage share of Karan's payment under any head can be at most
(A) 22.5%
(B) 90%
(C) 62.14%
(D) $66^2/_3$%

Directions for questions 41 to 45: Answer the questions based on the information given below:

Prof. Bean has been tracking the number of visits to his homepage. His service provider has provided him with the following distribution of the number of visits as per the country and the university from which the visits were made. The data pertains to three days from Day 1, Day 2 and Day 3.

Number of Visits

Country	Day		
	1	2	3
China	1	0	0
Philippines	1	1	0
UK	1	0	2
USA	1	2	0
Germany	0	0	1

Number of Visits

University	Day 1	Day 2	Day 3
A	1	1	0
B	1	0	0
C	1	0	0
D	0	0	1
E	0	2	0
F	1	0	0
G	0	0	2

Note: Each university is in only one country.

41. In which country is University E located?
(A) USA
(B) UK or Philippines
(C) China or USA but not UK
(D) Germany or USA but not Philippines

42. In which country is University G located?
(A) UK
(B) Germany
(C) China
(D) USA

43. In which of the five countries mentioned, are three of the seven universities mentioned possibly located?
(A) USA
(B) UK
(C) Philippines
(D) None of the countries

44. Which of the following universities is not located in China?
(A) C
(B) B
(C) A
(D) F

45. Which of the following universities is in Philippines?
(A) A
(B) B
(C) C
(D) D

Directions for questions 46 to 50: Answer these questions based on the information given below.

The table gives the number of passengers getting in and out of a bus which travels from City A (starting point) to City B (destination) with four stops from Stop 1, Stop 2, Stop 3 and Stop 4 in between. The first set of passengers boarded the bus at City A and all the passengers who were in the bus got down at City B. Each passenger travelled at least from one stop to the next and no passenger who got down the bus at any stop got in again.

Stop	Number of passengers Getting in	Getting out
City A	14	
Stop 1	12	5
Stop 2	7	10
Stop 3	10	12
Stop 4	8	11
City B		

46. How many passengers got down at City B?
(A) 8
(B) 12
(C) 13
(D) 15

47. At most how many passengers who got in at City A got down at Stop 2?
(A) 10
(B) 9
(C) 8
(D) 7

48. At least how many passengers who got in at Stop 3 got down at B?
(A) 0
(B) 1
(C) 2
(D) 3

49. The number of passengers who got in at Stop 1 and got down at Stop 4 is at most
(A) 12
(B) 11
(C) 10
(D) 6

50. What is the maximum number of passengers who got down at exactly the third stop from where they got in?
(A) 10
(B) 11
(C) 12
(D) 15

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

The following line graph shows the percentage increase in sales and profit, both when compared to that of the previous year, of company XYZ for five years starting from 2003.
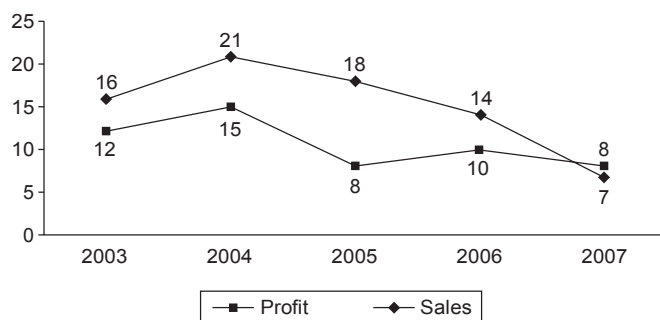
Note: The company made a profit in each of the given years.

1. If the sales in the year 2003 were `120 crore, then what was the approximate value of the sales in 2006 (in crore)?
   (A) 162   (B) 176
   (C) 198   (D) 208

2. In which of the given years were the increase in sales, the highest?
   (A) 2004   (B) 2005
   (C) 2006   (D) Cannot be determined

3. If profitability is defined as $\dfrac{\text{profit}}{\text{sales}}$, then in which year was the profitability the least?
   (A) 2004   (B) 2005
   (C) 2006   (D) 2007

Directions for questions 4 to 7: Answer these questions based on the information given below.

260 students in a school had enrolled for the hobby classes. The students had the option of taking one, two or three hobbies among Karate, Skating, Abacus, Cricket, Chess, Painting, Music and Dance. The following table gives the number of students who enrolled for each of the eight hobbies.

Hobby	Number of students
Karate	72
Skating	46
Abacus	83
Cricket	41
Chess	65
Painting	32
Music	37
Dance	38

4. Which of the following can be the number of students who opted for exactly one hobby?
   (A) 197
   (B) 184
   (C) 120
   (D) 104

5. What is the minimum number of students who opted for at least two hobbies?

6. What is the maximum number of students who opted for three hobbies?

7. What is the minimum number of students who opted for three hobbies?

Directions for questions 8 to 12: These questions are based on the following information.

The following table gives the number of students who passed in four subjects, namely in Maths, Physics, Chemistry and Biology in the three sections A, B and C in Class X of a school. Each section had a student strength of 40.

Section	Maths	Physics	Chemistry	Biology
A	28	31	39	26
B	34	32	37	33
C	26	34	31	29

8. The number of students in section A who passed in all the four subjects is at most.

9. The number of students in section C who passed in all the four subjects is at least.

10. At most how many students in section B passed in exactly one of the four subjects.

11. The number of students who passed in both Physics and Chemistry in the three sections combined is at most.

12. A student has to pass in all the four subjects to clear the Class X exam. The least number of students in the school who failed to clear the exam is

Directions for questions 13 to 17: Answer the questions based on the information given below.

The following pie chart gives the details of runs scored by five Indian batsmen in a match. Only five players batted during the innings and the table gives the details of the percentage of runs scored in 4s and 6s by these players. All other runs scored by each player were in an equal number of 1s and 2s. India's total score was the lowest number which satisfies all these conditions.

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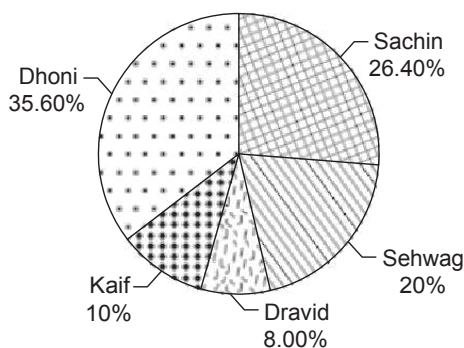
Player	4s	6s
Sachin	36.36%	18.18%
Sehwag	16%	24%
Dravid	40%	0%
Kaif	64%	0%
Dhoni	22.47%	33.70%

13. How many runs did Dravid score in singles (1's)?
(A) 2   (B) 4
(C) 6   (D) 3

14. The player who has made the maximum number of boundaries (4s) is
(A) Sachin   (B) Dravid
(C) Kaif   (D) Cannot be determined

15. Which of the following is India's minimum possible total score?
(A) 100   (B) 125
(C) 250   (D) Cannot be determined

16. The total number of runs scored in boundaries (4s) and sixers (6s) by the Indian batsmen are
(A) 65   (B) 66
(C) 130   (D) 140

17. How many sixers (6s) did Dhoni score?
(A) 3   (B) 4
(C) 5   (D) Cannot be determined

Directions for questions 18 to 21: These questions are based on the following information.

The table below gives the percentage share of expenses of Mr. Dubey on different items in the years from 2005 to 2008.

Expense type	2005	2006	2007	2008
Rent	14	12	13	12
Food	15	17	15	12
Clothing	10	12	11	14
Entertainment	17	15	15	13
Medical	6	5	8	10
Education	27	29	25	26
Travel	11	10	13	13

18. If the total expenses in 2008 was more than that in 2005, then the expenses under which head showed the highest percentage increase from 2005 to 2008?
(A) Clothing   (B) Entertainment
(C) Medical   (D) Travel

19. If the expenses under each head in 2007 was more than the corresponding value in 2005, then the percentage increase in total expenses from 2005 to 2007 was at least
(A) 10%   (B) 13.33%
(C) 15%   (D) 17.5%

20. If the medical expenses in 2008 was 25% more than that in 2006, then the expenses on clothing in 2008 was what percentage of the entertainment expenses in 2006?
(A) 37.5%   (B) 42.8%
(C) 52.5%   (D) 58.3%

21. If the expenses on rent increased by 10% every year from 2005 to 2008, by what percentage did the expenses on food increase from 2005 to 2008?
(A) 18%   (B) 24.3%
(C) 27.5%   (D) 32%

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

The following table gives the marks scored by four students, namely Anand, Balu, Chetan and Deepak in the three areas, such as Verbal, Quant and Reasoning of a mock CAT paper. The four students are disguised in the tables as A, B, C and D in no particular order.

	Student			
Section	A	B	C	D
Verbal	24	41	40	27
Quant	34	36	35	32
Reasoning	36	31	36	32

It is also known that, in reasoning, none of the other three students scored more than Chetan.

Balu's total score in the three sections differs from that of Anand's by 3 marks.

22. What can be said regarding the following two statements?
Statement I: Deepak scored the lowest marks in the reasoning section.

Statement II: Anand's total score in the three sections is more than that of Deepak.
- (A) If Statement I is true, then Statement II is necessarily true.
- (B) If Statement I is true, then Statement II is necessarily false.
- (C) Both Statement I and Statement II are true.
- (D) Neither Statement I nor Statement II is true.

23. What can be said regarding the following two statements?
Statement I: Balu's lowest score is in the reasoning section.
Statement II: Anand's lowest score is in the quantitative section.
- (A) If Statement II is true, then Statement I is necessarily false.
- (B) If Statement I is false, then Statement II is necessarily true.
- (C) If Statement I is true, then Statement II is necessarily true.
- (D) None of the above

24. What can be said regarding the following two statements?
Statement I: Anand had the highest score in the verbal section.
Statement II: Balu had the highest score in the quant section.
- (A) Both the statements could be true.
- (B) At least one of the statements must be true.
- (C) At most one of the statements must be true.
- (D) None of the above

25. If Deepak got his lowest score in the verbal section, then which of the following is true?
- (A) Chetan's lowest score is in the reasoning section.
- (B) Chetan's lowest score is in the quant section.
- (C) Chetan's lowest score is in the verbal section.
- (D) No definite conclusion is possible.

Directions for questions 26 to 29: Answer these questions based on the information given below.

The following table represents the number of cars sold (in thousands) by four companies in three countries. The companies Toyo Ltd., Mercedes Ltd., BWM Ltd., and Form Ltd., are disguised as Company A, Company B, Company C and Company D in the table, in no particular order.

Countries	Company A	Company B	Company C	Company D
USA	196	328	320	220
UK	276	288	280	260
Japan	288	252	288	260

Further it is known that, BWM Ltd. was one of the companies that had the highest sales in Japan.

Total cars sold by Mercedes Ltd. in the three countries differs from that of Toyo Ltd. by 20,000.

26. What can be said regarding the following two statements?
Statement 1: Mercedes Ltd. had its lowest sales in Japan.
Statement 2: Toyo Ltd. had its lowest sales in UK.
- (A) If statement 2 is true, then statement 1 is necessarily false.
- (B) If statement 1 is false, then statement 2 is necessarily true.
- (C) If statement 1 is true, then statement 2 is necessarily true.
- (D) If statement 1 is false, then statement 2 is necessarily true.

27. If Form Ltd. had its lowest sales in USA, then which of the following is necessarily true?
- (A) BWM Ltd. had its lowest sales in Japan.
- (B) BWM Ltd. had its lowest sales in UK.
- (C) BWM Ltd. had its lowest sales in USA.
- (D) BWM Ltd. is company B.

28. Which of the following additional information will help us to uniquely identify each of the four companies?
- (a) BWM Ltd. is Company A.
- (b) Toyo Ltd. is Company B.
- (c) Form Ltd. is Company D.
- (d) Mercedes Ltd. is Company C.
- (A) Only (a)
- (B) Only (b)
- (C) Only (d)
- (D) More than one of the above.

29. What can be said regarding the following two statements?
Statement 1: Toyo Ltd. had the highest sales in USA.
Statement 2: Mercedes Ltd. had the highest sales in UK.
- (A) Both statements could be true.
- (B) At least one of the statements must be true.
- (C) At most one of the statements is true.
- (D) Both statements are false.

Directions for questions 30 to 33: Answer these questions based on the information given below.

The table gives the ratio of the number of boys to the number of girls in different schools, in different cities, for the years 2015 and 2016.

School	Jaipur		Mumbai		Pune		Hyderabad	
	2015	2016	2015	2016	2015	2016	2015	2016
DPS	3 : 2	4 : 3	2 : 3	2 : 3	7 : 4	7 : 5	7 : 5	3 : 2
FPS	4 : 3	4 : 3	3 : 4	3 : 5	3 : 2	3 : 4	7 : 6	4 : 3
LSP	5 : 2	5 : 3	5 : 4	4 : 5	1 : 2	4 : 5	6 : 5	5 : 2
LPS	7 : 2	7 : 4	7 : 3	7 : 5	3 : 5	7 : 5	8 : 3	7 : 2
PDS	1 : 1	1 : 1	1 : 1	1 : 1	5 : 3	5 : 4	9 : 7	1 : 1
LFS	1 : 2	2 : 3	1 : 2	1 : 2	3 : 4	4 : 5	3 : 2	1 : 2

For any given school, in any year, assume that the number of students in Jaipur was more than that in Mumbai, which in turn was more than that in Pune, and in turn was more than that in Hyderabad.

Also, for any given city, in any year, the number of students followed this pattern n (DPS) > n (FPS) > n (LSP) > n (LPS) > n (PDS) > n (LFS) (Here, n (XYZ) denotes the number of students in the school XYZ in that year).

30. If in 2015, the difference between the number of boys and the number of girls in LSP was 120 and 90 in Jaipur and Pune, respectively, then what was the difference between the number of boys and the number of girls in LSP in Mumbai in that year?
(A) 29   (B) 30
(C) 31   (D) 33

31. If *'boyage'* is defined as the percentage of boys in the total students, then for how many of the given 24 campuses is the value of *boyage* in 2016, more than that in 2015? (Consider each school in each city as a campus.)
(A) 4   (B) 6
(C) 8   (D) 10

32. If the number of girls in LSP, Pune in 2015 is the same as the number of boys in DPS, Mumbai in 2016, then the total number of students in DPS, Mumbai in 2016 is more than the number of students in
(A) FPS, Hyderabad in 2015.
(B) DPS, Pune in 2015.
(C) LFS, Jaipur in 2016.
(D) LPS, Pune in 2015.

33. In 2015, if the number of boys in DPS, Hyderabad is 315, then what is the maximum possible number of girls in LFS, Hyderabad?
(A) 210   (B) 212
(C) 204   (D) 196

Directions for questions 34 to 37: Answer the questions based on the information given below.

The Venn diagram below shows the number of students who study Mathematics, Physics, Chemistry and Biology. The total number of students studying the given subjects in the given order is 64, 76, 63 and 72, respectively.
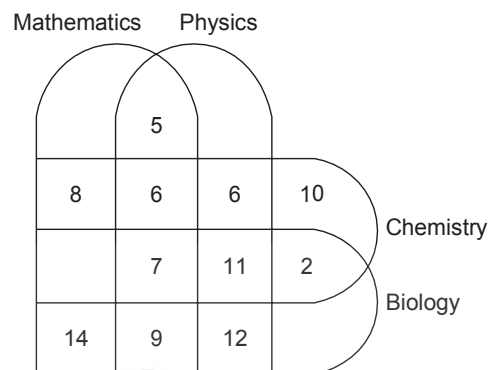
34. How many students study only Physics?
(A) 11   (B) 20
(C) 12   (D) 14

35. How many students study only Mathematics?
(A) 1   (B) 2
(C) 3   (D) 4

36. How many students study all the four subjects?
(A) 7   (B) 6
(C) 12   (D) 22

37. How many students study either Physics and Mathematics or Chemistry and Biology?
(A) 67   (B) 99
(C) 53   (D) 45

Directions for questions 38 to 41: Answer these questions based on the information given below.

The table gives some information about the foreign exchange reserves of India for a period of ten years from 1990-91 to 1999-2000. Foreign exchange reserves comprise currency holdings and gold holdings. Currency holdings comprise reserves in three foreign currencies, such as in US Dollar, Pound Sterling and Euro.

The following table gives the prices (in `) of the three currencies and the price (in `) of gold by considering the year 1990–91 as the base year, in which the price of each of the currencies and the price of gold are taken as 100. The prices of each of these in the following years are given relative to that in the base year.

Holdings	Price with respect to the base year (1990–91)								
	1990–91	1991–92	1992–93	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	1999–2000
US Dollar	100	96	110	96	98	94	102	92	112	98
Pound Sterling	100	110	102	100	96	100	106	98	116	90
Euro	100	104	106	104	104	106	106	96	108	106
Gold	100	102	104	108	110	107	108	109	112	109

(i) Value (in `) of a currency (or gold) holding = Volume of the holding × Price (in `) of the holding.

(ii) Volume of a currency (or gold) holding = Number of units of that currency (or gold) held.

(iii) The quantity of each currency and that of gold with India remained constant throughout the given period and India had at least one unit of each of the three currencies and gold with it.

38. If the percentage increase in the total value of the foreign exchange reserves from 1990-91 to 1998-99 is x%, then x cannot be equal to

(A) 10   (B) 12.5

(C) 8   (D) 11

39. If the total value of the currency holdings during 1995–96 was more than that in 1990–91, then what is the maximum possible number of years during which the total value of the currency holdings was less than that in 1990–91?

40. In how many of the given years was the total value of the currency holdings less than that in the year 1992-93?

41. During which of the given years was the total value of the foreign exchange reserves the highest?

Directions for questions 42 to 46: Answer the questions based on the information given below.

A total of six colleges, namely from A, B, C, D, E and F jointly conducted an entrance examination. The exam had four sections-I, II, III and IV. The following table gives the sectional cut off marks specified by the colleges and the over-all cut off marks. A student will get a call from a college only if he scores at least the sectional and overall cut off marks specified by that college. The maximum marks in each section is 50.

College	Section				
	I	II	III	IV	Overall
A	40		43		160
B		40	42	45	168
C	41		43		165

College	Section				
	I	II	III	IV	Overall
D		45		42	170
E	43		45		175
F		43		40	167

42. Anuj did not get a call from any of the colleges. What is the maximum marks he could have scored?

(A) 155   (B) 159

(C) 180   (D) 183

43. Ram got a call from only one college. What is the maximum marks he could have scored?

(A) 160   (B) 164

(C) 177   (D) 185

44. Madhuri got calls from all the six colleges. What is the minimum marks she could have scored?

(A) 175   (B) 178

(C) 179   (D) 180

45. Ravi scored a total of 190 marks. What is the minimum number of colleges from where he could have got calls from?

(A) 1   (B) 2

(C) 3   (D) 4

46. Ravi and Raja scored 175 marks each. What could be the maximum difference in the number of calls they got?

(A) 6   (B) 5

(C) 4   (D) 3

Directions for questions 47 to 50: Answer these questions based on the information given below.

A study on population of eight cities was conducted by the human resources and social welfare department. These eight cities were ranked from 1 to 8 based on social welfare and it was found that for any City X, the number of cities with a population less than it was exactly one less than the rank of City X on the basis of social welfare.

The following table gives the comparison of populations of the eight cities.

	Indore	Pune	Bhopal	Shillong	Agra	Cochin	Patna	Mysore
Indore	X	M	L					L
Pune		X			M			
Bhopal			X			L	L	L
Shillong				X				M
Agra					X			
Cochin						X	L	M
Patna							X	M
Mysore								X

M in the table denotes that the population of that city was more and L in the table denotes that the population of that city was less than the corresponding city. For example, the table shows that the population of Indore was more than that of Pune and less than that of Bhopal. It was also known that Indore was 3rd and Shillong was not among the top 5 in the rakings based on social welfare.

47. Which city was ranked first?
(A) Pune (B) Agra
(C) Bhopal (D) Mysore

48. How many cities have less population than Mysore?
(A) 3 (B) 2
(C) 4 (D) 7

49. What was the rank of Shillong based on Social Welfare?
(A) 7
(B) 6
(C) 5
(D) Cannot be determined

50. The cities are ranked again based on the population such that the city with the highest population is ranked 1st that with the second highest population ranked 2nd and so on. Which city would have its rank and the number of cities with a population less than it, as equal?
(A) Shillong (B) Mysore
(C) Bhopal (D) Cochin

exeRCISe-3

Directions for questions 1 to 4: Answer these questions on the basis of the information given below.

Table 8.1 shows the number of ships that arrived at Mumbai port on different days of the week from October 9th to 15th (i.e., from Sunday to Saturday).

Table 8.1

Day	9 Oct Sunday	10 Oct Monday	11 Oct Tuesday	12 Oct Wednesday	13 Oct Thursday	14 Oct Friday	15 Oct Saturday
Number of ships arrived	28	47	40	45	40	35	25

Each of the ships mentioned in Table 8.1 departs from the port in the next week, starting from October 16 to October 22 (i.e., Sunday to Saturday). Table 8.2 shows the number of ships that departed from the port on different days.

Table 8.2

Day	16 Oct Sunday	17 Oct Monday	18 Oct Tuesday	19 Oct Wednesday	20 Oct Thursday	21 Oct Friday	22 Oct Saturday
Number of ships departed	37	43	50	45	35	30	20

Further, no ship arriving at the port can depart from the port on or before the 5th day after the day on which it arrived. Also, no ship can remain at the port after the 10th day after the day on which it arrived. For example, a ship which arrived on Wednesday cannot depart on or before the next Monday, but it must definitely depart on or before the next Saturday.

1. If, of the ships that arrived on Monday, October 10th, 22 ships departed on the next Sunday, then the number of ships that arrived on Sunday, October 9th and departed after the next Sunday is
   (A) 13 (B) 15
   (C) 22 (D) 24

2. If in the above table, all the ships that arrived on or before Tuesday, left on or before next Tuesday, then the number of ships that arrived on Wednesday and departed on the next Tuesday is
   (A) 10 (B) 15
   (C) 20 (D) 25

3. If 20 ships that arrived on Wednesday departed on Friday, the number of ships that arrived on Friday and departed on Thursday is at least
   (A) 5 (B) 10
   (C) 25 (D) 30

4. The number of ships that arrived on Tuesday and departed on Monday is at least
   (A) 0 (B) 3
   (C) 5 (D) 10

Directions for questions 5 to 8: Answer these questions on the basis of the information given below.

Six students of a class wrote Physics and Chemistry exams. Each exam had nine questions and, in each exam, marks are given based on the number of questions attempted correctly as follows:

Number of correct attempts (n)	Marks
0, 1	$n \times 1$
2, 3, 4	$n \times 2$
5, 6, 7	$n \times 3$
8, 9	$n \times 4$

Note: Assume that no marks are given for wrong answers or unanswered questions.

Further, the results of the exams are as follows:

Student	Physics	Chemistry	Total	Total marks
A				
B			7	
C			13	
D				24
E				39
F				51
Total	36	30	66	

It is also known that,
(1) The number of questions answered correctly by D in Physics is the same as that of E in Chemistry.
(2) The number of questions answered correctly by F in Physics and Chemistry are equal to the number of questions answered correctly by B and C in Chemistry, not necessarily in the same order.

5. The total marks scored by A is
   (A) 21 (B) 25
   (C) 29 (D) 36

6. Who scored the second lowest total marks?
   (A) A (B) B
   (C) C (D) D

7. In Physics, how many students scored more marks than E?
   (A) 0 (B) 1
   (C) 2 (D) 3

8. How many students scored more marks in Physics than in Chemistry?
   (A) 4 (B) 3
   (C) 2 (D) 5

Directions for questions 9 to 13: Answer these questions on the basis of the information given below.

The following table gives the details of the number of mock CATs conducted by different institutes in 2004 and the number of these mock CATs written by different students.

	Institute				
Student	P (30)	Q (40)	R (32)	S (24)	T (26)
Akshay	12	21	23	10	22
Bobby	16	20	16	20	11
Chahat	18	33	17	15	8
Daram	14	16	28	16	13
Emran	21	18	18	9	15
Feroz	16	21	15	12	10
Govinda	10	30	20	11	20
Hrithik	20	22	19	17	19

The number given in the brackets is the total number of mock CATs conducted by the respective institutes in 2004.

9. The number of students who wrote at least one mock CAT of each institute in common with Feroz is at least
   (A) 0 (B) 1
   (C) 2 (D) 3

10. Among the total mock CATs held, the number of mock CATs written by exactly one of Akshay and Hrithik is at least
    (A) 18 (B) 20
    (C) 23 (D) 26

11. Of the mock CATs conducted by institute R, the number of mock CATs which were written by more than one among Bobby, Emran and Govinda is at least
(A) 8   (B) 11
(C) 13   (D) 15

12. If Daram wrote all the mock CATs which were written by neither Chahat nor Feroz, then the number of mock CATs conducted by institute S and written by Daram, Chahat and Feroz is at most
(A) 6   (B) 7
(C) 8   (D) 9

13. Of the mock CATs conducted by institute Q, the number of common mock CATs written is the highest for
(A) Feroz and Akshay
(B) Hrithik and Chahat
(C) Chahat and Govinda
(D) Daram and Emran

Directions for questions 14 to 17: Answer these questions on the basis of the information given below.

Intra-State Migration Trends in India, 1991

Migration stream	X	Y
R → R	49·67%	76.71%
R → U	27·27%	11·95%
U → U	15·38%	7.04%
U → R	7·68%	4·3%

R = Rural; U = Urban

X = Male migrants in the stream as a percentage of total intra-state male migrants.
Y = Female migrants in the stream as a percentage of total intra-state female migrants.

	Male	Female
% of total intra-state migrants	24.89% (47.04)	75.11% (141.96)

Figures in brackets show absolute number of migrants in millions.

14. Which of the four migration streams mentioned alone has the highest gender ratio? Gender ratio of a stream is defined as the ratio of the number of male migrants to the number of female migrants in that stream.
(A) R → U   (B) R → R
(C) U → R   (D) U → U

15. Male migrants from urban to urban form what percentage of the female migrants from rural to urban?
(A) 37.8%   (B) 42.6%
(C) 48.7%   (D) 53.7%

16. What is the percentage of male migrants from urban to rural out of the total migrant population?
(A) 1.9%   (B) 2.1%
(C) 2.3%   (D) 2.5%

17. Total migrants from rural to rural areas form what percentage of total migrants in all the streams together?
(A) 55.62%   (B) 54.89%
(C) 69.97%   (D) 73.27%

Directions for questions 18 to 21: Answer these questions on the basis of the information given below.

Six friends, who are from six different cities, were asked about the cities to which each of them and their friends belong. Their replies were as follows.

	Bangalore	Chennai	Delhi	Hyderabad	Kolkata	Mumbai
Aman	Emma	Biswa	Dev	Aman	Charan	Fazal
Biswa	Aman	Fazal	Biswa	Emma	Charan	Dev
Charan	Emma	Fazal	Dev	Biswa	Aman	Charan
Dev	Charan	Biswa	Fazal	Dev	Aman	Emma
Emma	Emma	Biswa	Dev	Charan	Aman	Fazal
Fazal	Biswa	Dev	Fazal	Charan	Emma	Aman

It is known that no two persons gave an equal number of true replies, and that they all belong to a city from among, Bangalore, Chennai, Delhi, Hyderabd, Kolkata and Mumbai and no two persons belong to the same city.

18. Which of the following persons gave the highest number of true replies?
(A) Emma   (B) Biswa
(C) Charan   (D) Dev

19. The person who belong to Hyderabad is
(A) Aman   (B) Biswa
(C) Charan   (D) Dev

20. How many persons gave more true replies than Biswa?
(A) 1   (B) 2   (C) 3   (D) 5

21. How many persons gave his/her city name correctly?
(A) 0   (B) 1   (C) 2   (D) 3

Directions for questions 22 to 25: Answer these questions on the basis of the information given below.

A group of four experts, namely Anand, Babu, Charan and David were asked to rate three features—expressions, dialogue delivery and body language-of two artists, such as A_1 and A_2.

Table 8.3 gives the minimum, average and maximum rating given by the four experts on a scale of (0 to 10) where 0, 1, are integers.

	Expressions	Dialogue delivery	Body language
A_1	(5, 7.75, 10)	(6, 7.25, 8)	(6, 7.5, 9)
A_2	(5, 6.75, 8)	(2, 4, 8)	(4, 5.5, 7)

Table 8.4 gives the minimum and maximum rating across the three features for each expert artist combination.

	A_1	A_2
Anand	(5, 9)	(7, 8)
Babu	(6, 8)	(3, 6)
Charan	(6, 10)	(2, 7)
David	(8, 9)	(3, 8)

Table 8.5 given the average rating by experts features separately with average being compared across artists.

Expert	Expressions	Dialogue delivery	Body Language
Anand	6	7.5	8
Babu	6	5.5	6
Charan	8.5	4	6
David	8.5	5.5	6

22. The rating given by Babu for 'Expressions' for A_1 is
(A) 5 (B) 6
(C) 7 (D) 8

23. The rating given by Charan for 'Body language' for A_2 is
(A) 4 (B) 5
(C) 6 (D) 7

24. The rating given by Charan for 'Expressions' for A_2 is
(A) 7 (B) 6
(C) 8 (D) 9

25. The rating given by Anand for 'Dialogue delivery' for A_2 is
(A) 5 (B) 6
(C) 7 (D) 8

ANSWER KEYS

Exercise-1

1. 3:5	10. (B)	19. (B)	28. (D)	37. (A)	46. (C)
2. 20	11. (B)	20. (A)	29. (C)	38. (B)	47. (B)
3. 141	12. (D)	21. (B)	30. (B)	39. (C)	48. (A)
4. 410	13. (C)	22. (C)	31. (D)	40. (C)	49. (D)
5. 9	14. (B)	23. (C)	32. (A)	41. (A)	50. (D)
6. (D)	15. (B)	24. (D)	33. (C)	42. (A)	
7. (B)	16. (D)	25. (B)	34. (B)	43. (D)	
8. (A)	17. (D)	26. (D)	35. (D)	44. (C)	
9. (B)	18. (D)	27. (D)	36. (B)	45. (A)	

Exercise-2

1. (C)	10. 8	19. (B)	28. (D)	37. (C)	46. (B)
2. (B)	11. 94	20. (D)	29. (C)	38. (C)	47. (B)
3. (C)	12. 36	21. (B)	30. (C)	39. 3	48. (C)
4. (C)	13. (B)	22. (B)	31. (C)	40. 6	49. (D)
5. 77	14. (A)	23. (C)	32. (D)	41. 1998–99	50. (B)
6. 77	15. (C)	24. (C)	33. (C)	42. (D)	
7. 0	16. (C)	25. (C)	34. (B)	43. (D)	
8. 26	17. (C)	26. (C)	35. (B)	44. (B)	
9. 0	18. (C)	27. (C)	36. (A)	45. (B)	

Exercise-3

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

SOLUTIONS

EXERcISE-I

1. The ratio of the number of villages that have a population in the range of 3001 – 5000, to the total number of villages having a population in the range of 6001 to 10,000 = 15:25 = 3:5.

2. The percentage of villages having a population in the range of 1000 – 3000 = 10 + 8 = 18%.
The percentage of villages having a population in the range of 3001 – 5000 = 15%.

The required percentage increase $= \dfrac{3}{15} \times 100 = 20\%$.

3. The percentage of villages having a population in the range of 5001 – 6000 = 20%
The percentage of villages having a population in the range of (6001 – 20,000) = 25 + 22 = 47%.
Given that 20% = 60

$\backslash$ 47% $= \dfrac{47}{20} \times 60 = 141$

4. The percentage of villages having a population of at least 3000 = 15 + 20 + 25 + 22 = 82%.
The number of villages having a population of at least

3000 $= \dfrac{82}{100} \times 500 = 410$

5. Since the number of villages in group-B has to be the minimum, the population of each village has to be the greatest.
$\backslash$ Each village should have a population of 5000 people.

The number of villages $= \dfrac{45000}{5000} = 9$

6. The number of students playing at least one game = 341.
$\backslash$ The number of students playing none of the games = 159
The number of students playing exactly one game
= 27 + 23 + 31 + 18 = 99
$\backslash$The number of students playing at most one game = 159 + 99 = 258

7. The number of students who play either cricket or basketball but not football = 27 + 18 + 19 + 8 + 16 + 31 = 119.

8. Students playing at least three games = Students playing exactly three + Students playing exactly four.
= 8 + 13 + 36 + 31 + 37 = 125

9. The number of students playing at most one game = 258.
The number of students playing at least two games
= 500 – 258 = 242.
Difference = 16

10. The number of students who do not play Cricket, Football or Hockey is 31 + 159 = 190

11. We must find the ratio of luxury cars to Fiat cars.
Luxury Fiat cars from the 1st table is 30%.
From the second table, it is 20% of total Fiat cars.
Now,
30% of Luxury = 20% of Fiat

$$\dfrac{\text{Luxury}}{\text{Fiat}} = \dfrac{20\%}{30\%} = \dfrac{2}{3}$$

Similarly,
Small : Maruti = 45 : 20 = 9 : 4
Small : Hyundai = 24 : 16 = 3 : 2
Small : Ford = 45 : 30 = 3 : 2
Small : Fiat = 24 : 24 = 1 : 1
Small : Toyota = 18 : 10 = 9 : 5
Now,
Maruti : Hyundai : Ford : Fiat : Toyota = 4 : 6 : 6 : 9 : 5
Similarly,
Small : Maruti = 9 : 4
Economy : Maruti = 3 : 4
Mid Size : Maruti = 2 : 1
Comfort : Maruti = 25 : 25 = 1 : 1
Luxury : Maruti = 3 : 2
Now,
Small : Economy : Mid size : Comfort : Luxury
9 : 3 : 8 : 4 : 6

12. The number of Luxury Fords = 150
$\backslash$Total number of Ford cars = 1500
So also, the total number of Luxury cars = 1500
The number of Hyundai cars sold = 1500
(as Hyundai : Ford = 1 : 1)
The number of Economy cars sold = 750
(as Economy : Luxury = 1 : 2)
Of them, Economy Hyundai (90) are already counted.
$\backslash$Hyundai or Economy cars = (1500 + 660 = 2160)

13. Toyota as a percentage of total

$$= \dfrac{5}{4 + 6 + 6 + 9 + 5} = \dfrac{5}{30} = 16.67\%$$

Percentage difference between small and midsize cars among Toyota cars sold = 2%
$\backslash$2% of 16.67% of total = 10
0.33% of total = 10
$\backslash$Total = 3000

14. Number of students who scored 50 or more marks in Social = 131.
Number of students who scored 60 and above in Social = 104.

Those who scored 50 or more but less than 60 in Social = 131 − 104 = 27.

15. Total number of students = 160
Those who scored 50 and above = 117
Those who scored less than 50 = 160 − 117 = 43

16. Number of students who scored 50 or more but less than 70.
In Maths = 127 − 83 = 44
In Marathi = 139 − 91 = 48
In Social = 131 − 103 = 28
In Statistics = 149 − 108 = 41
In English = 117 − 93 = 24
The number of students is the highest for Marathi.

17. A student who scored more than 60 marks in Maths might not have not scored more than 60 marks in Marathi. Hence, we cannot determine the number of students who scored more than 60 marks in all the given subjects.

18. Total number of students = 160
Those who scored 60 or more in Marathi = 113
Those who scored less than 60 = 160 − 113 = 47

Solutions for questions 19 to 22: It is said that the company made a profit in each of the given years. That is in each year, Sales > Expenses. Let the value of the sales in the given years be $100x$, $130x$, $160x$, $140x$, $200x$ and $230x$, respectively and the values of expenses be $100y$, $120y$, $160y$, $210y$, $90y$ and $230y$, respectively. Since sales is greater than expenses in each year, $140x > 210y$ or $x > 1.5y$.

The minimum values of sales and the value of expenses and the minimum value of profit in terms of y are as follows.

Year	Sales	Expenses	Profit
2010	$150y$	$100y$	$50y$
2011	$195y$	$120y$	$75y$
2012	$240y$	$160y$	$80y$
2013	$210y$	$210y$	$0y$
2014	$300y$	$190y$	$110y$
2015	$345y$	$230y$	$115y$

19. In the years 2011, 2012 and 2015, the sales, expenses and profits of the company increased or decreased in unison.

20. At least in the years, 2011, 2012, 2014 and 2015, the profits of ABC Corporation increased when compared to the previous year.

21. If profitability in the year 2012 was 50%, $160x = 320y$ or $x = 2y$.
In 2014, Sales = $200 × 2y = 400y$
Expenses = $190y$
∴ Profitability = $\dfrac{210}{400} × 100 = 52.5\%$

22. Even for the minimum possible value, i.e., when $x = 1.5y$, we can see that the profit is the highest in the year 2015. For any higher value of sales also the profit is going to be the highest in 2015.

23. The number of Tamil movies which collected ` 40 crore or more but less than `80 crore= 131 − 93 = 38.

24. As we do not know the number of movies which collected less than ` 20 crore, we cannot find the answer.

25. The number of movies which collected `60 crore or more but less than `100 crore in the different language are as follows.
Hindi = 107–63 = 44
Tamil = 119 − 71 = 48
Telugu = 111 − 83 = 28
Kannada = 129 − 88 = 41
English = 97 − 73 = 24
The highest is for Tamil.

26. From the previous question, the value is
44 + 48 + 28 + 41 + 24 = 185.

27. For maximum collection, we have to assume that the lowest 25 (170 − 145) movies collected only slightly less than ` 20 crore and movie in each range collected the maximum possible revenues in that range.
The maximum collection = 25 × 19.99 + 22 × 39.99 + 16 × 59.99 + 19 × 79.99 + 25 × 99.99 + 63 × 140
M 25 × 20 + 22 × 40 + 16 × 60 + 19 × 80 + 25 × 100 + 63 × 140
= 500 + 880 + 960 + 1520 + 2500 + 8820
= `15180 crore

Solutions for questions 28 to 31: As it is mentioned that 35 students passed out of Class IV at the end of year I, three students who were in Class IV in year I failed in the class and as the number of students in Class IV in year II was 32, it means that 29 students got promoted from Class III at the end of year I.
\ 2 students failed in Class III in year I, as there were 39 students in Class III in year II, 37 students were promoted from Class II.
\ 5 students failed in Class II in year 1 and as there were 38 students in Class II in year II, 33 students were promoted from Class I. Therefore, 3 students failed in Class I in year I and 31 students newly joined in year II. The following can be represented in a table as follows.

Class	Students in Year I	Promoted	Failed	Students in Year II
I	36	33	3	34
II	42	37	5	38
III	31	29	2	39
IV	38	35	3	32

28. 31 students joined the school in year II.

29. 3 students failed in class I in year I.

30. 29 students were promoted from class III at the end of year I.

31. 13 students in the school failed in the annual exams in year I.

32. The maximum number of emails (in billion) expected to be sent from Hotmail to Hotmail account.
= (2074) − (300 + 317 + 3) = 2074 − 620 = 1454

33. The required number = (317 + 198 + 1 + 1) = 517.

34. The maximum number of emails expected (from yahoo to Hotmail)
= Min [(2074) − (300 + 317 + 3), (2183) − (180 + 100 + 85 + 2)]
= Min [(2074 − 620), (2183 − 367)]
= Min [1454, 1816] = 1454.
Choice (B)

35. Maximum number of emails can be sent from Msn or Eudora.
The maximum number of emails that could be sent from Msn = 10,000 − (1182 + 1784 + 2074 + 85 + 372 + 4 + 1818)
= 10,000 − (7319) = 2681
The maximum number of emails that could be sent from Eudora = 10,000 (1182 + 1784 + 2074 + 386 + 198 + 4 + 1818) = 10,000 − (7446) = 2554
The maximum number of emails sent from Msn to Mail-city = 2681 − (386 + 198 + 3) = 2094
The maximum number of emails sent from Eudora to Hotmail or Msn = 2554 − (372 + 85 + 3) = 2094
\The maximum number of emails sent from one email account to another = 2094

Solutions for questions 36 to 40: If we convert the distribution of income from degrees to percentages, we get the incomes of Varun, Tarun, Arun, Karan and Charan as a percentage of total income of the family as 45%, 30%, 10%, 9% and 6%, respectively.

36 If Varun did not pay for 'Others', he can fully pay for fuel (8%), phone and electricity bill (10%) and rent (20%) or clothing (25%).

37. To get the least number of heads of expenses paid by more than one person, Varun (45%) must pay for clothing (25%) and rent (20%), Tarun (30%) must pay for food (30%), Arun (10%) must pay for the phone and electricity bill (10%) and Karan (9%) must pay for fuel. Only 'Others' (7%) is paid by Charan (6%) and Karan (1%).

38. If Varun does not spend any amount on food, his expenditure will be only on the remaining items. As remaining items constitute 70%, out of which 30 percentage points

are contributed by Varun. If Varun fully contributes to fuel, phone and electricity bill and others, then his contribution on rent and clothing will become the least.
\ The required percentage

$$= \frac{45 - (10 + 8 + 7)}{45} \times 100 = 44.44\%$$

39. The bill for food is 30%, and at most 40% of each person's income can be paid for food. If we use 40% of each person's income, we get 40% of the total. As we need only 30%, i.e., 75% of 40%, 25% of the total income need not be used.
As the sum of the incomes of Arun, Karan and Charan is 25%, if we use 40% of incomes of only Varun and Tarun, then all expenses of food can be accounted for.

40. As 5% of each of the expenses is contributed by Karan, his contribution will become maximum for that item which has the least value and, in this case, it is 'Others'.

Required percentage = $5\% + \frac{4}{7} \times 100 = 62.14\%$

41. Let us fix the countries and the universities based on the information from the 3rd day to the 1st day.
On day 3, as there are 3 logins from different countries and from different universities, University D should be in Germany and University G should be in UK.
In the same way, based on the 2nd day's information, University E should be in USA and University A should be in Philippines.
In the same way, from the 1st day's information University B or F or C should be in China. University B or C or F should be in any other country other than Philippines or Germany.
\ University E should be in USA.

42. University G is in UK.

43. Among the given countries, no country can host three universities.

44. As University A is in Philippines, it is not located in China.

45. University A is in Philippines.

46. As all passengers in the bus got down at city B, the required number is
(14 + 12 + 7 + 10 + 8) − (5 + 10 + 12 + 11) = 13

47. All the passengers who got in at stop 1 would have boarded the bus at city A.
\ At most 14 − 5 = 9 passengers who got in at city A got down at Stop 2.

48. All the 10 people who got in at Stop 3 could have got down at the next stop and so none of them might have got down at the last stop.

49. Of the 12 passengers who got in at Stop 1, at least one got down at Stop 2 and at least 5 got down at Stop 3.
∴ At most 12 – (1 + 5) = 6

50. Of the 14 passengers who got in at city A, at most nine of them could have got down at Stop 3. Only two of the people who got in at Stop 1 could have got down at Stop 4 (as

10 of them would have got down at Stop 2). Among the seven people who got in at Stop 2, three of them would have got down at Stop 3 and four of them could have got down at city B, the third stop from where they got in
∴ At most 9 + 2 + 4 = 15 passengers could have got down at the third stop from where they got in.

Exercise-2

1. If the sales in the year 2003 were `120 crore, then its value in the year 2006 was
120 × 1.21 × 1.18 × 1.14 = 120 × 1.65 = 198 crore.

2. Let the value of sales in 2003 be 100.
The approximate values in the other years would be 2004–121, 2005–143, 2006–163, 2007–174.
The highest increase is in 2005.

3. As, till the year 2006 the growth in profit in each year is less than that of sales and the growth of profit in 2007 is more than that of sales, the profitability would be the least in 2006.

4. As the number of students is 260 and the total number of instances is 414, the minimum and maximum values of students taking only one hobby is 106 and 183.
∴ Only 120 is possible.

5. The minimum number of students who opted for at least two hobbies would be when all the students opted for exactly one or three hobbies and is obtained as follows.
$$x + y = 260$$
$$x + 3y = 414$$
$$y = 77$$

6. As in the previous question, the maximum number of students who opted for three hobbies would be 77.

7. All the students could have opted for one or two hobbies and so the minimum number of students who opted for exactly three hobbies is 0.

8. The maximum number of students in section A who passed in all the four subjects is 26.

9. In section C, 14 students have failed in Maths, 6 students in Physics, 9 students in Chemistry and 11 students in Biology. If all these students are distinct, 14 + 6 + 9 + 11 = 40 students would have failed in one subject each and so no student passed in all the four subjects.

10. For having the maximum number of students passing in exactly one subject, you should have the maximum number of students passing in all the four.

If x is the number of students in section B who passed in exactly one subject and y is the number of students who passed in exactly four subjects, then
$$x + y = 40 \text{ and } x + 3y = 136$$
$$x = 8 \text{ and } y = 32$$

11. The maximum number of students who passed in both Physics and Chemistry in the different sections are as follows.

A-31, B-32 and C-31, i.e., 31 + 32 + 31 = 94

12. We need to find the maximum number of students who passed in all the four subjects in each of the three sections, the values are as follows.
Section A – 26
Section B – 32
Section C – 26

Total   84.
∴ At least 120 – 84 = 36 students in the school failed to clear the Class X exam.

Solutions for questions 13 to 17: Sachin scored 18.18% of his runs in sixers (6s)

If we assume he scored the minimum number of 6s, i.e., one six, he would have scored six runs in sixers. As the percentage of runs scored in sixers is 18.18, his total score would be $\dfrac{6}{18.18} \times 100 = 33$

∴ Sachin has scored at least 33 runs.
But if he had scored only 33 runs, the total score would be 125 and since Kaif scored 10% of the total, the total score cannot be 125. So, we have to consider the next possibility, i.e., 250. When the total is 250, all the conditions are satisfied.

13. Dravid scored 20 runs of which 8 are in boundaries. Of the remaining 12, he scored an equal number of 1s and 2s or he scored 4 runs in singles.

14. Of all the players, the one with the highest number of boundaries was Sachin.

16.

	4s	6s
Sachin	6	2
Sehwag	2	2
Dravid	2	0
Kaif	4	0
Dhoni	5	5
Total	19	9

Total runs scored = 19 × 4 + 9 × 6 = 76 + 54 = 130

17. Dhoni scored five sixers (6s).

18. The medical expenses increased from 6% of total expenses to 10% of the total which is the highest increase along with expenses on clothing. But as the increase of medical expenses is on a lower base, the expenses under that head would have the highest percentage increase.

19. The percentage share of entertainment expenses has fallen the most from 2005 to 2007. As it is given that the expenses under each head in 2007 was more than the corresponding value in 2005, assuming that the total expenses in 2005 and 2007 to be x and y, respectively.

$0.15\,y > 0.17\,x$

$\therefore 15\,y > 17x$

$\dfrac{y}{x} > \dfrac{17}{15}$

$\therefore$ Total expenses in 2007 was at least 13.33% more than the corresponding value in 2005.

20. If the total expenses in 2006 and 2008 are x and y, respectively,

$$\frac{5}{4} \times 0.05x = .10y$$

$$\frac{0.25}{4}x = .10y$$

$$\frac{x}{y} = \frac{40}{25} = \frac{8}{5}$$

$\therefore$ Expenses on clothing in 2008 = 14 × 5 = 70
Expenses on entertainment in 2006 = 15 × 8 = 120

$\therefore$ The required percentage $= \dfrac{70}{120} \times 100 = 58.33\%$

21. Let expenses on rent in 2005 be `14.
$\therefore$ Total expenses in 2005 = `100
Expenses on rent in 2008
= 14 × 1.1 × 1.1 × 1.1 = 14 × 1.331 = 18.65
Expenses on food in 2005 = `15
Expenses on food in 2008 = `18.65

$\therefore$ The percentage increase $= \dfrac{18.65 - 15}{15} \times 100 = 24.3\%$

Solutions for questions 22 to 25: As it is said that in reasoning none of the other three persons scored more than Chetan, Chetan is either A or C. From the second condition we can conclude that Balu and Anand is one among A or D in any order or one among B or C in any order.

22. If Deepak scored the lowest marks in the reasoning section, Deepak is student B which means Balu and Anand are one of A and D in any order and so Statement II would be false.

23. If Balu's lowest score is in the reasoning section, Balu is student B and Anand is student C and the statement that Anand's lowest score is in the quantitative section is true.

24. If Anand gets the highest score in the verbal section, he is student B and Balu is student C.
\ Both statements cannot be simultaneously true. Anand and Balu can also be A or D in any order in which case both statements would be false.
\ At most one of the statements is true.

25. If Deepak gets his lowest score in the verbal section, he is student D in which case Chetan is student A.

26. If Mercedes Ltd. had its lowest sales in Japan, Mercedes Ltd. is Company B and Toyo Ltd. is Company C while BWM Ltd. is Company A.
\ If Statement 1 is true, then Statement 2 is necessarily true.

27. If Form Ltd. had its lowest sales in USA, then it is either Company A or Company D.
Case 1: Form Ltd. is Company A, then BWM Ltd. is Company C and the second condition cannot be satisfied.

Case 2: Form Ltd. is Company D. Then BWM Ltd. is Company A, and Mercedes Ltd. and Toyo Ltd. are companies B and C in any order.
\ BWM Ltd. has its lowest sales in USA.

28. Using either statement
(B) or statement (D) we can uniquely determine each of the four companies.

29. If Toyo Ltd. had the highest sales in USA, then it is Company B and Mercedes Ltd. is Company C and BWM Ltd. is Company A.
If Mercedes Ltd. had the highest sales in UK, then it is Company B and Toyo Ltd. is Company C in which case BWM Ltd. is Company A.
\ If one of the statement is true, then the other must be false.
If Company B is Form Ltd., then Company C is BWM Ltd. and Toyo Ltd. and Mercedes Ltd. are one of companies A and D in any order.
\ At most one of the two statements is true.

30. In 2015, the difference between the number of boys and the number of girls in LSP, Jaipur is 120.

\ Number of students in the school is 280.

The difference between the number of boys and girls in LSP, Pune is 90.

The total number of students in LSP, Pune is 270.

The number of students in LSP, Mumbai must be between 270 and 280 and must be a multiple of 9.

It must be 279.

The difference between the number of boys and the number of girls is 31.

31. The value of *boyage* increased for DPS – Hyderabad, FPS – Hyderabad, LSP – Pune, LSP – Hyderabad, LPS – Pune, LPS – Hyderabad, LFS – Jaipur and LFS – Pune, i.e., a total of 8 schools.

32. As the number of girls (i.e., 2/3) in LSP, Pune in 2015 is same as that of boys in DPS, Mumbai in 2016, i.e.,

$\dfrac{2}{5}$ (the number of students in DPS, in Mumbai, in 2016).

⇒ Number of students in LSP, Pune in 2015 < Number of students in DPS, Mumbai in 2016.

Number of students in DPS, Mumbai in 2016 will be definitely more than LPS, Pune in 2015.

33. The number of students in Hyderabad in DPS = 540

Maximum possible number of students in FPS is as follows:

In Hyderabad = 533 (multiple of 7 + 6 = 13)

In LSP, in Hyderabad = 528 (multiple of 6 + 5 = 11)

In LPS, in Hyderabad = 517 (multiple of 8 + 3 = 11)

In PDS, in Hyderabad = 512 (multiple of 9 + 7 = 16)

In LFS, in Hyderabad = 510 (multiple of 3 + 2 = 5)

\ Number of girls = 204.

Solutions for questions 34 to 37:
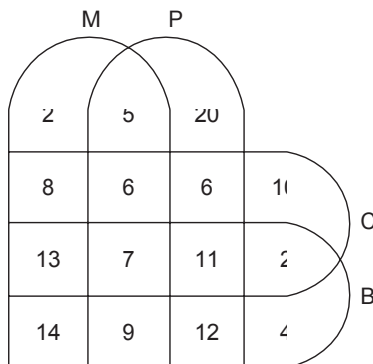
34. 76 − (5 + 6 + 6 + 7 + 11 + 9 + 12) = 20.

35. 64 − (5 + 8 + 6 + 13 + 7 + 14 + 9) = 2.

36. By observation, only seven students study all the four subjects.

37. Physics and Mathematics = 5 + 6 + 7 + 9 = 27
Biology and Chemistry = 13 + 7 + 11 + 2 = 33
Maths, Physics, Chemistry and Biology = 7
\ 27 + 33 − 7 = 27 + 33 − 7 = 53.

38. The least growth from 1990–91 to 1998–99 is in the price of Euro, i.e., 8% and the highest is for Pound Sterling, i.e.,16%. The value must be greater than 8% and less than 16%.

39. Since the total currency holdings in 1995–96 were more than that of 1990–91, it can be concluded from the data that it can be possible only when the percentage share (by volume) of Euro in currency holding is more than that of US Dollar. Comparing the values of currency holding for different currencies in different years, we get only three possible years (1994–95, 1997–98 and 1999–2000).

40. Comparing the currency reserves with the currency reserves in 1992–93, we can observe that the total currency holdings were less than those in the year 1992–93 in the years (90–91, 93–94, 94–95, 95–96, 97–98, 99–00). Therefore, there are 6 such years.

41. By observation it can be seen that in the year 1998–99, the value of each of the currency and the price gold was the highest, therefore, irrespective of shares of individual currencies in total reserves, the year 1998–99 had the highest reserves.

42. If Anuj scores 50, 42, 41, and 50 marks in Sections I, II, III and IV, respectively, then he would miss the cut off of colleges D and F due to Section II and would miss the cut off of colleges A, B, C and E due to Section III score. So, he would not get a single call even with a score of 50 + 42 + 41 + 50 = 183 marks.

43. If Ram scores 50, 44, 41 and 50 in Section I, II, III and IV, respectively, then he would get a call from only college F with a score of 185 marks.

44. To get calls from all colleges, she needs to score at least 43 in Section I, 45 in Section II, 45 in Section III and 45 in Section IV. The total (43 + 45 + 45 + 45 = 178) is also more than the overall cut off of all the colleges.

45. If Ravi scores 50 marks each in Sections I, II and IV and scores only 40 marks in Section III, he would only get calls from colleges D and F.

46. With a minimum of 174 marks (41 in Section I, 45 in Section II, 43 in Section III and 45 in Section IV) one can get calls from all colleges other than E. As seen from the first question, one can score 175 marks and still not get a call from any college. Therefore, the maximum difference is 5.

47. Here, it is given that for any City X, the number of cities with a population less than it was exactly one less than its rank, i.e., the city with the lowest population is ranked as 1. So, the city with the highest population is ranked as 8, it means that its population is greater than all the other 7 cities.

From the given table, we can say that all cities except Agra have more population than at least one other city.

\ Agra was ranked first.

48. Here, we can tabulate all the information as follows:

	Indore	Pune	Bhopal	Shillong	Agra	Cochin	Patna	Mysore
Indore	X	M	L	L	M	L	L	L
Pune		X	L	L	M	L	L	L
Bhopal			X	L	M	L	L	L
Shillong				X	M			M
Agra					X	L	L	L
Cochin						X	L	M
Patna							X	M
Mysore								X

We know that Agra has the lowest population. Accordingly, we can fill Agra's spaces.

After doing this we can see that except for Pune and Agra, all the cities have a population more than at least 2 cities. So, Pune was ranked second. Accordingly, we can fill the remaining.

It is given that Indore was ranked third.

\ Bhopal was ranked fourth and Mysore was ranked fifth, i.e., four cities have a lesser population than Mysore.

50. The city ranked fourth in terms of population, i.e., Mysore would have its rank according to population and the number of cities having a population less than it as equal.

Exercise–3

Solutions for questions 1 to 4: From the given data the following table can be constructed.

		Departure Day							
		Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Arrival Day	Sun	a	b	c	d	-	-	-	28
	Mon	e	f	g	h	i	-	-	47
	Tue	-	j	k	l	m	n	-	40
	Wed	-	-	o	p	q	r	s	45
	Thu	-	-	-	T	u	v	w	40
	Fri	-	-	-	-	x	y	z	35
	Sat	-	-	-	-	-	a'	b'	25
	Total	37	43	50	45	35	30	20	

1. Given that: $e = 22$

$\Rightarrow a$ is $(37 – 22) = 15$

\ $b + c + d$ is $(28 – 15) = 13$

The number of ships that arrived on Sunday and departed after the next Sunday is 13.

2. From the table,

$d + h + i + l + m + n = 0$

$\Rightarrow a + b + c + e + f + g + j + k = 28 + 47 + 40 = 115$

And also, $a + b + c + e + f + g + j + k + o$

$= 37 + 43 + 50 = 130$

$\Rightarrow o = 15$

\ o is 15.

3. From the table, $n + r + s + v + w + y + z + a' + b1$

$= 30 + 20 = 50$

$a' + b' = 25$

$n + r + s + v + w + y + z = 25$

As $r = 20$, the maximum value of $y + z = 5$

As $x + y + z = 35$, the least possible value of x is 30.

4. From the table, $a + b + e + f + j = 80$

$(a + b + e + f)$ is at the most 75.

\ j is at the least 5.

Solutions for questions 5 to 8: As D got 24 marks, the only possibility is

$3 \times 2 + 6 \times 3 (=24)$

$\Rightarrow$ 9 correct attempts.

Now as E got 39 marks, the only possibility is

$(7 + 6) \times 3 (= 39)$

⇒ 13 correct attempts.

But given that D and E got the same number of correct answers in Physics and Chemistry respectively (i.e., 6 correct answers)

⇒ D has 3 correct answers in Chemistry and E has 7 correct answers in Physics.

As F got 51 marks the only possibility is

$9 × 4 + 5 × 3 (= 51)$

⇒ F has 14 correct answers.

But given that B and C has the number of correct answers in Chemistry as the correct answers of F in different subjects.

⇒ B and C got 5 and 9 correct answers in Chemistry respectively.

(∴ Total correct answers of B is 7)

⇒ B and C got 7 − 5 = 2 and 13 − 9 = 4 correct answers in Physics.

As the total correct answers of B, C, D and E in Chemistry

= 5 + 9 + 3 + 6 = 23.

F can have at most 7 correct answers in Chemistry.

⇒ F has 5 correct answers in Chemistry and 9 in Physics.

⇒ A has 8 and 2 correct answers in Physics and Chemistry, respectively.

	Physics	Chemistry	Total	Marks
A	8	2	10	36
B	2	5	7	19
C	4	9	13	44
D	6	3	9	24
E	7	6	13	39
F	9	5	14	51
Total	36	30	66	213

5. A scored 36 marks.

6. D scored the second lowest total marks.

7. In Physics, only A and F scored more marks than E

8. A, D, E and F got more marks in Physics than in Chemistry.

9. Feroz wrote 16 mock CATs conducted by institute P. Hence, the person who wrote more than 30 − 16 = 14 mock CATs conducted by P would have written at least one Mock CAT in common with Feroz.

Similarly, the values for Q, R, S and T are 19, 17, 12 and 16, respectively.

Only Hrithik satisfies the required condition.

10. The value will be the least when maximum number of mock CATs are written by both or none.

Among the tests conducted by P, at least 20 − 12 = 8 tests are written by exactly one of Akshay and Hrithik.

Similarly, the values for Q, R, S and T are 1, 4, 7 and 3, respectively.

\ Required value = 8 + 1 + 4 + 7 + 3 = 23.

11. Among the 32 Mock CATs conducted by R, Bobby, Emran and Govinda wrote 16, 18 and 20, i.e., a total of 54 instances.

For the number of Mock CATs written by more than one of them to be minimum, maximum possible tests are to be written by one or three persons.

If each Mock CAT is assigned one person, 54 − 32 = 22 instances will be left.

Among these 22 instances, 2 instances per Mock CAT be assigned to 11 Mock CATs.

12. For the value to be maximum, each Mock CAT must be written by one or three persons.

Total instances = 16 + 15 + 12 = 43.

\ Required value = $\dfrac{43 - 24}{2}$ = 9.

13. A total of 40 Mock CATS were conducted by institute Q. Among these, Chahat and Govinda wrote at least 33 + 30 − 40 = 23 Mock CATs in common.

As no other person has written more than 23 Mock CATs in common with any person.

Hence, it is the highest for Chahat and Govinda.

14. By observation,

only R → U and U → U are the possible choices.

U → U = $\dfrac{15.38\text{(males)}}{7.04\text{(females)}} \cong 2.2$

R → U = $\dfrac{27.27\text{(males)}}{11.95\text{(females)}} \cong 2.3$

\ Maximum gender ratio is R → U.

15. The ratio of total number of female immigrants to male immigrants is

$\dfrac{75.11}{24.89} \cong 3$. It is slightly more than 3.

Now the required value is:

$\dfrac{15.38}{11.95 \times 3} \times 100 = \dfrac{11.38}{35.85} \times 100 \cong 43\%$

The value will be slightly less than 43%.

16. Total male migrants from urban to rural areas is

= 7.68% of total male migrants

$\cong 7.68\% \times \dfrac{1}{4}$ × total migrants

$\cong 1.9\%$ of total migrants.

17. The ratio of total male migrants and total female migrants is 1 : 3.

Now total migrants from rural to rural areas as a percentage of total migrants from all streams can be found out by using allegations method, i.e.,

$$= 76.71 - \frac{(76.71 - 49.67) \times 1}{(1 + 3)}$$

= 76.71 – 6.76 = 69.95%

As the actual ratio is a bit more than 1 : 3, the value will be slightly more than 69.95%.

Solutions for questions 18 to 21: As given that no two persons gave equal number of true replies, the number of true replies is 0, 1, 2, 3, 4 and 6 (as if five replies are correct the sixth reply also has to be correct).

If all the replies of Aman are correct, then Biswa and Dev will have equal number of correct replies, i.e., 1 each.

Similarly, if all the replies of Biswa are correct, then Aman and Charan will have 1 each as correct replies.

If all the replies of Charan are correct, then Biswa and Dev will have 1 each as correct replies.

Similarly, Dev and Fazal also cannot have all the replies correct.

\If all the replies of Emma are correct, then

Aman – 4
Biswa – 0
Charan – 3
Dev – 2
Emma – 6
Fazal – 1

\The persons and the city pairs are as follows:

Emma – Bangalore; Charan – Hyderabad, Biswa – Chennai; Aman – Kolkata, Dev – Delhi; Fazal – Mumbai

21. Only Emma gave her city name correctly.

Solutions for questions 22 to 25: Taking data from the three tables, we can arrive at the following expert, actor and feature combination.

	A₁			A₂		
	Expressions	**Dialogue delivery**	**Body language**	**Expressions**	**Dialogue delivery**	**Body language**
Anand	5	7	9	7	8	7
Babu	7	8	6	5	3	6
Charan	10	6	7	7	2	5
David	9	8	8	8	3	4

22. The rating given by Babu for 'Expressions' for A_1 is **7**.

23. The rating given by Charan for 'Body language' for A_2 is 5.

24. The rating given by Charan for 'Expressions' for A_2 is 7.

25. The rating given by Anand for 'Dialogue delivery' for A_2 is 8.

❑ Introduction

This chapter contains questions similar to the ones asked in other management entrance tests (OMET) like XAT, IIFT, SNAP, NMAT, etc. Exams like IIFT and NMAT are known to ask very calculation-intensive DI questions than the ones asked in CAT, also XAT is known to have asked unconventional and unorthodox sets which stand apart from the regular models asked in the CAT exam.

Solved Examples

These questions are based on the pie chart and the table given below.

The pie chart shows the breakup of the investment of a person in various schemes in 2000 and the table shows the investments in the same schemes in 2001.

LIC premium 15%
Post office deposits 10%
NSC 25%
PPF 20%
Mutual funds 30%

Total investment = `50,000
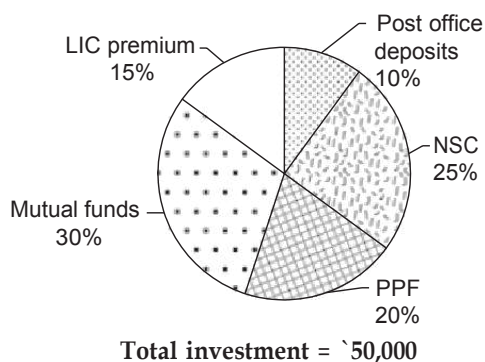
Scheme	Percentage of total investment that is invested in the scheme
Post office deposits	8%
NSC	30%
LIC Premium	15%
PPF	15%
Mutual funds	32%

Total investment = `60,000

9.01: In how many of the schemes is his investment in 2000 less than that in 2001?

(A) 1   (B) 2
(C) 3   (D) 4

Sol: The share of LIC premium in both years were the same. His total investment increased from 2000 to 2001.

∴ His LIC premium in 2000 < His LIC premium in 2001.

His investments in post office deposits, mutual funds, PPF and NSC in 2000 were

$\frac{10}{100}(50000), \frac{30}{100}(50000), \frac{20}{100}(50000)$ and

$\frac{25}{100}(50000)$, i.e., 5000, 15,000, 10000 and 12500, respectively.

His investments in these schemes in 2001 were

$\frac{8}{100}(60000), \frac{32}{100}(60000), \frac{15}{100}(60000)$ and

$\frac{30}{100}(60000)$, i.e., 4800, 19,200, 9000 and 18000.

∴ A total of three schemes satisfied the given conditions.

9.02: In which scheme was his total investment in both years together the maximum?

(A) Post Office deposits

(B) NSC

(C) LIC premium

(D) Mutual funds

Sol: From the previous solution, his total investment in both years in Post Office deposits, mutual funds, PPF and NSC (in `) were 9800, 34,200, 19000 and 30500. His total investment in LIC Premium in both yeas = $\frac{15}{100}$ (50000 + 60000) = `16,500.

∴ Maximum total investment was in mutual funds.

Alternately: Percentage of his investments was maximum in mutual funds in each year. Therefore, his total investment must be maximum in mutual funds.

9.03: In 2002, his total investment was `70,000. His investment breakup was the same as that in 2000. In how many schemes in 2002 was his investment more than `12,600?

(A) 0   (B) 1

(C) 2   (D) 3

Sol: 12600 = $\frac{12600}{70000}(100)$ = 18% of his total investment. His investment was more than 18% of his total investment in three schemes, i.e., PPF, NSC and mutual funds.

9.04: In how many schemes in 2001 was his investment more than his average investment in the schemes?

(A) 2   (B) 3

(C) 4   (D) 0

Sol: There were 5 schemes.

∴ Average investment would be $\frac{100}{5}$ = 20% of total investment. His investments in mutual funds and NSC exceeded this.

∴ Two schemes satisfied the given conditions.

9.05: If his combined investments in the various schemes in 2000 and 2001 were represented in a pie chart, for how many schemes would the angle be more than 90°?

(A) 0   (B) 1

(C) 4   (D) 2

Sol: 90° = $\frac{90°}{360°}(100)$ = 25%.

As his investments in LIC premium, PPF and Post Office deposits in both years formed less than 25% of his total investment, the angle for these schemes in the pie chart formed will be less than 90°.

∴ For the other two schemes the angle would be more than 90°.

Directions for questions 1 to 5: These questions are based on the table given below which shows the number of tons of fish caught through the traditional and modern methods across several years in Andhra Pradesh.

| | Fishing in inland waters in different types of water bodies | | | | | | Fishing in the seas | |
| | Artificial Tanks | | Lakes | | Rivers | | Seas | |
	Traditional	Modern	Traditional	Modern	Traditional	Modern	Traditional	Modern
1996	25	586	41	169	129	1348	569	5341
1997	47	631	72	201	181	1421	831	5583
1998	57	754	131	296	241	1639	947	6164
1999	61	836	129	354	297	1743	1152	6341
2000	63	929	129	421	324	1869	1181	6861
2001	60	1016	108	494	351	1931	1261	7146
2002	61	1089	121	528	407	2046	1734	7232
Total	374	5841	731	2463	1930	11997	7675	44668

1. During the year 1998, what is the total tonnage of fish caught in the inland waters?
(A) 10229   (B) 6164
(C) 4768   (D) 3118

2. Which of the following can be inferred from the given data for the period from 1999 to 2002?
I. The tonnage of fish caught in the inland waters by traditional methods is increasing every year over its value in the previous year.
II. The tonnage of fish caught by the traditional methods is continuously decreasing.
III. The tonnage of fish caught by the modern methods is continuously decreasing.
IV. There is a decrease in the quantity of fish caught by traditional methods in two successive years.
(A) I only   (B) II only
(C) II and III only   (D) I and IV only

3. During the given years, the quantity of fish caught by modern methods is approximately how many times that caught by traditional methods?
(A) 3   (B) 4
(C) 2   (D) 6

4. When compared to the previous year during which of the following years is the growth rate in quantity of fish caught, the least?
(A) 1998   (B) 1999
(C) 2000   (D) 2001

5. The average weight of the fish caught in the artificial tanks, lakes, rivers and the seas is in the ratio 2 : 3 : 4 : 5. The number of fish caught in which of the following water bodies is the least?
(A) Artificial tanks   (B) Lakes
(C) Rivers   (D) Seas

Directions for questions 6 to 10: These questions are based on the table and the bar graph given below.

Income plan of five persons for the year 2003–04

Rupees in Lakh

Name of the person	Sharma	Rao	Gupta	Solkar	Kuchroo
Profession	Doctor	Engineer	Business man	Doctor	Professor
Annual income	4.50	3.50	3.00	4.00	5.00
Annual expenditure	3.00	2.50	2.50	2.50	3.50
Annual savings	1.50	1.00	0.50	1.50	1.50

The annual savings are invested as shown below

Rupees in Thousand

Name of the person	Sharma	Rao	Gupta	Solkar	Kuchroo
PPF	50	50	25	50	80
Life insurance	20	8	7	20	15
Medical insurance	5	2	3	5	5
Pension plan	10	17	5	15	10
Debt funds	35	13	5	40	20
Monthly income plan (MIP)	30	10	5	20	20

The graph below shows various income slabs and the corresponding tax rates. For example, an annual income of `1.8 lakh falls in the range of `1.5 lakh – `2.0 lakh. Hence, the tax rate applicable is 10%. Similarly, for an income of `2 lakh, the tax rate is 15% as it falls in the slab of `2 lakh – `2.5 lakh.
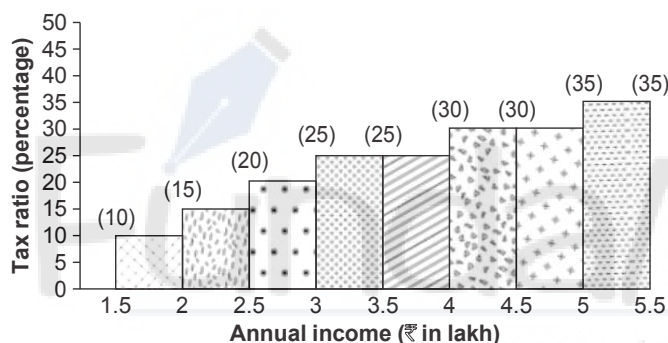
Note: Income tax is calculated on the annual income.

6. How many of the given five persons paid an income tax exceeding rupees one lakh for the year 2003–04?

7. For which of the given persons, the ratio of the annual savings to that of the annual expenditure is least?

8. How much more should Gupta save so that his savings is 35% of his income?

9. An interest of 8% per annum is payable on the investment in PPF for the given year. Considering all the five persons, what is the average amount of interest payable per person?

10. If there is an exemption of tax on PPF, what is the total tax payable by the two doctors on their total taxable income?

Directions for questions 11 to 14: These questions are based on the pie charts below.

The pie charts give the breakup of graduates and postgraduates among males and females and the breakup of males and females in percentage.
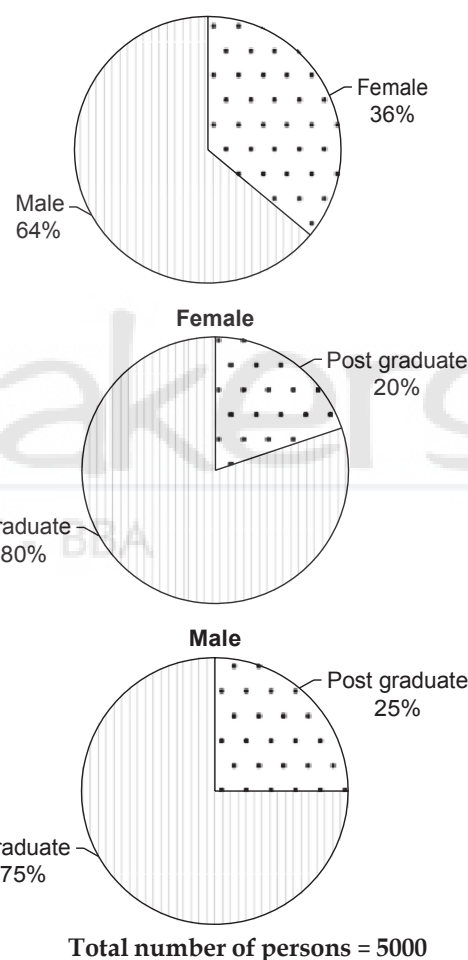
Total number of persons = 5000

11. If 10% of the female postgraduates are married, the number of unmarried female postgraduates is
(A) 36   (B) 54
(C) 324   (D) 224

12. What approximate percentage of the students of the college are graduates?
(A) 65%   (B) 75%
(C) 70%   (D) 77%

13. If 496 male postgraduates are at least 30 years old, the number of male postgraduates aged below 30 years is
(A) 292   (B) 284
(C) 304   (D) 316

14. The total number of postgraduates is approximately what percentage of the total number of graduates?
(A) 32.4%   (B) 28.6%
(C) 26.8%   (D) 30.2%

Directions for questions 15 to 18: Study the following tables carefully and answer these questions.

Number of candidates who qualified in a competitive examination from five cities over the years

	City				
Year	Chennai	Delhi	Hyderabad	Kolkata	Mumbai
2004	4224	8670	8100	15600	4200
2005	6720	10500	6240	16240	1700
2006	4626	13000	14490	13230	3750
2007	3150	12960	13490	18900	3080
2008	7280	13340	11200	15870	4680
2009	6900	9120	13440	11800	4060
2010	9280	9800	13440	11590	5120

Percentage of candidates not qualified in the competitive examination from the five cities

	City				
Year	Chennai	Delhi	Hyderabad	Kolkata	Mumbai
2004	89	83	82	76	88
2005	86	79	88	72	90
2006	90	75	77	79	85
2007	94	76	81	73	89
2008	87	77	84	77	87
2009	88	81	79	80	86
2010	90	80	76	81	84

15. The difference in the number of candidates who qualified from Mumbai in any of the given years and that in the previous year was the highest in
(A) 2007   (B) 2009
(C) 2010   (D) 2006

16. In which of the following years was the number of candidates who appeared from Chennai, the highest?
(A) 2010   (B) 2007
(C) 2008   (D) 2006

17. What is the number of candidates who did not qualify from Kolkata in 2009?
(A) 46,400   (B) 45,200
(C) 47,200   (D) 49,200

18. How many candidates appeared from Hyderabad in 2007?
(A) 73,000   (B) 76,000
(C) 71,000   (D) 77,000

Directions for questions 19 to 23: These questions are based on the following graph.

Six different companies A, B, C, D, E and F manufacture a similar product. The cost of raw materials, labour cost and overheads per unit are given below.
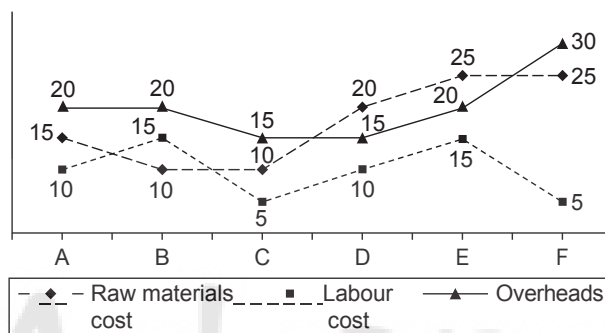
19. Which of the following products has the maximum cost per unit?
(A) A   (B) B
(C) D   (D) F

20. If company B produces 5000 units and sells them at `68, then the profit of the company is
(A) `1,65,000        (B) `1,40,000
(C) `1,15,000        (D) `1,55,000

21. Which of the following statements is true?
(A) The labour costs of E and F are same.
(B) The ratio of costs, overheads and labour is same for A, B and E.
(C) The ratio of total cost of A and D is same as the ratio of total cost of E and F.
(D) Both (A) and (B).

22. Company D can produce a maximum of 1000 units per day and company F can produce up to 800 units per day. If these companies sell their products at `60 and `80, respectively, then what percentage of D's profit is F's profit in the total maximum production of 10 days?
(A) 15 : 16   (B) 3 : 4
(C) 7 : 8   (D) 9 : 10

23. If the labour cost of B is the same as the labour cost of C, then what is the ratio of the total cost of the two companies?
(A) 1 : 1   (B) 1 : 2
(C) 1 : 3   (D) Cannot be determined

Directions for questions 24 to 28: These questions are based on the following table which represents the number of garments manufactured by four companies A, B, C and D for four segments of people, males (M), females (F), children (C) and sports persons (S) during quarters I, II, III and IV of the year 2003.

(in thousands)

	A				B				C				D				Total
	M	F	C	S	M	F	C	S	M	F	C	S	M	F	C	S	
I	33	60	72	20	18	25	36	12	26	35	41	21	41	71	88	30	629
II	44	76	80	25	23	31	43	15	40	59	71	28	55	78	98	35	801
III	45	75	85	30	30	34	48	18	52	68	81	26	60	80	95	41	868
IV	96	84	95	25	32	35	52	21	62	75	83	30	71	92	99	35	937
Total	168	295	332	100	103	125	179	66	180	237	276	105	227	321	380	141	3235

24. If the companies are arranged based on the number of garments manufactured by them in the year 2003, then which of the following is true?
(A) A > D > B > C
(B) D > B > C > A
(C) D > A > C > B
(D) A > D > C > B

25. For which of the following quarters is the percentage increase over the previous quarter in the number of garments manufactured by company C, for the female segment, the least?
(A) I
(B) II
(C) III
(D) IV

26. In the year 2003, the overall growth achieved by these companies in the number of garments manufactured is 25% more when compared to the number of garments manufactured in 2002. What was the total production of garments by these companies in the year 2002 in thousands?
(A) 2426
(B) 2588
(C) 2634
(D) 2432

27. For the year 2003, what is the ratio of the total number of garments manufactured for male segment to that of the female segment?
(A) 113 : 163
(B) 489 : 206
(C) 231 : 106
(D) 369 : 103

28. For how many companies is there a growth in the number of garments in every quarter and for every segment?
(A) 0
(B) 1
(C) 2
(D) 3

Directions for questions 29 to 32: These questions are based on the information given below.

The table represents the percentage of votes cast in an election in five small constituencies over four different election years and the bar graph shows the population (in thousands) of these five constituencies in the respective years.

Year	A	B	C	D	E
1990	45%	60%	75%	40%	55%
1994	50%	64%	80%	60%	70%
1998	65%	85%	60%	50%	80%
2002	70%	72%	65%	45%	60%
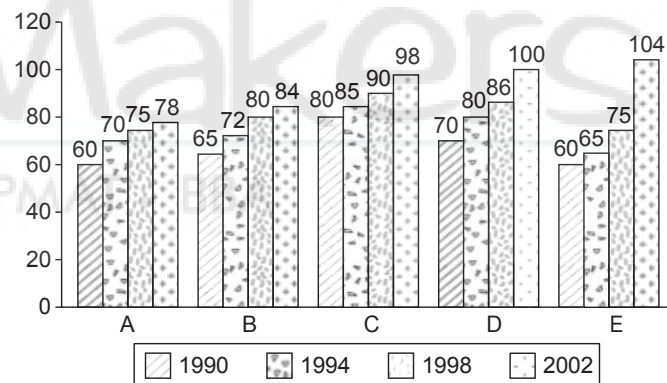
29. What is the total number of votes cast in the given five constituencies in the year 1998?
(A) 2,93,000
(B) 2,73,750
(C) 2,84,250
(D) 3,43,800

30. In the year 1994, what is the average number of votes cast in the given five constituencies?
(A) 48,516
(B) 44,295
(C) 42,248
(D) 48,446

31. In 2002, how many people in the five constituencies put together did not cast their vote?
(A) 1,67,246
(B) 1,77,820
(C) 1,79,840
(D) None of these

32. What is the ratio of the total number of votes cast in constituency D in the given four years to that in constituency E?

(A) 1231 : 2481   (B) 2481 : 1231
(C) 1640 : 2009   (D) 2009 : 1640

Directions for questions 33 to 36: Answer the following questions based on the table given below.

A, B, C and D are four different trains starting from the same station at different times with different average speeds and all are travelling on parallel tracks. Train A started at 05:00 hrs.

| Time	Distance from the starting point (in kilometers)			
	Train A	Train B	Train C	Train D
6:10	100	--	--	--
6:30	100	--	30	--
7:00	130	40	60	--
8:00	200	100	130	--
12:00	400	260	330	187.5
16:00	600	460	530	437.5
18:00	680	560	610	492.5
19:00	720	600	650	562.5
19:15	720	600	650	562.5
19:30	740	650	690	562.5
20:00	750	700	730	656.25
21:00	800	760	800	718.75
22:00	840	840	820	778.25
23:30	850	910	900	875
00:00	900	940	900	906.25
01:30	1000	1000	1000	1000

Note: Some of the trains had maintained uniform speed.

33. The average speed of which train was the least among the four trains between 16:00 hrs to 22:00 hrs?
(A) Train A   (B) Train B
(C) Train D   (D) Train C

34. At 16:00 hrs, which two trains are farthest from each other?
(A) Train A and Train C
(B) Train A and Train B
(C) Train A and Train D
(D) Train C and Train D

35. At how many instances, is there a possibility of one train crossing another train after 12 noon?
(A) 1 time
(B) 0 times
(C) 2 times
(D) More than two times

36. If the stoppages of train A are not considered, then the approximate average speed of train A from 05:00 hrs to 01:30 hrs will be (assume it has only two stops).
(A) 48.8 kmph   (B) 50.2 kmph
(C) 52 kmph   (D) 54 kmph

Directions for questions 37 to 40: These questions are based on the graph and the table given below.

As per the National Readership Survey (NRS), the details regarding the readership (in million) of four major newspapers in regions P, Q, R and S are as follows:
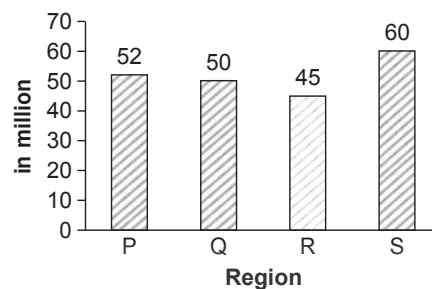
The following table gives the percentage of readers for the newspapers in the four regions.

Newspapers	Region			
	P	Q	R	S
A	30%	25%	20%	30%
B	40%	25%	30%	30%
C	10%	30%	40%	20%
D	20%	20%	10%	20%

37. How many readers (in million) read newspaper B in region P?
(A) 20.8   (B) 30
(C) 16.5   (D) 22.5

38. What is the ratio of the number of readers who read newspaper A in region Q to the number of readers of newspaper B in region S?
(A) 11 : 12   (B) 25 : 36
(C) 18 : 17   (D) None of these

39. What is the total number (in millions) of readers who read newspaper C in all the four regions?
(A) 26   (B) 52.5
(C) 48.5   (D) 50.2

40. What is the ratio of the total readers of newspaper B to that of newspaper C?
(A) 341 : 171   (B) 324 : 251
(C) 3 : 5   (D) None of these

Directions for questions 41 to 44: These questions are based on the table given below.

Table 9.1 Details of Indian immigrants (people of Indian origin) in different countries as on 1980

Country	Persons of Indian origin (PIOs)(in 000s)	PIOs as a % of host country's population	No. of PIOs (in 000s) having foreign citizenship	% of total PIOs
(1) AFRICA				
(a) Kenya	70	0.31	1	0.55
(b) Mauritius	701	70.10	700	5.52
(c) Mozambique	21	0.14	11	0.16
(d) South Africa	850	2.57	850	6.69
(e) Tanzania	40	0.17	33	0.32
(2) AMERICA				
(a) Canada	229	0.89	129	1.80
(b) Guyana	300	30.30	300	2.36
(c) Jamaica	39	1.62	38	0.30
(d) Suriname	140	35.90	140	1.10
(e) Trinidad and Tobago	430	35.25	430	3.39
(f) USA	500	0.21	287	3.94
(3) ASIA				
(a) Afghanistan	46	0.30	45	0.36
(b) Bhutan	70	4.93	–	0.55
(c) Burma	330	0.84	50	2.60
(d) Malaysia	1170	7.07	1029	9.21
(e) Nepal	3900	27.12	2388	30.64
(f) Singapore	100	3.83	74	0.79
(g) Sri Lanka	1023	6.28	457	8.05
(h) Thailand	65	0.12	55	0.51
(4) EUROPE				
(a) France	42	0.8.	38	0.33
(b) Germany	32	0.50	8	0.25
(c) Netherlands	103	0.70	100	0.81
(d) UK	789	1.39	395	6.21
(5) MIDDLE EAST				
(a) Bahrain	48	11.16	–	0.38
(b) Iraq	35	0.21	–	0.28
(c) Kuwait	110	5.88	1	0.87
(d) Libya	36	0.88	–	0.28

(*Continued*)

Country	Persons of Indian origin (PIOs)(in 000s)	PIOs as a % of host country's population	No. of PIOs (in 000s) having foreign citizenship	% of total PIOs
(e) Oman	190	14.29	–	1.50
(f) Qatar	52	15.76	–	0.41
(g) Saudi Arabia	250	1.80	–	1.97
(h) UAE	240	16.55	1	1.89
(I) Yemen	103	1.41	100	0.81
(6) OCEANIA INDONESIA				
(a) Australia	99	0.61	87	0.78
(b) Fiji	339	47.75	339	2.67
(c) Indonesia	30	0.02	15	0.24
Total	12522	0.25	8101	100.00

41. In how many countries is the number of PIOs having citizenship of the country as a percentage of total PIOs in the country more than 90%?
(A) 5   (B) 11   (C) 12   (D) 14

42. The names of how many of the given countries which has the number of PIOs more than one lakh but less than five lakh, ends with a consonant?
(A) 2   (B) 3   (C) 4   (D) 5

43. For how many of the given countries is the country's total population less than the total number of PIOs in all the countries together?
(A) 16   (B) 18   (C) 19   (D) 17

44. The number of persons of Indian origin in ASIA is more/ less than that in AMERICA by what percentage?
(A) 24.8   (B) 48   (C) 71.2   (D) 309.2%

Directions for questions 45 to 47: Answer the following questions based on the information given below.

The following table shows the growth in urban population since 1901 and the percentage of rural and urban population in the total population of India.

Year	Urban population (in million)	Percentage of total population Rural	Percentage of total population Urban
1901	25.8	89.0	11.0
1911	25.9	89.6	10.4
1921	28.0	88.7	11.3
1931	33.5	87.8	12.2
1941	44.1	85.9	14.1
1951	62.4	82.4	17.6
1961	78.9	81.7	18.3
1971	108.9	79.8	20.2
1981	162.2	76.3	23.7
1991	217.6	74.3	25.7

45. The approximate percentage increase in the rural population from 1901 to 1991 was approximately
(A) 130%   (B) 160%
(C) 210%   (D) 240%

46. For which of the following periods was the percentage increase in the total population, the highest?
(A) 1951–1961   (B) 1961–1971
(C) 1971–1981   (D) 1981–1991

47. In the time given, the only occasion when India's total population decreased was during
(A) 1901–1911   (B) 1911–1921
(C) 1921–1931   (D) 1931–1941

Directions for questions 48 to 50: The following graph shows the percentage of marks scored by Antony, Bill, Clinton, Danny, Ellen, Francis and Goutham in four subjects in their Class XII exam.
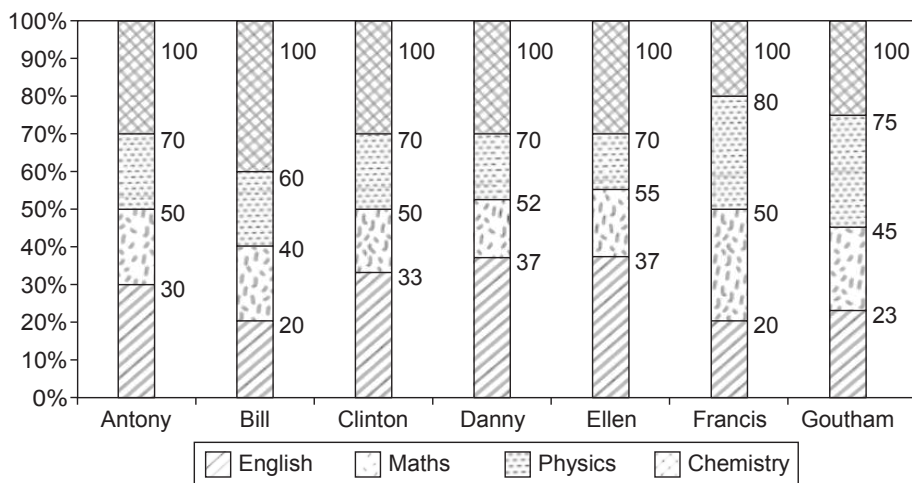
48. Who scored the highest marks in Maths?
(A) Goutham   (B) Francis
(C) Danny   (D) Anthony

49. In English, the marks scored by Ellen is approximately what percentage more than those by Goutham?
(A) 43%   (B) 55%
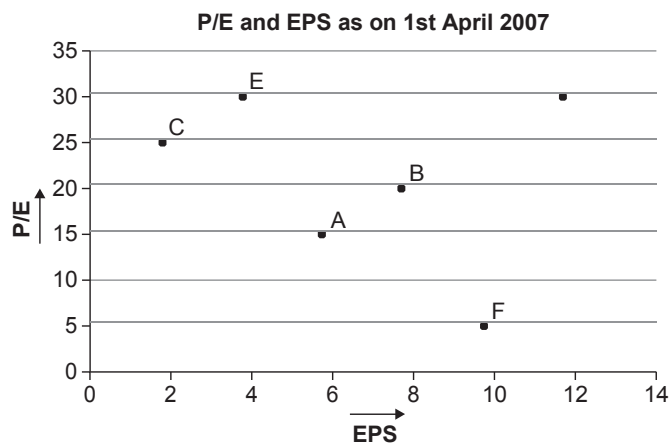(C) 65%   (D) 63%

50. The total marks scored by all the seven students in Physics is approximately
(A) 672   (B) 650
(C) 480   (D) 553

EXERCISE-2

Directions for questions 1 to 5: Answer the following questions based on the information given below.

The following data gives the P/E ratio and EPS of six companies for two consecutive years.

P/E and EPS as on 1st April 2007

Total number of shares on 1st April 2007

A	B	C	D	E	F
12.5	14.8	27.0	8.5	22	7.2

P/E and EPS as on 1st April 2008
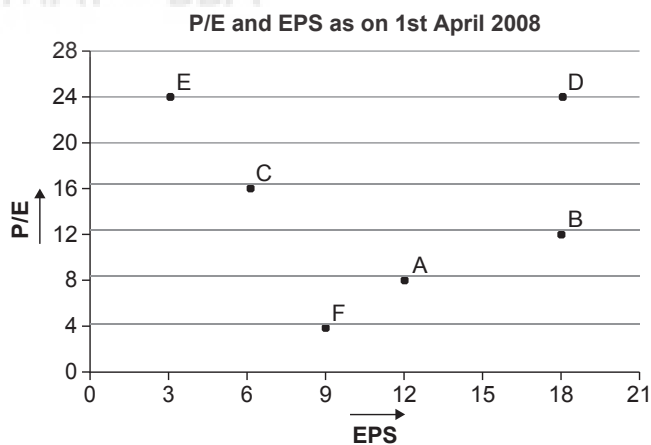
Total number of shares as on 1st April 2008 (in lakh)

A	B	C	D	E	F
17.5	14.8	40.5	8.5	22.0	7.2

$$\text{P/E ratio} = \frac{\text{Price of the share in rupees}}{\text{Earnings per share in rupees(EPS)}}$$

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$$EPS = \frac{\text{Total earnings of the company}}{\text{Total number of shares of the company}}$$

1. What is the percentage increase in total earnings of Company A from 1st April 2007 to 1st April 2008?

2. Which company had the highest increase in total earnings from 1st April 2007 to 1st April 2008?

3. What is the price of a share of Company B on 1st April 2008?

4. In percentage terms, the share price of which company appreciated the most from 1st April 2007 to 1st April 2008?

5. If the total earnings of Company E is same as that of Company D as on 1st April 2009, then what will be the EPS of Company E on 1st April 2009, given that the earnings of Company D decrease by 10% compared to that on 1st April 2008 and the number of shares of Company E as on 1st April 2009 is 27.0 lakh?

Directions for questions 6 to 10: Study the following table and answer the questions that follow. The table below compares five different countries on various aspects.

Country	Population (Lakh)	Literacy rate	Number of women per 1000 men	% of rural population
A	1321	70%	970	45%
B	2501	61%	951	62%
C	540	85%	1021	51%
D	91	90%	992	39%
E	832	80%	989	42%

6. Which country has the highest number of illiterate people?
   (A) A
   (B) B
   (C) C
   (D) D

7. The urban population of Country A exceeds the urban population of Country E by
   (A) 254.5 lakh
   (B) 377 lakh
   (C) 244 lakh
   D) 223 lakh

8. What is the approximate number of women in the country which has the second highest number of men?
   (A) 4140 lakh
   (B) 650 lakh
   (C) 670 lakh
   (D) Cannot be determined

9. Which country has the least number of literate women?
   (A) D
   (B) C
   (C) E
   (D) Cannot be determined

10. For which country is the number of men who are literate, as a percentage of the total number of men, the highest?

(A) E
(B) C
(C) D
(D) Cannot be determined

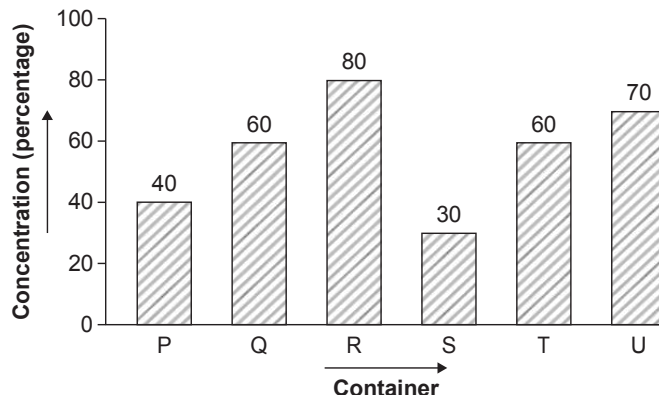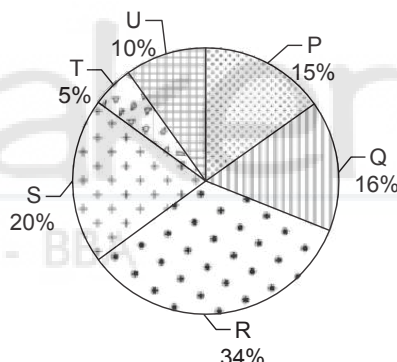*Directions for questions 11 to 15:* Answer the following questions based on the information given below.

Each of six different containers, labelled from P to U contains some solution of milk and water with the concentration of milk (in percentage) as specified as above.

Percentage distribution of the total volume of six solutions

Total volume of all six solutions together = 100 litres

11. Which two solutions when mixed will yield a solution with maximum concentration?
    (A) R and Q
    (B) Q and U
    (C) R and T
    (D) R and U

12. Solutions P, Q, R are mixed in equal proportions and the resultant solution is labelled as X, while solutions S, T and U are mixed in equal proportions to give a solution labelled as Y. Which of the following is definitely true?
    (A) The concentration of X is more than that of Y.
    (B) The concentration of X is less than that of Y.
    (C) The concentration of X is equal to that of Y.
    (D) None of the above

13. What is the approximate concentration of the solution formed by mixing the entire volumes of R and S?
    (A) 27%
    (B) 55%
    (C) 61.5%
    (D) 64%

14. Which solution contains the maximum quantity of milk?
(A) Q   (B) R
(C) S   (D) T

15. How many pairs of solutions can be selected such that if their entire volumes are mixed, the concentration of the resulting solution will be more than 50%?
(A) 8   (B) 9
(C) 10   (D) 11

Directions for questions 16 to 20: Answer these questions based on the information given below.

In the recent past India has witnessed a mass transition to ATM enabled services. The following table shows the costs incurred by any bank, in rupees per transaction, when a customer of that bank uses an ATM of any of the banks.

For example, when an SBI customer uses an SBI ATM, then the cost incurred by SBI is `3 per transaction. When he uses an ICICI ATM, the cost incurred by SBI is `10 per transaction and when he uses a UTI ATM, the cost incurred by SBI is `12 per transaction.

(Transaction costs* in `)

Customer	ATM of									
	SBI	**ICICI**	**UTI**	**HDFC**	**PNB**	**IDBI**	**GTB**	**Citi Bank**	**HSBC**	**Corp Bank**
SBI	3	10	12	6	8	15	20	6	15	20
ICICI	12	2	21	7	9	19	11	14	17	22
UTI	16	10	5	14	10	14	9	17	19	18
HDFC	7	12	16	6	11	18	16	21	8	14
PNB	8	10	14	20	4	16	11	5	18	8
IDBI	22	11	12	8	17	8	12	7	11	14
GTB	13	8	12	13	22	17	11	25	13	20
Citi Bank	11	9	12	14	16	22	16	8	24	13
HSBC	28	16	17	22	22	23	17	18	12	15
Corporation Bank	14	14	17	10	17	27	14	13	11	9

* Transaction costs from January 2003 to June 2003.

From the month of July 2003 onwards, the banks in the above list formed two alliances, namely STAR and JUMBO, where HDFC and PNB are part of the STAR alliance while the remaining banks belong to the JUMBO alliance. Members of the STAR alliance get a 25% discount on transaction costs incurred for all transactions between themselves and similarly members of JUMBO alliance get a 20% discount on all transactions between themselves.

Transaction costs between members belonging to STAR alliance and those belonging to JUMBO alliance continue as per the table above (i.e., without any discounts).

16. If in a particular month in 2003, the customers of SBI bank made a total of 2 million ATM transactions, of which 75% were transacted through its SBI's own ATM's and the remaining through HDFC ATM's, then what is the total expenditure (in millions) incurred on ATM transactions by SBI in that month?

17. After the alliances are formed, for how many banks is it profitable to use the ATM's of another bank instead of its own?

**18.** If in June 2003, HSBC incurred a total expenditure of `252 lakh on account of its customers transacting through ATM's and of this, 50% was on account of transactions through HSBC ATM's, then what is the least possible number of ATM transactions (in lakh) by the customers of HSBC in June 2003?

19. If in the month of March 2003, all the banks had 10 million transactions each through their own ATM's, then which bank would incur the maximum additional expenditure in case its ATM's went out of operation for that month and its customers transacted through the ATM's of the next cheapest alternative bank?

20. After the alliances were formed, for how many banks is the cost incurred per transaction, when it's customer uses the ATM of any other bank at least five and at most 18.

Directions for questions 21 to 25: These questions are based on the following information.

After every question there are two statements I and II. Mark your answer as Choice (A) if statement I alone is true. Choice (B) if statement II alone is true. Choice (C) if both statements are true. Choice (D) if neither of the statements is true.

Details of expenses of Excellent Management Training Institute (EMTI) are given in the pie chart and the table below.

Expenses of EMTI for 2015–16
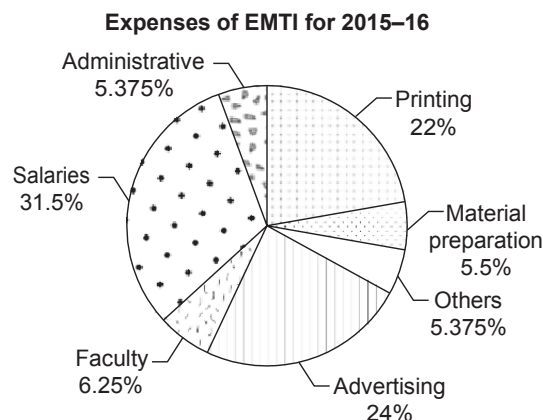
Percentage increase in expenses from 2014–15 to 2015–16

Faculty	25%
Advertising	20%
Material preparation	10%
Printing	25%
Administrative	7.5%
Salaries	5%
Others	7.5%

Note: It is known that the expenses towards faculty in 2015–16 were `12.5 lakh.

21. I. The total expenses incurred towards advertising in 2014–15 were `10 lakh.
    II. The total expenses incurred towards 'Others' in 2015–16 were `10.75 lakh.

22. I. In 2014–15, the total expenses incurred towards faculty and that incurred towards material preparation were equal.
    II. In 2015–16, the total expenses incurred were `200 lakh.

23. I. The expenses incurred towards printing in 2015–16 are 4.4 times the expenses incurred towards material preparation in 2014–15.
    II. The total expenses incurred in 2014–15 were `169.40 lakh.

24. I. The ratio of the expenses incurred towards administrative expenses in 2015–16 to that in 2014–15 is 47 : 40.
    II. The increase in the total expenditure from 2014–15 to 2015-16 is more than 10%.

25. I. The total expenses incurred towards salaries in both the years put together are `126 lakh.
    II. The total expenses incurred towards material preparation in both the years put together are `2.1 lakh.

Directions for questions 26 to 30: Answer these questions based on the information given below.

The following table gives the percentage share in the turnover of a business group by all the four companies, such as A, B, C and D of the group, for the period from 2003 to 2008. The table also gives the total turnover (in ` crore) of the group in these years.

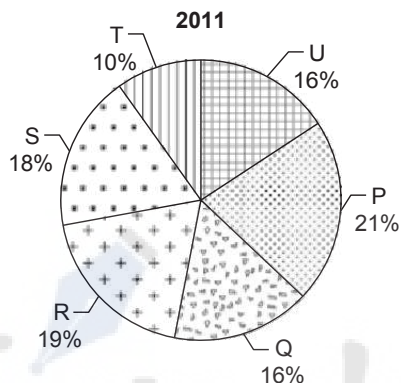|	2003	2004	2005	2006	2007	2008
A	31	36	32	34	29	27
B	18	24	26	27	26	24
C	22	15	19	21	23	25
D	29	25	23	18	22	24
Total	850	1020	1165	1245	1380	1425

26. What was the percentage increase in the turnover of Company A from 2005 to 2006?
    (A) 10.4% (B) 12.1% (C) 13.5% (D) 15.2%

27. How many of the companies of the group had an increase in turnover from 2003 to 2004?
    (A) 0 (B) 1 (C) 2 (D) 3

28. Which company had the highest percentage increase in turnover from 2003 to 2008?
    (A) A (B) B (C) C (D) D

29. In which of the following years was the percentage increase in the turnover, over the previous year of all the four companies put together, the highest?
    (A) 2004 (B) 2005 (C) 2006 (D) 2007

30. Which company of the group had an increase in turnover, when compared to the previous year in each year from 2004 to 2008?
    (A) Only A   (B) Only B
    (C) Only D   (D) None of the companies

Directions for questions 31 to 34: The following pie charts highlights the details of sales and expenses of six units, such as P, Q, R, S, T and U of a company across two years.
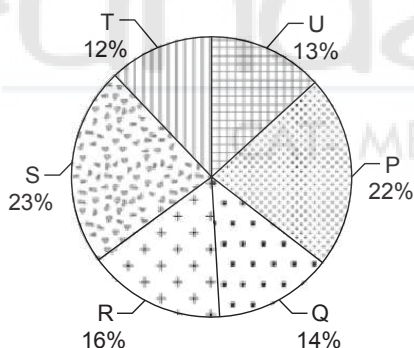
2010

Total sales = ₹ 4800 crore

T 9%
U 17%
S 21%
P 20%
R 18%
Q 15%
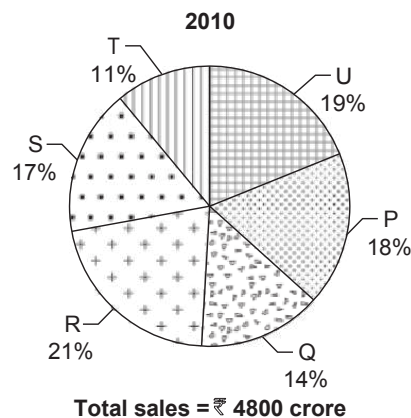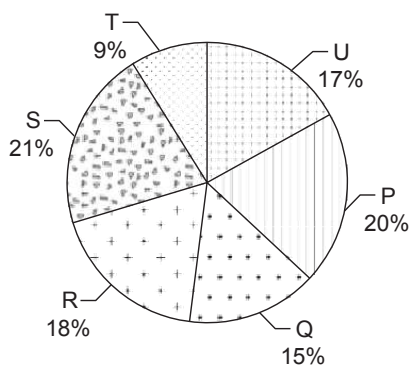
Total expenses = ₹ 3650 crore

2011

T 10%
U 16%
S 18%
P 21%
R 19%
Q 16%

Total sales = ₹ 5600 crore

T 12%
U 13%
S 23%
P 22%
R 16%
Q 14%

Total expenses = ₹ 4200 crore

$$\text{Profitability (\%)} = \frac{\text{Profit}}{\text{Expenses}} \times 100$$

31. Which unit of the company had the highest percentage increase in sales from 2010 to 2011?
(A) P (B) Q
(C) R (D) T

32. The highest percentage increase in profits for any unit from 2010 to 2011 is
(A) 131.6% (B) 138.3%
(C) 147.4% (D) 162.5%

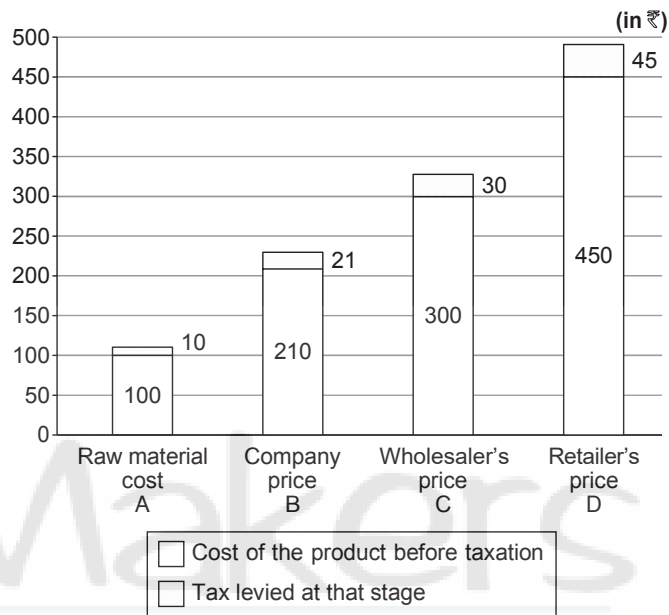**33.** Which unit of the company had the highest profitability in 2010?
(A) U (B) T
(C) R (D) Q

34. How many units of the company had a profitability more than 50 in 2011?
(A) 5 (B) 4
(C) 3 (D) 2

Directions for questions 35 to 38: These questions are based on the following graph, which gives a particular system of taxation applicable upon a certain product.

Price of a product at various stages in the supply-chain

(in ₹)

100	210	300	450
10	21	30	45

Raw material cost **A** | Company price **B** | Wholesaler's price **C** | Retailer's price **D**

☐ Cost of the product before taxation
☐ Tax levied at that stage

Note: (i) The company buys the product from the raw material supplier at the 'Raw material cost' and then sells the product to the wholesale dealer at the 'Company price'. The retailer buys the product from the wholesale dealer at the 'wholesaler's price' and then sells it to the customers at the 'Retailer's price'.

(ii) The rate at a stage =

$$\frac{\text{Tax levied at the stage}}{\text{Cost of product before taxation}} \times 100\%$$

The above taxation system is replaced by a new system of taxation in which only the 'value added' in any particular stage is taxed by the corresponding tax rate.

Value added in a stage = [cost of product before tax in that stage – cost of product after tax in the previous stage (according to new taxation)]. There will be no change in the tax at the first stage and in each of the other stages the price of the product will be reduced by the cumulative amount that is saved in all the earlier stages as well as that stage due to the new system of taxation. So that the value added in each of the stages remained same as that in the old taxation.

35. What is the least value added to the product in any stage (in ₹)?

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36. What is the cost of the product after tax at the end of stage C as per the new system of taxation?

37. A retailer had bought a product when the old system of taxation was in place. After two days the new system of taxation came into act and he had to sell the same product at the new price. What is the approximate amount that the retailer would have saved, on each unit of the product if he waited for another two days before buying the product?

38. What is the final price that a customer needs to pay as per the new system of taxation?

Directions for questions 39 to 42: These questions are based on the information given below.

Indian Thermal Power Corporation (ITPC) has nine thermal power plants setup at various locations, such as in A, B, C, D, E, F, G, H, and I. The utilization factor is the ratio of the actual electricity generated (output) by a power plant to its installed capacity. The net capacity factor of ITPC is the ratio of net electricity generated (net output) by all the plants to the total installed capacity. The following table gives details about the installed capacity and the utilization factor of four of the nine plants in 2014.

Power Plant	Installed capacity (in MW)	Utilization factor
A	1200	0.6
B	600	0.8
C	1100	0.9
D	800	0.7

The following information is also given:

  I. Plant B has the lowest installed capacity and plant A has the highest capacity.
 II. Plants E and G have the same installed capacity whereas every other plant has a distinct installed capacity which is a multiple of 100 MW.
III. The average utilization factor of plants E and G is the same as that of plant B and the total output of plants E and G together is the same as that of plants B and D together.
 IV. The installed capacity as well as the output of plant I is more than that of F, whose capacity as well as output is more than that of H.
  V. The utilization factors of the five plants which are not mentioned in the table above are 0.4, 0.5, 0.5, 0.7 and 0.9.
 VI. The average utilization factor of plants E, G and H is 0.66.

39. Find the net capacity factor of ITPC.
(A) 0.60 (B) 0.62
(C) 0.63 (D) 0.66

40. What is the percentage contribution of plants H and C in the net output?
(A) 16.7% (B) 23.33%
(C) 26.67% (D) 25.3%

41. In 2015, the average capacity utilization of plants A, C and E is 0.82 and there is no change in their installed capacity. What is the change in the net output of these plants over 2014?
(A) 254 MW (B) 384 MW
(C) 124 MW (D) Cannot be determined

42. What is the installed capacity of Plant F?
(A) 700 MW
(B) 900 MW
(C) 1000 MW
(D) Cannot be determined

Directions for questions 43 to 46: Answer these questions based on the information given below.

The following table gives the production and demand of a product from the year 2008 to 2015.

Year	Production (P) (in units)	Demand (D) (in units)
2008	500	500
2009	350	440
2010	400	400
2011	280	380
2012	480	510
2013	600	500
2014	600	600
2015	550	480

Every year a certain percentage of the production in that year is kept as storage(s) for the next year's use. The surplus, if any, is exported and additional quantity, if required, then it is imported.

43. If the storage is 20% every year and the export in 2008 was 10 units, then the production in 2007 was
(A) 750 units (B) 550 units
(C) 600 units (D) 650 units

44. From 2009 to 2015, in how many years was the product definitely exported or imported?
(A) 1 (B) 2
(C) 3 (D) 4

45. What should be the storage percentage at which there is neither import nor export in the year 2013?
(A) 83.33 (B) 66.66
(C) 50 (D) 25

46. If the storage is 10% in each of the years, then between the years 2009 and 2015, the exports in year A is equal to the imports in year B. A + B =
(A) 4010
(B) 4008
(C) 4009
(D) More than one of the above

*Directions for questions 47 to 50:* Answer the questions based on the information given below.

India scored less than 1000 runs in a test match and most of the runs were scored by five batsmen, namely Rohit, Dhawan, Dhoni, Kohli and Rahane. Given below are the charts showing the distribution of the total runs scored by these batsmen and the runs scored by them in 4's and 6's.

Further it is given that these players scored 77.77% of their combined total score in 4's and 6's and scored 90% of the total runs scored by India in that match.
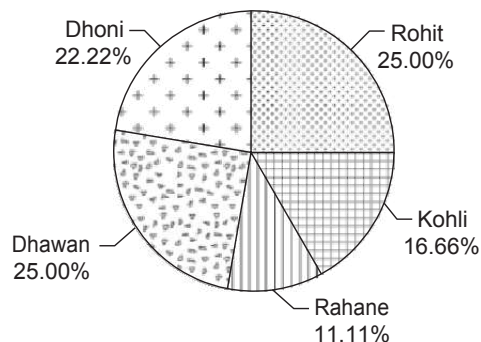
Distribution of the total runs scored by the five batsmen
Runs scored in 60's
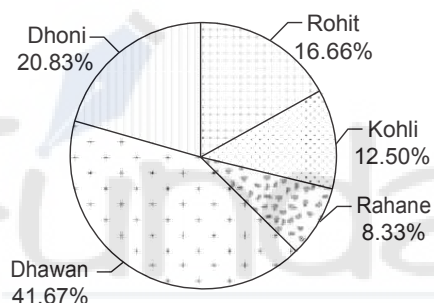
Runs scored in 4's
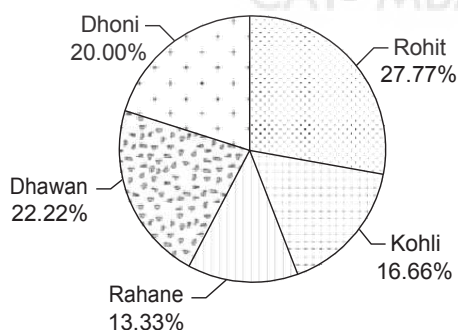
Total runs scored in the match

The remaining runs scored by these players were in 1's and 2's.

47. What per cent of the total runs scored by Rahane was in 4's and 6's?
(A) 37.5%
(B) 62.5%
(C) 75%
(D) 83.33%

48. The total number of 4's and 6's hit by Dhawan was
(A) 10   (B) 15
(C) 25   (D) 30

49. By what per cent is the total runs scored by Dhawan in 6's more/less than the total runs scored by Rohit in 4's?
(A) Less by 40%
(B) Less by 20%
(C) More by 25%
(D) Less by 20.83%

50. Kohli scored what percentage of his total score in 1's and 2's?
(A) 15%
(B) 20%
(C) 20.83%
(D) 27.77%

EXERCISE-3

Directions for questions 1 to 3: Answer these questions on the basis of the information given below.

Based on the diagram given below five terms, such as A, B, C, D and E are defined as follows:

A → Sum of all the numbers inside the equilateral triangle.
B → Sum of all the numbers inside the rectangle.
C → Sum of all the numbers inside the right-angled triangle.
D → Sum of all the numbers inside the square.
E → Sum of all the numbers inside the circle.

The heights of five friends, namely Abhinav, Bindia, Chetan, Dravid and Enosh are as follows:

1. Abhinav's height is 3D – 3A.

2. Bindia's height is E divided by the only number inside the right-angled triangle that is not part of any other figure, then it is multiplied by the smallest number in the square.

3. Chetan's height is the sum of all the numbers that are part of exactly three figures.

4. Dravid's height is the sum of all the numbers that are part of at least two figures.

5. Enosh's height is the sum of all the numbers which are greater than eight and lie inside the square or the rectangle.
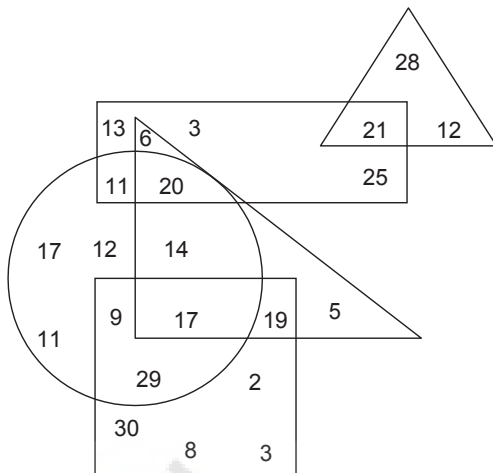
1. What is the difference in the heights of Bindia and Abhinav?
(A) 109   (B) 112
(C) 176   (D) 134

2. Who is the tallest among the five?
(A) Bindia   (B) Chetan
(C) Enosh   (D) Abhinav

3. If the height of Suman, Enosh's cousin, is the sum of all the numbers that are part of at least three figures, what is the difference in the heights of Dravid and Suman?
(A) 90   (B) 83
(C) 72   (D) None of these

Directions for questions 4 to 7: Answer these questions on the basis of the information given below.

The following table gives the percentage distribution of the runs scored by four cricketers in the first five matches of their career.

Match	Gaurav	Sheru	Tenchin	Drahul
1st	25	24	20	18
2d	18	22	26	15
3rd	20	24	21	22
4th	25	14	26	23
5th	12	16	7	22

Further, it is known that,

(1) The runs scored by Gaurav in his 2nd match was not more than that scored by Drahul in his 2nd Match.

(2) The runs scored by Tenchin in his 3rd match was not less than that scored by Sheru in his 3rd match.

(3) In the fifth match, the runs scored by Tenchin was not more than half of that scored by Gaurav.

4. If the number of runs scored by the given players in their fourth matches are compared, then who had the highest score?
(A) Gaurav   (B) Sheru
(C) Tenchin   (D) Drahul

5. If Drahul scored 126 runs in his first match, then the total runs scored by Tenchin in his first five matches is at most
(A) 350   (B) 400
(C) 450   (D) 500

6. The ratio of the runs scored by Gaurav in his second match to the runs scored by Sheru in his third match was at least
(A) 0.96   (B) 1
(C) 1.1   (D) 1.2

7. Among all the given players, the highest score made in a match in their first five matches was by
(A) Gaurav   (B) Sheru
(C) Tenchin   (D) Drahul

Directions for questions 8 to 12: Answer these questions on the basis of the information given below.

A total of eight teams, namely P, Q, R, S, T, U, V and W take part in a hockey tournament. In the first stage, the teams are divided into two groups of four teams each. Each team in a group played exactly one match with every other team in its group. The tournament is scheduled such that two group matches take place every day and all the group matches are over in six days. Three points are awarded for a win and one point for a draw. The following table gives the points of each team at the end of each of the six days.

Team	P	Q	R	S	T	U	V	W
Day 1	3	1	0	0	0	0	1	0
Day 2	3	1	0	3	0	1	1	1
Day 3	4	1	0	3	3	1	1	2
Day 4	4	1	0	4	4	4	1	2
Day 5	4	1	0	7	4	4	1	5
Day 6	4	2	0	7	5	7	1	5

It is known that no team played on three consecutive days and that team Q played on Day 2.

8. Which of the following teams are in one group?
(A) P, V, R, W   (B) P, R, T, S
(C) P, R, U, W   (D) None of these

9. Which of the following teams played on Day 3?
(A) T and R   (B) T and V
(C) T and U   (D) Cannot be determined

10. Which of the following teams lost a match on Day 5?
    (A) V   (B) P
    (C) Q   (D) T

11. Which of the following teams played a match on Day 5?
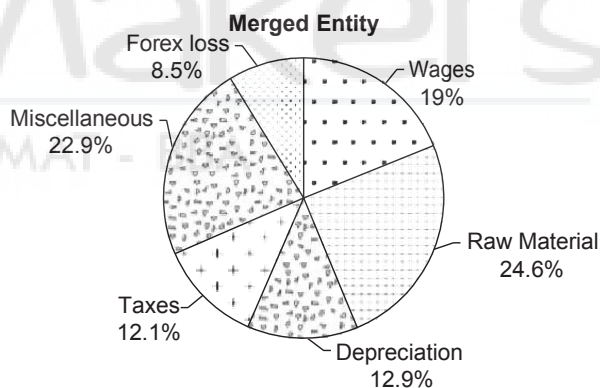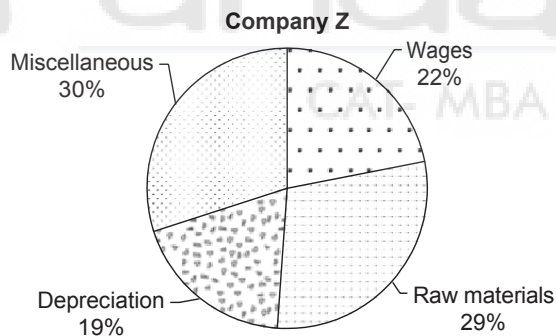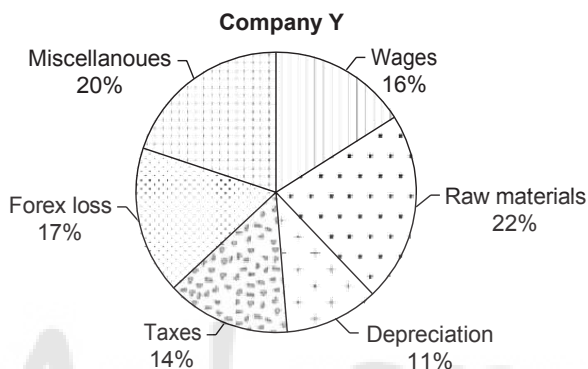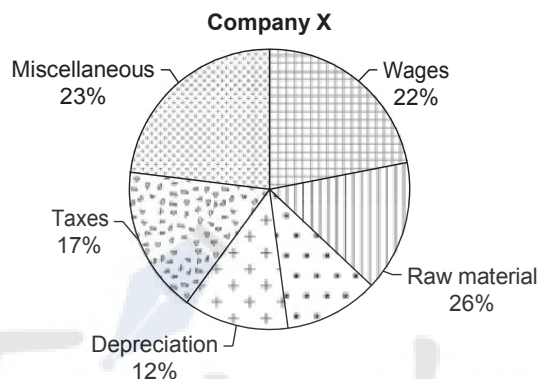   (A) T, W   (B) Q, V
    (C) W, P   (D) W, R

12. Which team did U beat on Day 4?
    (A) P
    (B) V
    (C) R
    (D) Cannot be determined

Directions for questions 13 to 16: Answer the questions on the basis of the information given below.

The Agenta group was a diversified business house which had three companies X, Y and Z. As part of restructuring, the group decided to merge all the three companies. The following pie charts give the break-up of expenses of each company and that of the merged entity in the year 2007.

Company X
- Miscellaneous 23%
- Wages 22%
- Taxes 17%
- Raw material 26%
- Depreciation 12%

Company Y
- Miscellanoues 20%
- Wages 16%
- Forex loss 17%
- Raw materials 22%
- Taxes 14%
- Depreciation 11%

Company Z
- Miscellaneous 30%
- Wages 22%
- Depreciation 19%
- Raw materials 29%

Merged Entity
- Forex loss 8.5%
- Wages 19%
- Miscellaneous 22.9%
- Raw Material 24.6%
- Taxes 12.1%
- Depreciation 12.9%

13. What is the ratio of the total expenses of companies X and Y?
    (A) 3 : 2   (B) 2 : 5
    (C) 3 : 5   (D) 2 : 3

14. The forex loses of company Y was what percentage of the depreciation expenses of Company Z?
    (A) 152%   (B) 186%
    (C) 205%   (D) 223%

15. The wage bill of which of the three companies was the highest?

    (A) X   (B) Y
    (C) Z   (D) Both X and Y

16. The expenses of Company Z was under quoted by 20% because the taxes paid by it was not included in the given diagrams. If this figure is also included, then the taxes paid would account for what percentage of the expenses of the merged entity?
    (A) 23.2%   (B) 21.5%
    (C) 18.6%   (D) None of these

Directions for questions 17 to 20: Answer these questions on the basis of the information given below.

The following are the runs scored by the players of the Indian cricket term in a match. The names are given in the order in which they came out to bat.

1.	Rahul	–	11
2.	Dhawan	–	27
3.	Pujara	–	35
4.	Kohli	–	53
5.	Rahane	–	6
6.	Pandya	–	27
7.	Saha	–	5
8.	Jadeja	–	39
9.	Ashwin	–	28
10.	Umesh	–	11
11.	Kuldip	–	5

The remaining runs in the team's total score are extras, which are not credited in the name of any batsman. It is also known that no batsman stopped his innings in between or retired hurt. The values below give the runs at which India lost its wickets, the fall of wickets occurred during 22, 54, 98, 121, 146, 157, 193, 212, 231, 252.

17. Who was the third batsmen to be out?
(A) Dhawan   (B) Pujara
(C) Kohli   (D) Cannot be determined

18. Who was the last batsmen to be out?
(A) Ashwin
(B) Umesh
(C) Kuldip
(D) Cannot be determined

19. By the time Pandya was out, how many wickets had India lost?
(A) 5   (B) 6
(C) 7   (D) 8

20. If during none of the partnerships India got more than two extra runs, who was the second last batsman to be out?
(A) Jadeja
(B) Ashwin
(C) Umesh
(D) Cannot be determined

ANSWER KEYS

Exercise-1

1. (D)	10. 207500	19. (D)	28. (B)	37. (A)	46. (C)
2. (A)	11. (C)	20. (C)	29. (B)	38. (B)	47. (B)
3. (D)	12. (D)	21. (C)	30. (A)	39. (D)	48. (B)
4. (D)	13. (C)	22. (A)	31. (B)	40. (B)	49. (B)
5. (B)	14. (D)	23. (D)	32. (C)	41. (B)	50. (D)
6. 3	15. (D)	24. (C)	33. (A)	42. (C)	
7. Gupta	16. (A)	25. (D)	34. (C)	43. (D)	
8. 55000	17. (C)	26. (B)	35. (D)	44. (D)	
9. 4080	18. (C)	27. (A)	36. (B)	45. (C)	

Exercise-2

1. 180	10. (D)	19. ICICI	28. (B)	37. 34	46. (A)
2. (C)	11. (D)	20. 3	29. (A)	38. 428	47. (D)
3. 216	12. (A)	21. (B)	30. (D)	39. (D)	48. (D)
4. (C)	13. (C)	22. (C)	31. (A)	40. (D)	49. (A)
5. 5.1	14. (B)	23. (A)	32. (C)	41. (D)	50. (D)
6. (B)	15. (C)	24. (B)	33. (B)	42. (D)	
7. (C)	16. 7.5	25. (D)	34. (C)	43. (B)	
8. (B)	17. 4	26. (C)	35. 69	44. (C)	
9. (A)	18. 15	27. (D)	36. 296	45. (A)	

Exercise-3

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

SOLUTIONS

EXERCISE-1

1. The total tonnage of fish caught in the inland waters in 1998 = (Total quantity of fish caught in 1998) – (Total quantity of fish caught in the sea in 1998)
= (10,229) – (947 + 6164) = 3118 tons.

2. The tonnage of fish caught in the inland waters during 1999 = 61 + 129 + 297 = 487.
Similarly, the tonnage in 2000 = 516, in 2001 = 519 and in 2002= 589
There has been an increase in every year, statement (I) is true. Statement (I) is maintained in Choice (A) as well as Choice (D). By checking statement (IV), the quantity of fish caught, using the traditional method has decreased successively in two years.
∴IV cannot be inferred.
Only statement (I) can be inferred.

3. During the given years, the total quantity of fish caught by the modern methods
= 5841 + 2463 + 11997 + 44668 = 64,969 ≅ 65,000 The quantity of fish caught by traditional methods = 374 + 731 + 1930 + 7675 = 10,710 ≅ 11,000; $\frac{65,000}{11,000} \cong 6$

4. The percentage increase in the quantity (tonnage) of fish caught over previous year in 1999 = $\frac{684}{10,229}$

In 1998 = $\frac{1262}{8,967}$, In 2000 = $\frac{864}{10,913}$,

in 2001 = $\frac{590}{11,777}$ and in 1997 = $\frac{759}{8208}$

Among the given fractions, in the fraction pertaining to 2001, the denominator is the greatest and the numerator is the least. Hence, the value of this fraction is the least.

5. Number of fish caught = $\frac{\text{Quantity of fish}}{\text{Average weight}}$

Number of fish caught in artificial tanks

$$= \frac{374 + 5841}{2} = \frac{6215}{2} = 3017 \times 5$$

In lakes = $\frac{731 + 2463}{3} = 1064$

In rivers = $\frac{1930 + 11997}{4} = 3481.$

In seas = $\frac{7675 + 44668}{5} = \frac{52343}{5} = 10468.6$

The number of fish caught in the lakes is the least.

6. Income tax paid by Sharma = (30/100) × 4.5
= 1.35 > 1 lakh
Income tax paid by Rao = (25/100) × 3.5
= 1/4 × 3.5 < 1 lakh
Income tax paid by Gupta = (25/100) × 3 < 1 lakh
Income tax paid by Solkar = (30/100) × 40 > 1 lakh
Income tax paid by Kuchroo = (35/100) × 5 > 1 lakh
There are three such persons.

7. The ratio of savings to expenditure for the persons are as follows:

Sharma $= \frac{1.5}{3} = \frac{1}{2}$

Rao $= \frac{1}{2.5} = \frac{2}{5}$

Solkar $= \frac{1.5}{2.5} = \frac{3}{5}$

Gupta $= \frac{0.5}{2.5} = \frac{1}{5}$

Kuchroo $= \frac{1.5}{3.5} = \frac{3}{5}$

We can observe that Gupta has the least ratio.

8. 35% of Gupta's Income = (35/100) × 3 lakh = `1.05 lakh
Savings of Gupta currently = `50,000
Gupta should save `55,000 more to reach the target of 35%.

9. Total investments in PPF by the five persons
= 50 + 50 + 25 + 50 + 80 = `2.55 lakh = `2,55,000
Interest payable per annum
= (8/100) × 2,55,000 = `20,400
Average interest payable per person = 20,400/5 = `4080

10. The two doctors are Sharma and Solkar.
Sharma's income = `4.50 lakh
PPF = `50000 or `0.50 lakh
Taxable income = 4.5 – 0.5 = `4.00 lakh
Tax payable = (30/100)` 4 = `1.20 lakh
Solkar's taxable income = 4.00 – 0.50 = `3.50 lakh
Tax payable = 25/100 × 3.50 = `87,500
Total tax payable by these two doctors
= 1,20,000 + 87,500 = `2,07,500

11. Number of female postgraduates
$$= \frac{20}{100} \cdot \frac{36}{100} .5000 = \frac{20}{100} .1800 = 360$$
Number of unmarried female postgraduates
$$= \frac{90}{100} .360 = 324$$

12. Number of graduates = Number of female graduates + Number of male graduates = $\left(\frac{80}{100}\right)\left(\frac{36}{100}\right)(5000)$ + $\left(\frac{75}{100}\right)\left(\frac{64}{100}\right)(5000)$

$= \left(\frac{28.8}{100}\right)(5000) + \left(\frac{48}{100}\right)(5000) = \left(\frac{76.8}{100}\right)(5000)$

∴ 76.8% of the students of the college are graduates.

13. Number of male postgraduates = $\frac{25}{100}\frac{64}{100}.5000$

$= \frac{16}{100}5000 = 800$

Number of male postgraduates who are at least 30 years old = 496

Number of male postgraduates aged below 30 years = 800 – 496 = 304

14. Number of postgraduates = Number of male postgraduates + Number of female postgraduates

$= \frac{25}{100}\frac{64}{100}5000 + \frac{20}{100}\frac{36}{100}.5000$

$= \frac{16}{100}5000 + \frac{7.2}{100}5000 = \frac{23.2}{100}5000$

Required % = $\dfrac{\dfrac{23.2}{100} \times 5000}{\dfrac{76.8}{100} \times 5000} \times 100\% = 30.2\%$

15. The maximum difference occurred between the number of qualified candidates in 2005 and 2006.

16. The number of candidates who appeared from Chennai in 2004 = $\frac{4224 \times 100}{100 - 89}$ = $\frac{4224 \times 100}{11}$

(∵ 4224 candidates qualified in 2004, 89% did not qualify)
∴ 11% qualified.
Also, the number of candidates who appeared from Chennai in 2006, 2007, 2008 and 2010 were $\frac{4626 \times 100}{10}$, $\frac{3150 \times 100}{6}$, $\frac{7280 \times 100}{13}$ and $\frac{9280 \times 100}{10}$, respectively.

The maximum of all these = $\frac{9280 \times 100}{10}$

(∵ From all the above values, $\frac{9280 \times 100}{10}$ has the highest numerator and proportionate denominator.
Therefore, it is the highest of the values).
∴ Highest value occurred in 2010.

17. In 2009, 80% did not qualify.
∴ 20% qualified
20% = 11800
80% = 4(11800) = 47200

18. In 2007, 81% did not qualify.
∴ 19% qualified
19% = 13490
1% = 710
Number appeared = 100% = 71000

19. The total costs per unit of the different companies are as follows.

A = 10 + 15 + 20 = `45    B = 15 + 10 + 20 = `45
C = 5 + 10 + 15 = `30    D = 20 + 10 + 15 = `45
E = 25 + 15 + 20 = `60    F = 25 + 5 + 30 = `60

20. Sales income of the company:
B = 5000 × 68 = `3,40,000
Total cost of production of B for 5000 units
= 5000 × 45 = `2,25,000
∴ Profit = `1,15,000

21. If we observe the total cost of all the companies, then total costs of A and D are `45 and `45, respectively.
∴ Ratio of total costs = 1 : 1
Similarly, for E and F, the ratio of total costs = 1 : 1
∴ Statement C is correct.

22. Profit of company D for one-day production
= 1000 (60 – 45) = `1,50,000
Profit of company F for one-day production
= 800 (80 – 60) = `1,60,000
The ratio will be the same whether it is calculated for one day or for ten days.
∴ Ratio of profits = 15 : 16

23. The labour cost of B and C is same, say x.
∴ Total cost of B is $x + 20 + 10 = x + 30$
Total cost of C is $x + 15 + 10 = x + 25$
∴ The ratio of the total cost is $x + 30 = x + 25$
The solution cannot be determined.

24. During the year 2003, the total number of garments manufactured by A = 168 + 295 + 332 + 100 = 895.
Similarly, those manufactured by
B = 473, C = 798 and D = 1069.
Hence, D > A > C > B

Alternate method:
By observation, we can find that the total number of garments is the greatest for company D, and the next highest is for A.

25. The percentage increase in the number of garments manufactured by company C for female segment for the appropriate periods is as follows:

Second quarter = $\frac{59 - 35}{35} = \frac{24}{35}$

Third quarter = $\frac{68 - 59}{59} = \frac{9}{59}$

Fourth quarter = $\frac{75 - 68}{68} = \frac{7}{68}$

265

$\frac{7}{68}$ is the least as the numerator is the smallest and the denominator is the greatest.

Note: First quarter need not be considered since the number of garments for the previous quarter is not given.

26. If the total number of garments manufactured in 2002 was 100, then the total number of garments manufactured in 2003 was 125. Since the total number of gar-

ments manufactured in 2003 is 3235, those manufactured in 2002 = $\frac{100}{125}$ × 3235 = 2588 thousands.

27. The ratio of the total number of garments manufactured for the male segment to that of female segment
= (168 + 103 + 180 + 227): (295 + 125 + 237 + 321)
= 678 : 978 = 113 : 163

28. Only for company B there is a growth in every segment for every quarter.

Solutions for questions 29 to 32: Let us calculate the total number of votes cast in different constituencies in different years.

Year	A	B	C	D	E
1990	60,000 × $\frac{45}{100}$ = 27,000	65,000 × $\frac{60}{100}$ = 39,000	80,000 × $\frac{75}{100}$ = 60,000	70,000 × $\frac{40}{100}$ = 28,000	60,000 × $\frac{55}{100}$ = 33,000
1994	70,000 × $\frac{50}{100}$ = 35,000	72,000 × $\frac{64}{100}$ = 46,080	85,000 × $\frac{80}{100}$ = 68,000	80,000 × $\frac{60}{100}$ = 48,000	65,000 × $\frac{70}{100}$ = 45,500
1998	75000 × $\frac{65}{100}$ = 48,750	80,000 × $\frac{85}{100}$ = 68,000	90,000 × $\frac{60}{100}$ = 54,000	86,000 × $\frac{50}{100}$ = 43,000	75,000 × $\frac{80}{100}$ = 60,000
2002	78000 × $\frac{70}{100}$ = 54,600	84000 × $\frac{72}{100}$ = 60,480	98000 × $\frac{65}{100}$ = 63,700	100000 × $\frac{45}{100}$ = 45,000	104000 × $\frac{60}{100}$ = 62,400

29. Required answer =
48750 + 68000 + 54000 + 43000 + 60000, i.e., 2,73,750.

30. In 1994, the required average number of votes cast
= (35000 + 46080 + 68000 + 48000 + 45500) ÷ 5 = 48,516.

31. In 2002, 464000 – 286180 = 1,77,820 people did not cast their vote.

32. Required ratio = $\frac{164000}{200900} = \frac{1640}{2009}$.

33. Trains A, B, C, D covered 240, 380, 290 and 341 km between 16:00 hrs. and 22:00 hrs. Hence, the average speed of Train A was the least during this period.

34. At 16:00 hrs
Train A is 600 km away from starting point.
Train B is 460 km away from starting point.
Train C is 530 km away from starting point.
Train D is 437.5 km away from starting point.
∴ Trains A and D are 162.5 km apart which is the farthest distance.

35. B crosses A at 840 kms at around 22:00 hrs.
C crosses A at 840 kms at around 22:00 hrs.
B crosses C at 840 kms at around 22:00 hrs.
Similarly, trains B, C and D could have crossed train A anytime between 12:00 and 16:00 before train A crossed them again and took the lead.
Hence, there are more than two cases possible.

36. The total stoppage times of Train A
= (6:10 to 6:30) + (19:00 to 19:15) = 35 minutes
Total distance = 1000 km
Total time = 05:00 hrs to 01:30 hrs – 35 minutes
= 19 hours 55 minutes ≃ 20 hours

Hence, the average speed = $\frac{1000}{20}$ = 50 kmph

(Slightly more than 50, actually)

37. In region P, the total number of readers = 52 million.
The number of readers reading newspaper B

$$= \frac{40}{100} \times 52 \text{ million}$$

$$= \frac{2}{5} \times 52 \text{ million}$$

$$= 20.8 \text{ million}$$

38. The number of readers reading newspaper A in region

$$Q = \frac{25}{100} \times 50 \quad \rightarrow \quad (1)$$

The number of readers reading newspaper B in region

$$S = \frac{30}{100} \times 60 \quad \rightarrow \quad (2)$$

The required ratio = 25 × 50 : 30 × 60 = 25 : 36

39. The required number of readers

$$= \frac{10}{100} \times 52 + \frac{30}{100} \times 50 + \frac{40}{100} \times 45 + \frac{20}{100} \times 60$$

= 5.2 + 15 + 18 + 12 = 50.2 million

40. The total readers of B

$$= \frac{40}{100} \times 52 + \frac{25}{100} \times 50 + \frac{30}{100} \times 45 + \frac{30}{100} \times 60$$

= 20.8 + 12.5 + 13.5 + 18 = 64.8
The total readers of C = 50.2
The required ratio = 64.8 : 50.2 = 324 : 251

41. The required percentage is more than 90%, in the countries Mauritius, South Africa, Guyana, Jamaica, Suriname, Trinidad and Tobago, Afghanistan, France, Netherlands, Yemen and Fiji, i.e., a total of 11 countries.

42. The countries are Netherlands, Kuwait, Oman and Yemen.

43. The given condition is satisfied for a country only when PIOs as a percentage of the country's population is more than the value of PIOs as a percentage of total PIOs. This happened for 17 countries, namely for Mauritius, Guyana, Jamaica, Suriname, Trinidad and Tobago, Bhutan, Singapore, France, Germany, Bahrain, Kuwait, Libya, Oman, Qatar, UAE, Yemen and Fiji.

44. PIO 's (ASIA)
= 46 + 70 + 330 + 1170 + 3900 + 100 + 1023 + 65 = 6704
PIO 's (America)
= 229 + 300 + 39 + 140 + 430 + 500 = 1638

$$\therefore \text{ Required } \% = \frac{6704}{1638} - 1 \ (100) = 309.2\%$$

45. Since the answer choices are not close, we can approximate the values.
Urban population in 1901 ≈ 26 million
Rural population in 1901 ≈ eight times the urban population
∴ Rural population = 26 × 8 = 208 million
In 1991, urban population ≈ 215
In 1991, rural population = three times urban population
∴ Rural population in 1991 = 215 × 3 = 645% increase =

$$\frac{645 - 208}{208} \times 100 = 210$$

46. The approximate population in the years are as follows:

1941: $\frac{44.0}{19} \times 100 = 315$

1951: $\frac{62 \cdot 5}{17 \cdot 6} \times 100 = 355$

1961: $\frac{79}{18 \cdot 3} \times 100 = 430$

1971: $\frac{109}{20 \cdot 2} \times 100 = 540$

1981: $\frac{162}{23 \cdot 7} \times 100 = 685$

1991: $\frac{218}{25 \cdot 7} \times 100 = 847$

Among the years mentioned only for 1961–71 and 1971–81 there is more than 25% increase

$$= \frac{540 - 430}{430} \times 100 = 25 \cdot 5\% \text{ and } \frac{685 - 540}{540} \times 100 \approx 27\%$$

47. Closely observing the values for urban population and the percentage of urban population in the total population we can see that only for the period 1911–1921, the actual increase in urban population

$$= \frac{28 - 25 \cdot 9}{25 \cdot 9} \times 100 = 8 \text{ which is less than the percentage}$$

increase in the percentage of urban population

$$= \frac{11 \cdot 3 - 10 \cdot 4}{10 \cdot 4} \times 100 \approx 8 \cdot 5\% \text{ which means there is a decrease in the base, i.e., total population.}$$

48. The marks scored by Antony in Maths = $\frac{20}{100} \times 370 = 74$.

The marks scored by Bill in Maths = $\frac{20}{100} \times 280 = 56$

The marks scored by Clinton in Maths = $\frac{17}{100} \times 380 = 64.6$

The marks scored by Danny in Maths = $\frac{15}{100} \times 365 = 54.75$

The marks scored by Ellen in Maths = $\frac{18}{100} \times 375 = 67.5$

The marks scored by Francis in Maths = $\frac{30}{100} \times 360 = 108$

The marks Goutham scored in Maths = $\frac{22}{100} \times 390 = 85.8$
Francis scored the highest in Maths.

49. The marks scored by Ellen in English = $\frac{37}{100} \times 375$
= 138.75

The marks scored by Goutham in English = $\frac{23}{100} \times 390$
= 89.7

The required percentage = $\frac{138.75 - 89.7}{89.7} \times 100 = 54.6\%$

50. The total marks scored in Physics by all the students

$$= \frac{20}{100} \times 370 + \frac{20}{100} \times 280 + \frac{20}{100} \times 380 + \frac{18}{100} \times 365 + \frac{15}{100} \times 375$$

$$+ \frac{30}{100} \times 360 + \frac{30}{100} \times 390$$

= 74 + 56 + 76 + 65.7 + 56.25 + 108 + 117
= 553

1. Total earnings = EPS × Total number of shares
The number of shares of Company A has increased from 12 × 5L to 17 × 5L (L = lakhs)

$$\frac{17 \cdot 5 - 12 \cdot 5}{12 \cdot 5} \times 100 = 40\%$$

Assume that Company A had only 10 shares in 2007.
∴ Total earnings = 10 × 6 = `60
Now, for the next year, the number of shares increases by 40% that is 10 becomes 14.
Total earnings = 14 × 12 = 168
∴ Required percentage increase

$$= \frac{168 - 60}{60} \times 100 = \frac{108}{60} \times 100 = 180\%$$

2. For A it is 180% (from the previous question).
For B, as the number of shares hasn't changed, we can directly calculate the increase in total earnings from the increase in EPS.

Increase $= \frac{18 - 8}{8} \times 100 = \frac{10}{8} \times 100 = 125\%$

For C, the number of shares increases from 27 × 0L to 40 × 5 lakh, that is a 50% increase.
Assume that C had only 10 shares in 2007.
Total earnings 10 × 2 = 20
The next year, the number of shares increases by 50%, that is 10 becomes 15.
Total earnings 15 × 6 = 90

Increase $= \frac{90 - 20}{20} \times 100 = 350\%$

For D, as the number of shares does not change, we can use the same logic as used for Company B and find that the increase is 50%.

3. Share price = EPS × P/E = 18 × 12 = ` 216

4. Since the share price = P/E × EPS, the prices of companies on 1st April 2007 and 1st April 2008 can be found as follows.

Company	2007	2008
A	90	96
B	160	216
C	50	96
D	360	432
E	120	72
F	50	36

It is the highest for C.

5. Total earnings of D in 2008:
∴ EPS × The number of shares = 18 × 8× 5L = `153 lakh

Earnings in 2009 $= \frac{90}{100} \times 153$

Earnings of E in 2009:
EPS $= \frac{90 \times 153}{100 \times 27} = 5.1$

6. For the number of illiterates to be maximum, the literacy rate should be minimum. By observing the data given, it is true for Country B.

7. 55% of 1321 – 58% of 832
Treating 55% as (50% + 5%) and 58% as (60% – 2%)
{660.5 + 66.05} – {499.2 – 16.64}
726.5 – 482.6 = 243.9

8. The second highest number of men is in Country A, as it has the second highest population.

Number of women in A $= \frac{970}{1970} \times 1321$

$\frac{970}{1970} \cong \frac{1}{2}$ but less than $\frac{1}{2}$

∴ Number of women $< \frac{1}{2} \times 1321 < 660.5$

Thus, it is slightly less than 660.

9. Even if all the women in Country D is literate, there will only be 91 × 1/2 = 45 lakh literate women in D.
Even if all the men in any other country (say C) are literate, out of a total of 540 × 0.85 = 460 lakh literates, only about 270 lakh (half the total population) can be men (since the male-female ratio is approximately 1) and the remaining 190 lakh will have to be literate women which is definitely higher than the number of literate women in D; thus, D has the least number of literate women.

10. Here, we need literacy rate among men and women separately which is not given.

11. We have to select amongst the solutions Q, R, T and U (as they have higher concentration as compared to others).

(R, Q) : C $= \frac{(80)(34) + (16)(60)}{16 + 34}$

$= \frac{2720 + 960}{50} = \frac{3680}{50} = 73.6$

(R, U) : C $= \frac{(80)(34) + (10)(70)}{44}$

$= \frac{2720 + 700}{44} = \frac{3420}{44} = 77.7$

$(R, T) : C = \dfrac{(80)(34)+(60)(5)}{39}$

$= \dfrac{2720 + 300}{39} = \dfrac{3020}{39} = 77.4$

For Q and U, the concentration is less than 70%.

∴ Solutions R and U have to be mixed to get maximum concentration.

12. P + Q + R = X

S + T + U = Y

By observation, X has more concentration than Y.

13. (Concentration) R and S

$= \dfrac{(80)(34)+(30)(20)}{34+20} = \dfrac{2720+600}{54}$

$\Rightarrow \dfrac{3320}{54} = 61.5\%$

14. The solution which contains the maximum quantity of milk is R since its concentration as well as its total quantity is maximum.

15. Pairs of solutions are (P, Q), (P, R), (P, U)

(Q, R), (Q, T), (Q, U)

(R, S), (R, T), (R, U), (T, U).

A total of 10 pairs of solutions are there.

16. ATM transactions through SBI ATM's

$= 2 \times \dfrac{75}{100} = 1.5$ million.

∴ Total expenditure incurred by SBI = 1.5 × 3

= 4.5 million rupees

ATM transactions of SBI through HDFC ATM's = 0.5 million

∴ Total expenditure incurred by SBI = 0.5 × 6

= 3 million rupees

Total cumulative expenditure = 4.5 + 3 = 7.5 million rupees.

17. Let us make a table to represent the information:

Bank	Cost per transaction	Next best alternative	Cost of this alternative	Profitable (Y/N)
SBI	3	HDFC	6	No
ICICI	2	HDFC	7	No
UTI	5	ICICI	$10 \times \dfrac{80}{100} = 8$	No
HDFC	6	SBI	7	No
PNB	4	Citi Bank	5	No
IDBI	8	Citi Bank	$7 \times \dfrac{80}{100} = 5.60$	Yes
GTB	11	ICICI	$8 \times \dfrac{80}{60} = 6.4$	Yes
Citi Bank	8	ICICI	$9 \times \dfrac{80}{100} = 7.2$	Yes
HSBC	12	Corporation	$15 \times \dfrac{80}{100} = 12$	No
Corporation	9	HSBC	$11 \times \dfrac{80}{100} = 8.80$	Yes

It can thus be seen that for four banks it is profitable to use another bank's ATM's after the alliances are formed.

18. Total expenditure of HSBC = 252 lakh

Total expenditure through its own ATM's = 126 lakh

∴ Total transaction through its own ATM's

$= \dfrac{\text{Total expendidture}}{\text{Cost per transaction}} = \dfrac{126}{12} = 10.5$ lakh

For the transactions to be minimum the remaining 126 lakh expenditure must be through an ATM that has the highest cost per transaction for HSBC customers, which is the case of SBI at `28 per transaction.

∴ Total transactions through SBI $= \dfrac{126}{28} = 4.5$ lakh

Total cumulative transactions = 10.5 + 4.5 = 15 lakh

19. In the month of March 2003, the alliance was not formed were no discounts are possible on member banks transactions, this has to be kept in mind while working out these questions. Let us now form a table and solve the question.

Bank	Cost	Least cost alternative	Additional expenditure per transaction
SBI	3	HDFC – 6	3
ICICI	2	HDFC – 7	5
UTI	5	GTB – 9	4
HDFC	6	SBI – 7	1
PNB	4	Citibank – 5	1
IDBI	8	Citibank – 7	*Saving of `1 *
GTB	11	ICICI – 8	* Saving of `3 *
Citi Bank	8	ICICI – 9	1
HSBC	12	Corporation – 15	3
Corporation Bank	9	HDFC – 10	1

Since transactions (ATM) are the same for all banks, ICICI will have the maximum additional expenditure.

20. Only for ICICI, PNB and IDBI was the cost of transaction at least five and at most 18.

Solutions for questions 21 to 25:
Given that the expenses towards faculty
= 6.25% of total expenses = `12.5 lakh
Total expenses = 12.5 × 100 / 6.25 = `200 lakh
Tabulating the expenses in lakh of rupees.

	2015–16	2014–15
Faculty	12.5	12.5/1.25 = 10.0
Advertising	48.00	48/1.2 = 40.0
Material preparation	11.00	11/1.1 = 10.0
Printing	44.00	44/1.25 = 35.20
Administrative	10.75	10.75/1.075 = 10.0
Salaries	63.00	63/1.05 = 60
Others	10.75	10.75/1.075 = 10
Total	200	175.20

21. Statement I is wrong because the expenses towards advertisement in 2014-15 were `40 lakh.
As per the table, Statement II is correct.

22. As per the table, Statements I and II are true.

23. As per the table, the ratio of printing expenses in 1995–96 to material preparation in 2014–15 = 44/10 = 4.4
Thus, statement I is true.
As per the table, total expenses in 2014–15 are not `169.40 lakh.
Thus, statement II is wrong.

24. As per the table, the ratio of amounts incurred towards the administrative expenses in 2015–16 and 2014–15
= 10.75: 10 = 1075 : 1000 = 43 : 40
Thus, statement I is wrong.
The percentage increase in total expenditure from 2014-15 to 2015–16 = (200/175.20 – 1) × 100 = 14.1%
Thus, statement II is correct.

25. As per the table, the total expenses towards salaries are 60 + 63 = `123 lakh
Thus, statement I is wrong.
The total expenditure towards material preparation in both the years = 11 + 10 = `21 lakh
Therefore, both the statements are wrong.

26. The turnover of Company A in 2005 = $\frac{32}{100}$ × 1165 = 372.8
The turnover of Company A in 2006 = $\frac{34}{100}$ × 1245 = 423.3
The percentage increase = $\frac{50.5}{372.8}$ × 100 = 13.5%

27. The turnover of the group increased by 20% from 2003 to 2004. If the percentage share in 2003 is less than 120% of that in 2004, there will be an increase in turnover from 2003 to 2004, i.e., for companies A, B and D.

28. To find the company with the highest percentage increase, we need to find only the company which had the highest percentage increase in share in the group turnover, i.e., Company B.

29. The turnover of all the four companies put together is the group turnover and the highest percentage increase in the group turnover was from 2003 to 2004.

30. None of the companies had an increase in turnover over the previous year in each year from 2004 to 2008.

Solutions for questions 31 to 34: The sales, expenses and profits of the different units in 2010 and 2011 are as follows.

2010

Units	Sales (`crore)	Expenses (`crore)	Profit (`crore)	Profitability
P	864	730	134	14.3%
Q	672	547.5	124.5	22.7%
R	1008	657	351	53.4%
S	816	766.5	49.5	6.6%
T	528	328.5	199.5	60.9%
U	912	620.5	291.5	47.0%

2011

Units	Sales (`crore)	Expenses (`crore)	Profit (`crore)	Profitability
P	1176	924	252	27.3%
Q	896	588	308	52.4%
R	1064	672	392	58.0%
S	1008	966	42	4.0%
T	560	504	56	11.1%
U	896	546	350	64.2%

31. We need to consider only P or Q as they are the only companies to have more than 25% increase in sales.

For P it is = $\dfrac{1176 - 864}{864} \times 100 = \dfrac{312}{864} \times 100 = 36\%$

For Q it is $\dfrac{896 - 672}{672} \times 100 = \dfrac{224}{672} \times 100 = 33.3\%$

Therefore, the highest is for P.

32. The highest percentage increase in profit would be for Q

which is $\dfrac{308 - 124.5}{124.5} \times 100 = \dfrac{183.5}{124.5} \times 100 = 147.4\%$

33. In 2010, the profitability was the highest for unit T.

34. Units Q, R and U had a profitability more than 50% in 2011.

Solutions for questions 35 to 38: From the given data:

Stage	A	B	C	D
Total cost after tax	110	231	330	495
Total cost before tax	100	210	300	450
Value added	100	100	69	120
Tax rate	10%	10%	10%	10%

According to new system of taxation, only 'value added' is to be taxed.

Stage	A	B	C	D
Total cost after tax	110	220	295.9	428
Total cost before tax	100	210	289	416
Value added	100	100	69	120
Rate	10%	10%	10%	10%
Tax on value added	10/-	10/-	6.9/-	12/-

35. In stage 'C', the least value is added, i.e., `69.

36. From the above table, it is `295.9.

37. The operator in stage D had to buy from stage C operators.
In the old system, he paid `330.
In the new system he pays `295.9.
Thus, if he follows the old system, he will pay
330 – 295.9 = `34.1 more.

38. From the table, final cost = 427.9

39. The lowest installed capacity of a plant is 600 MW and the highest capacity is 1200 MW. As it is mentioned that every plant except E and G have distinct capacities which are multiples of 100 MW, of the remaining five plants three of them will have installed capacities of 700, 900 and 1000 MW.

Power plant	Capacity (in MW)	Utilization factor	Output
A	1,200	0.6	720
B	600	0.8	480
C	1,100	0.9	990
D	800	0.7	560
	700		
	900		
	1,000		
	X		
	X		

As the total output of plants E and G is same as that of plants B and D (1040 MW) and their average utilization factor is same as that of B (0.8), installed capacity of E and G together = 1040/0.8 = 1300 MW
∴ Installed capacity of plants E and G is 650 MW each.

Power plant	Capacity (in MW)	Utilization factor	Output
A	1200	0.6	720
B	600	0.8	480
C	1100	0.9	990
D	800	0.7	560
	700		
	900		
	1000		
E	650		
G	650		

As their installed capacities are the same, plants E and G must have utilization factors of 0.7 and 0.9 so that the average will be 0.8. But we don't know which one has a

utilization factor of 0.7. Since the installed capacity of I, F and H are in a descending order, we know their respective installed capacities.

Power plant	Installed capacity (in MWs)	Utilization factor	Output
A	1200	0.6	720
B	600	0.8	480
C	1100	0.9	990
D	800	0.7	560
E	650	0.7/0.9	455/585
F	900		
G	650	0.9/0.7	585/455
H	700		
I	1000		

The installed capacity of E, G and H together is 2000. If their combined utilization factor is 0.66, their output must be (2000) (0.66), i.e., 1320 MW. Since we already know that the output of E and G together is 1040, the output of H is 280 MW. Since plant H's capacity and output are known, its utilization factor
= 280/700 = 0.4.
The utilization factor of the only two remaining plants, F and I will be 0.5 each.

Power plant	Installed capacity (in MWs)	Utilization factor	Output
A	1,200	0.6	720
B	600	0.8	480
C	1,100	0.9	990
D	800	0.7	560
E	650	0.7/0.9	455/585
F	900	0.5	450
G	650	0.9/0.7	585/455
H	700	0.4	280
I	1,000	0.5	500
Total	7,600		5,020

Net capacity factor = Total output / Total installed capacity = 5020/7600 = 0.66

40. Contribution of plants H and C = [(990 + 280)/ 5020] × 100 = 25.3%

41. The question cannot be answered as the utilization factor of E cannot be uniquely determined (it can be 0.7 or 0.9).

42. The installed capacity of Plant F is 900 MW.

43. Export in 2008 = P − D + S_{2007} − S_{2008}

$= 500 − 500 + S_{2007} - \dfrac{20}{100}(500)$

$= S_{2007} − 100 = S_{2007} − 100$

But it is given to be 10 units.

∴ $S_{2007} = 110$

$\Rightarrow \quad \dfrac{20}{100}(P_{2007}) = 110$

$\Rightarrow \quad P_{2007} = 550$ units

44. Let x be the storage percentage.

Export in 2009 $= 350 − 440 + \dfrac{x}{100}(500 − 350)$

If there is neither export nor import, export = 0

∴$0 = 350 − 440 + \dfrac{x}{100}150$

$x = 60\%$

∴ When storage percentage is 60, there is neither export nor import.

But in 2010 the export $= 400 + \dfrac{x}{100}(350 - 400)$

The value can never be zero. Hence, there is an import. Similarly, there is either import or export in 2012 and 2015.

∴ There are three such instances.

45. Export $= 600 − 500 + \dfrac{x}{100}(480 − 600)$

$= 100 + \dfrac{x}{100}(-120)$

But there is neither an import nor an export.

∴$0 = 100 + \dfrac{x}{100}(-120)$

$\Rightarrow x = \dfrac{10000}{120} = 83.33$

46. The export (E) or import (I) will be as follows:

Year	P	D	E	I
2009	350	440	–	75
2010	400	400	–	5
2011	280	380	–	88
2012	480	510	–	50
2013	600	500	88	–
2014	600	600	–	–
2015	550	480	75	0

The imports in 2009 are equal to the exports in 2015.
∴ 2009 + 2015 = 4010
But the imports in 2011 are equal to the exports in 2013.
∴ 2011 + 2013 = 4010

Solutions for questions 47 to 50:

6's		
Kohli	12.5%	$\frac{1}{8}$
Rohit	16.66%	$\frac{1}{6}$
Dhoni	20.83%	$\frac{5}{24}$
Dhawan	41.67%	$\frac{5}{12}$
Rahane	8.33%	$\frac{1}{12}$

4's		
Kohli	16.66%	$\frac{1}{6}$
Rohit	27.77%	$\frac{5}{18}$
Dhoni	20%	$\frac{1}{5}$
Dhawan	22.22%	$\frac{2}{9}$
Rahane	13.33%	$\frac{2}{15}$

Let the number of 4's and 6's be 90 K_1 and 24 K_2, respectively.
Choice total runs scored in 4's = 90 K_1 × 4
Total runs scored in 6's = 24 K_2 × 6

For K_1, K_2 = 1
Runs scored 4's 6's by the 5 bats men: 90 × 4 24 × 6
They scored 77.77% of their total runs in 4's and 6's.
360 + 144 = 504
Their total score = $\frac{9}{7}$ (504) = 648 runs.

Now this is 90% of India's total score.
$\frac{9}{10}$ (India's total Score) = 648

Therefore, India's total score = 720
We can check that no other combinations satisfy the given conditions.

Runs scored				
Batsmen	4's	6's	In 1's and 2's	Total runs
Kohli	60 (15)	18 (3)	30	108
Rohit	100 (25)	24 (4)	38	162
Dhoni	72 (18)	30 (5)	42	144
Dhawan	80 (20)	60 (10)	22	160
Rahane	48 (12)	12 (2)	12	72

47. Rahane scored 48 + 12 = 60 runs in 4's and 6's whereas his total score was 72.
$$\frac{62}{72} \times 100 = 83.33\%$$

48. The total number of 4's and 6's hit by Dhawan was 30. 20 boundaries and 10 over boundaries.
20 + 10 = 30

49. The total runs scored by Dhawan in 6's = 60
Total runs scored by Rohit in 4's = 100
Now, 60 is less than 100 by
$$\frac{40}{100} \times 100 = 40\%$$

50. Kohli scored 30 runs out of a total of 108 runs in 1's and 2's.
Now, $\frac{30}{108} \times 100 = 27.77\%$

EXErcISE-3

Solutions for questions 1 to 3:
  Value of A is = 28 + 21 + 12 = 61
  Value of B is = 13 + 11 + 6 + 20 + 3 + 25 + 21 = 99
  Value of C is = 6 + 20 + 14 + 17 + 5 + 19 = 81
  Value of D is = 9 + 29 + 17 + 2 + 17 + 30 + 8 + 3 = 117
  Value of E is = 17 + 11 + 12 + 9 + 29 + 17 + 14 + 20 + 11 = 140
  Abhinav's height = 3 × 117 – 3 × 61 = 168

Bindia's height = E ÷ Only no. inside the right-angled triangle X
The smallest number in the square
Bindia's height = 140 ÷ 5 × 2 = 56
Chetan's height = 20 + 17 = 37
Dravid's height = 21 + 6 + 11 + 20 + 14 + 17 + 9 + 29 + 19 + 30 = 194
Enosh's height = 13 + 11 + 20 + 21 + 25 + 9 + 17 + 29 + 19 + 30 = 194

1. Difference in the heights of Bindia and Abhinav is 168 – 56 = 112.

2. The tallest person is Enosh.

3. Suman's height = 20 + 17 = 37
Dravids height = 146
∴ Difference = 146 – 37 = 109.

Solutions for questions 4 to 7: Let the total runs scored by Gaurav, Sheru, Tenchin and Drahul in their first five matches be G, S, T and D, respectively.

From (1), we get: $\dfrac{18}{100}$ G ≤ $\dfrac{15}{100}$ D

⇒ $\dfrac{D}{G} ≥ \dfrac{6}{5}$ →   (1)

From (2), we get: $\dfrac{21}{100}$ T ≥ $\dfrac{24}{100}$ S ⇒ $\dfrac{T}{S} ≥ \dfrac{8}{7}$ →   (2)

From (3), we get: $\dfrac{7}{100}$ T ≤ $\dfrac{1}{1}\dfrac{12}{100}$ G

⇒ $\dfrac{G}{T} ≥ \dfrac{7}{6}$ →   (3)

4. $\dfrac{23}{100}$ D ≥ $\dfrac{23}{100}\dfrac{6}{5}$ G ≥ $\dfrac{27.6}{100}$ G

But Gaurav scored only 25% of the total runs in his fourth match. Hence, Drahul scored more than Gaurav in the fourth match. Similarly, Drahul scored more than Sheru and Tenchin, and hence, he is the highest scorer.

5. Given $\dfrac{18}{100}$ D = 126

⇒ D = 700

$\dfrac{D}{T} = \dfrac{D}{G}\dfrac{G}{T} ≥ \dfrac{6}{5}\dfrac{7}{6}$

⇒ T ≤ $\dfrac{5}{7}$ D

⇒ T ≤ 500

6. Required ratio = $\dfrac{\dfrac{18}{100}G}{\dfrac{24}{100}S}$

= $\dfrac{3G}{4S} = \dfrac{3}{4}\dfrac{G}{T}\dfrac{T}{S} ≥ 1$

The ratio is at least 1.

7. For Drahul the highest score in any match is $\dfrac{23}{100}$ D

≥ $\dfrac{23}{100}\dfrac{6}{5}$ G
(i.e., 27.6%)

≥ $\dfrac{23}{100}\dfrac{7}{5}$ T
(i.e., 32.2%)

≥ $\dfrac{23}{100}\dfrac{8}{5}$ S
(i.e., 36.8%)

But none of G, T and S had more than these percentages as scores in any match.
∴ Drahul scored the highest.

Solutions for questions 8 to 12: On day 1, Q and V both scored one point each. So, they would have drawn their match. On day 6, Q again drew with T and on day 4, T drew with S.

∴ Q, V, T and S are in one group and P, R, W and U are in the other group.
The matches on the different days which can be directly obtained from the table are:

Day 1	P	Q – V
Day 2	U – W	S
Day 3	P – W	T
Day 4	U	S – T
Day 5	W	S
Day 6	U	Q – T

Since U scored 7 points, it did not lose to P. As P won on Day 1 and played W on Day 3, P would have won against R on Day 1. U would have won against P or R on Day 4 and the other team (R or P) on Day 6.

In the second group as T had played on Day 4 and Day 6, it beat V on Day 3 and Q cannot play on Day 3 as it had already played on Day 1 and Day 2. The final table would be as follows:

Day 1	P – R	Q – V
Day 2	U – W	S – Q
Day 3	P – W	T – V
Day 4	U – P/R	S –T
Day 5	W – R	S –V
Day 6	U – R/P	Q – T

8. P, R, U and W are in one group.

9. T and V played on Day 3.

10. R and V lost on Day 5.

11. Among the given teams, W and R played on Day 5.

12. U could have won against P or R on Day 4.

Solutions for questions 13 to 16: It can be seen that the expenses on account of forex loses is only for Company Y. As it is 17% of the total expenses of Company Y and 8.5% of the merged entity, the expenses of Company Y is 50% of the total expens-

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es of the merged entity. As the expense under taxes are only for companies X and Y, the taxes paid by Company Y would account for $\frac{14}{2}$ = 7% of the taxes paid by the merged entity while the remaining 5.1% of the taxes paid was due to Company X.

17% of X = 5.1% of ($x + y + z$)

∴ x = 30% of ($x + y + z$)

∴ Ratio of expenses of X, Y and Z = 3 : 5 : 2.

13. Ratio of expenses of companies X and Y = 3 : 5

14. Forex loses of Company Y = 8.5% of total

depreciation expenses of Company Z = 19 × $\frac{2}{100}$ = 3.8% of total

Required ratio = $\frac{8.5}{3.8}$ × 100 = 223%

15. As the total expenses of the companies are in the ratio 3 : 5 : 2, the wage bill of Company Y would be the highest as 16% of 5 > 22% of 3 > 22% of 2.

16. Assume the expenses of X, Y and Z are `300, `500 and `200, respectively.

∴ Taxes paid by company Z = `50

Share of taxes paid = $\frac{171}{1050}$ × 100 = 16.3%

Solutions for questions 17 to 20: As the name of the players are given in the order in which they came to bat, Rahul and Dhawan are the openers. As the first wicket fell at the score of 22, it has to be Rahul as Dhawan scored 27 runs. The next wicket has to be Dhawan as 32 runs were scored between the fall of the first and the second wickets and Pujara scored 35 runs. Using the same logic, the third wicket to fall was that of Pujara. When the fourth wicket fell, India's score was 121. As the first three batsmen scored 11 + 27 + 35 = 73 runs and Kohli scored 53 runs, had Kohli been out, India's score had to be at least 73 + 53 = 126 runs. Therefore, Rahane was the fourth batsman out. Similarly, Kohli was the fifth to be out. Now, the batsmen who were out have scored 11 + 27 + 35 + 53 + 6 = 132 runs. As the next wicket fell at 157, it was Saha (6th wicket). The seventh wicket was that of Pandya and the eighth Jadeja. The next wicket (9th wicket) can be Ashwin or Umesh. Had Ashwin been the 9th batsman out, the scores of all players till that point adds up to 231, which means all the 5 extra runs in India's innings happened during the last wicket partnership.

17. The third batsman to be out was Pujara.

18. The last batsmen to be out cannot be determined.

19. By the time Pandya was out, India had lost seven wickets.

20. In the case mentioned, Umesh was the 10th batsman to be out.

Challenge Your Understanding
Practice Set 1

Directions for questions 1 to 4: Answer these questions on the basis of the information given below.

The table below gives the process of manufacture of four different products A, B, C and D, each of which has to pass through all the four machines 1, 2, 3 and 4.

Product / Machine	A	B	C	D
1	(6, 1)	(4, 1)	(3, 1)	(6, 2)
2	(8, 2)	(5, 1)	(6, 2)	(4, 1)
3	(3, 1)	(4, 2)	(6, 1)	(5, 1)
4	(5, 1)	(4, 1)	(5, 1)	(6, 2)

Each product should pass through machines 1, 2, 3 and 4 in that order, before it is ready. For each machine the first figure in bracket indicates the quantity (in units) of the corresponding product made, while the second indicates the time taken to produce that quantity.

For example, machine 1 can produce 6 units of product D in 2 hours or 1 unit every 20 minutes.

Each day only one type of product can be made and each day the working time is from 9.30 a.m. to 5.30 p.m. All machines are operated in such a way that any unit that is started on a day is finished by the end of that day. The selling prices and the percentage profit on each of the products is as given below.

Product	A	B	C	D
Selling price	275	504	234	345
Profit percentage *	10	12	30	15

* as a percentage of cost price.
All machines operate simultaneously.

1. What is the maximum number of units of any product that can be manufactured in a single day?

2. If the maximum revenue is to be realised on a day, then which product should be manufactured on that day? (All the quantity that is manufactured is sold on that same day)

3. To get the maximum profit on a single day which of the following should be produced?

4. Considering the day on which the maximum profit is earned, the total idle time of all the machines put together is (in mins)

Directions for questions 5 to 8: Answer these questions on the basis of the information given below.

Dandia Times, a national daily, decided to conduct a poll regarding the qualities which the people expect their Prime Minister to have. For this, Dandia Times surveyed exactly 100 respondents from each of the six major cities, namely Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad.

In each city mentioned, each of the 100 respondents was given a response sheet listing out the five qualities that the Prime Minister was expected to have. Each respondent could mark one or more of the five given qualities that he expected in the Prime Minister, otherwise the respondent should mark a special option provided, which read 'None of the five qualities'. The following table gives, for each of the six cities, the number of people who expected each of the five given qualities in the Prime Minister.

Qualities / Cities	Integrity	Political experience	Academic qualification	Public speaking skills	Leadership qualities
Delhi	35	63	35	48	26
Mumbai	42	32	42	25	27
Kolkata	55	26	38	37	48
Chennai	62	18	83	41	33
Bangalore	47	15	41	28	25
Hyderabad	51	29	47	39	36

For example, of the 100 persons surveyed in Delhi, the table shows that 35 persons expect the quality of 'integrity' in the Prime Minister.

5. Among the people surveyed in all the six cities put together, what is the maximum number of people who expected all the five listed qualities in the Prime Minister?

6. At least how many of the people surveyed in Bangalore expected a minimum of two of the five listed qualities in the Prime Minister?

7. If in Hyderabad, none of the persons surveyed expected more than three of the five listed qualities in the Prime Minister, then what is the minimum number of people surveyed in Hyderabad who expected exactly three of the five qualities in the Prime Minister?

8. At most how many of the people surveyed in Delhi and Chennai, put together, expected at most two of the five listed qualities in the Prime Minister?

Directions for questions 9 to 12: These questions are based on the following data.

Twelve teams took part in a football tournament, which is conducted in three stages. In the first stage the teams are divided into two groups of six teams each. The teams within a group play with each other once and the top three teams of each group go to the second stage. In the second stage, the three teams of each group play with each other once and the top two teams from each group then go to the third stage. In this stage, the two teams in each group play with each other and the winners from each group play with each other to decide the winner of the tournament. All games produce results. In case of a draw, a penalty shootout is used to decide the winner. In case of a tie, at the end of any of the first two stages the winner is decided by a set of complex tie breaking rules to ensure that only one team goes into the next round.

9. What is the total number of matches in the tournament?

10. What is the minimum number of games a team should win to ensure that it goes into the second stage?

11. Of all the teams that reached the second stage, what is the minimum number of games a team could have won?

12. If a team gets `50,000 for each win in the first stage, `1,00,000 in the second stage and `1,50,000 in the third stage, find the maximum amount that any team can win.

Directions for questions 13 to 16: Answer these questions on the basis of the information given below.

Mr. Anand is planning to set up a small-scale unit to manufacture water tanks. He can manufacture three types of tanks – 250 L, 500 L and 1000 L tanks. The costs involved are machinery rent and a variable cost which depends on the type and number of tanks made. The rent for machinery for making the 250 L and 500 L tanks is `1.2 lakh per month and the variable costs involved are `500 and `700 for a 250 L tank and a 500 L tank, respectively. For the manufacture of a

1000 L tank, the machinery would cost `1.7 lakh per month and the variable cost is `900 for a tank. He also has the option of renting machinery for `2.5 lakh per month, which can manufacture all the three types of tanks with the variable costs being `250, `400 and `700 for a 250 L, a 500 L and a 1000 L tank, respectively.

13. What is the least cost incurred per tank if Anand has to manufacture 900 tanks of 250 L capacity each month?

14. Anand decides to manufacture only 250 L tanks. What is the minimum number of tanks that he should manufacture so that the machinery which can manufacture all the three types of tanks is the economically viable option?

15. If Mr. Anand manufactures 2,500 units of 1000 L tanks per month, then what is the lowest price (in `) at which he should sell each tank to make a profit of 15%?

16. If Mr. Anand sells tanks of 500 L capacity at a price of `1300 per unit and makes a profit of `200 per unit, then how many 500 L tanks did he sell?

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

A family consists of four persons, namely Rama, Jaya (Rama's wife), Hari (Rama's son) and Harini (Hari's wife). Rama's salary and Harini's salary put together is `24,000. Rama's salary is 25% of his son's and Harini's salary put together. Harini's salary is `15,000 less than Hari's salary. Jaya doesn't work and takes good care of her family and each member of the family rewards her by giving 10% of his/her salary and she donates 10% of what she receives to an old age organization and saves the rest.

17. What is Hari's salary (in `)?

18. What is the savings of Jaya (in `)?

19. The amount Jaya donates to the old age organization is what percentage of the total salary of all the members of the family?

Directions for questions 20 to 23: Answer these questions on the basis of the information given below.

The famous business school, IIM-P, has six branches, one in each of six different cities, such as in Delhi, Hyderabad, Mumbai, Bangalore, Chennai and Kolkata with an intake of 100 students in each branch. During the placement week, all the 100 students at each of the six branches attended job interviews. The distribution of the number of students with different specialisations and the number of students placed in various sectors is given in the following tables. Table P.1 gives the distribution of the students at each of the branches, based on their specialization and Table P.2 gives the distribution of the students at each of the branches, based on the sector in which they got placed.

Table P.1

Specialization	Delhi	Hyderabad	Mumbai	Bangalore	Chennai	Kolkata
Retail	24	15	10	16	20	20
HR	10	12	14	22	16	10
Information Systems	12	17	25	14	15	22
Finance	24	14	16	10	18	22
Operations	16	22	17	25	14	10
Marketing	14	20	18	13	17	16

Table P.2

Specialization	Delhi	Hyderabad	Mumbai	Bangalore	Chennai	Kolkata
Retail	34	20	22	20	22	27
IT	10	14	14	18	10	14
ITES	10	18	12	10	25	13
Banking	16	16	10	18	18	22
Telecom	18	19	25	14	9	14
Automobile	12	13	17	20	16	10

Further, it is also known that,

(i) All the students who had specialized in Retail, got placed in the Retail sector.

(ii) None of the students, who got placed in the Automobile sector, specialized in marketing.

(iii) All students who had specialized in Information Systems, got placed in either the IT or ITES sector.

(iv) None of the students who got placed in the Banking sector, specialized in either Finance or Operations.

Note: All students had exactly one job offer and each one of them had taken up exactly one specialization.

20. The number of students, at all the branches put together, who specialized in HR but got placed in the Retail sector, is at most

21. The number of students, at all the branches put together, who specialized in Marketing but got placed in the Banking sector, is at least

22. If none of the students who specialized in Finance got placed in the Automobile sector, the number of students, at all the branches put together, who specialized in Operations but got placed in the IT sector, is at most

23. What percentage of students who got placed in IT or ITES sector did not specialize in information systems?

Directions for questions 24 to 27: Answer these questions on the basis of the information given below.
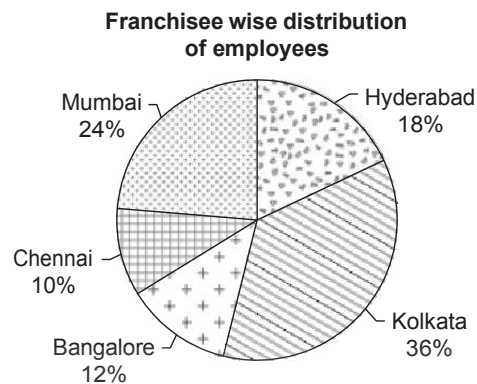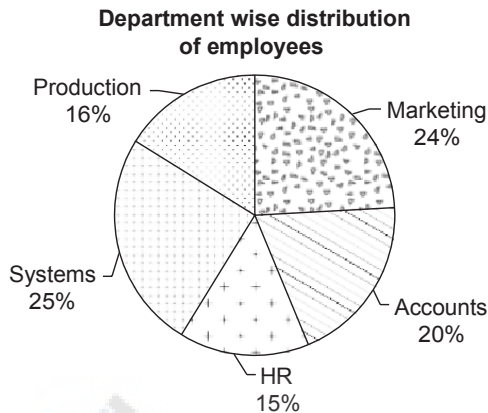
The following table gives the distance (in kms) between 10 cities which Mr. Anand plans to visit. The cities A to J, not necessarily in that order are in a straight line and he plans, to start his journey from his home in city G. The distances given are the distances from the southernmost city C.

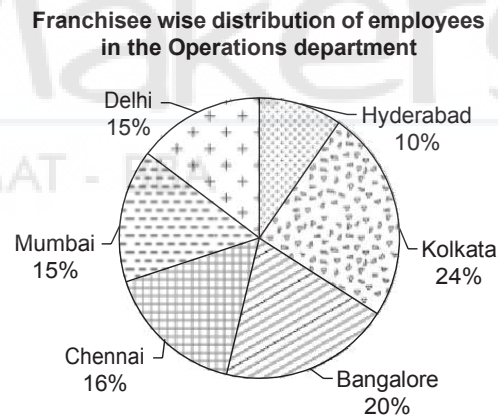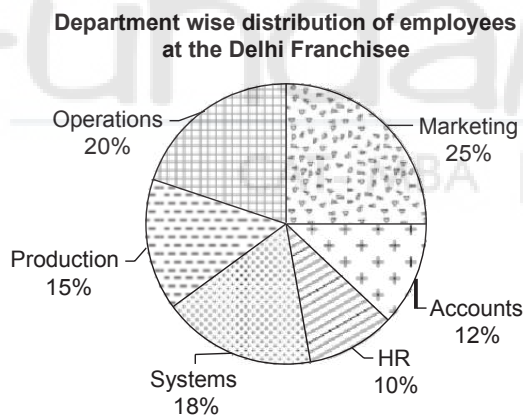|	A	B	C	D	E
F	160	280	65	190	305
G	105	225	120	135	250
H	180	60	405	150	35
I	30	150	195	60	175
J	65	55	290	35	80

24. What is the distance between cities G and I (in kms)?

25. The northernmost city among the given ten cities is

26. If Mr. Anand has to visit all the ten cities, then the total distance he has to travel is (in kms)

27. What is the least distance between any two of the given ten cities (in kms) is?

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

In company XYZ, which has a total of six franchisees, the head of the HR department wanted to find out the department wise as well as the franchisee wise distribution of all the employees in the company. The HR department started the task but as the number of employees working in the Operations department at the Delhi franchisee was not known, the employees of the Operations department at all the franchisees were left out while representing the department wise distribution. Further, all the employees at the Delhi franchisee were left out while representing the franchisee wise distribution of the total employees. The pie charts thus obtained were as follows.

Department wise distribution of employees

- Production 16%
- Marketing 24%
- Accounts 20%
- HR 15%
- Systems 25%

Franchisee wise distribution of employees

- Mumbai 24%
- Hyderabad 18%
- Chennai 10%
- Kolkata 36%
- Bangalore 12%

After the exact number of employees in the Operations department of the Delhi franchisee was known, two more pie charts, one for the department wise distribution of the employees at the Delhi franchisee and the other one for the franchisee wise distribution of the employees in the Operations department, were drawn as shown below.

Department wise distribution of employees at the Delhi Franchisee

- Operations 20%
- Marketing 25%
- Accounts 12%
- HR 10%
- Systems 18%
- Production 15%

Franchisee wise distribution of employees in the Operations department

- Delhi 15%
- Hyderabad 10%
- Mumbai 15%
- Kolkata 24%
- Chennai 16%
- Bangalore 20%

28. If the total number of employees at the Delhi franchisee is the same as that of the Bangalore franchisee, then what percentage of the employees working at the Mumbai franchisee work in the Operations department?

29. If the total number of employees at the Mumbai franchisee forms 15% of the total number of employees at all the franchisees put together, what is the ratio of the number of employees working in the Accounts department at all the franchisees put together to that of the total number of employees working at the Chennai franchisee?

30. If the total number of the employees in the company XYZ is known, then which of the following additional statements can enable one to find the total number of employees in each department?

(1) The number of employees in the Marketing department at the Hyderabad franchisee.
(2) The number of employees in the Systems department at the Chennai franchisee.
(3) The number of employees in the Operations department at the Mumbai franchisee.
(4) The number of employees in the Accounts department at the Chennai franchisee.

Mark your answer as the number of the required statement.

ANSWER KEYS

1. 22	**6.** 14	**11.** 2	**16.** 300	**21.** 24	**26.** 535
2. (D)	**7.** 2	**12.** 7,50,000	**17.** 28,500	**22.** 51	**27.** 25
3. (C)	**8.** 184	**13.** 528	**18.** 4725	**23.** 37.5	**28.** 10
4. 618	**9.** 39	**14.** 520	**19.** 1	**24.** 75	**29.** 1.6
5. 139	**10.** 4	**15.** 920	**20.** 35	**25.** H	**30.** 3

SOLUTIONS

Solutions for questions 1 to 4:

1. Let us first calculate the time taken to produce a unit of each product.
   Product – A – Machine 1 takes 10 minutes.
   From the 11th to the end of 25th minute, machine 2 is working on product A.
   From the beginning of the 26th minute to the end of 45th minute machine 3 works on product A and for the next 12 minutes machine 4 works on A.
   1 unit of product A is completed in 57 minutes.
   When machine 2 is working on a unit of product A, machine 1 can operate on the next unit of product A and so on.
   After the first unit of product A is completed, every succeeding unit is produced in 20 minutes and this time is determined by the slowest unit in operation. (machine 3 in this case).
   So, one unit of product A is manufactured after 57, (57 + 20), (57 + 20 + 20) minutes and so on.
   That is 57, 77, 97, ...
   . In 480 minutes, 22 units can be produced.
   Similarly, for B, each unit is produced in 72, (72 + 30) minutes and so on.
   . In 8 hours, 14 units can be completed.
   For machine C first unit is produced after 62 mins and each succeeding one after a 20 minutes interval.
   . In 8 hours, 21 units can be produced.
   For machine D each unit is produced in 67, (67 + 20) minutes and so on.
   . In 8 hours, 21 units can be produced.

2. Revenues per day:
   For A – 22 × 275 = 6050
   For B – 14 × 504 = 7056
   For C – 21 × 234 = 4914 and
   For D – 21 × 345 = 7245
   'D' realises maximum revenue.

3. The profit for each unit is as follows:
   A – `25
   B – `54

   C – `54 and
   D – `45
   Profit for A – 25 × 22
   Profit for B – 54 × 14
   For C – 54 × 21 and
   For D – 45 × 21
   By observation we can say that the profit is maximum for C.

4. For maximum profit, product C has to be manufactured.
   For 21 units of C, machine I needs to operate for 21 × 20 = 420 minute.
   Idle time = 480 – 420 = 60 minutes
   For 2, idle time = 60 minutes.
   For 3, idle time = 270 minutes.
   For 4, idle time = 228 minutes.
   Total = 60 + 60 + 270 + 228 = 618 minutes.

Solutions for questions 5 to 8:

5. The maximum number of people who expected all the five listed qualities in the Prime Minister is at most 26 (Delhi) + 25 (Mumbai) + 26 (Kolkatta) + 18 (Chennai) + 15 (Bangalore) + 29 (Hyderabad) = 139.

6. The number of people who expected a minimum of two of the five listed qualities occurs when the number of people expecting exactly one quality and the rest expect all the five qualities.
   Total in Bangalore = 47 + 15 + 41 + 28 + 25 = 156
   If x people expected exactly one quality and y people expected all the five qualities.
   $x + y = 100$ and $x + 5y = 156$
   . $x = 86$ and $y = 14$.

7. As no person expected more than three qualities, to find the minimum number of people who expected exactly three of the five qualities occurs when the number of people expecting exactly two qualities is the maximum.
   Total instances in Hyderabad
   = 51 + 29 + 47 + 39 + 36 = 202.
   If 'a' people expected exactly two qualities and 'b' people expected exactly three qualities,

$a + b = 100$ and $2a + 3b = 202$

$\therefore a = 98$ and $b = 2$

At least two people in Hyderabad expected exactly three of the five listed qualities in the Prime Minister.

8. The people who expected at most two of the listed qualities would be maximum when a maximum number of people expect two qualities and the rest, all the five qualities. Total instances in Delhi = 207.

If 'a' persons expects two qualities and 'b' persons expect five qualities,

$a + b = 100$ and $2a + 5b$ 207.

The maximum value of 'a' is 97.

Similarly, in Chennai, $a + b = 100$ and $2a + 5b$ 237

The maximum value of 'a' is 87.

$\therefore$ Maximum persons at both the places combined = 97 + 87 = 184.

Solutions for questions 9 to 12:

9. There are 30 matches in the first stage, six matches in the second stage and three matches in the next stage. A total of 39 matches.

10. The wins of different teams can be as follows. The teams are arranged in descending order of the number of wins. If a team wins 4 matches, there can't be 3 other teams with a better performance.

5	4	3	2	1	0
4	4	4	2	1	0
4	4	3	2	2	0
4	4	3	2	1	1
4	4	2	2	2	1
4	3	3	3	2	0
4	3	3	3	1	1
4	3	3	2	2	1
4	3	2	2	2	2
3	3	3	3	3	0
3	3	3	3	2	1

From the last row we see that there are five teams with three wins each. So, two teams with three wins will get eliminated. So, three wins are not enough.

11. If the top two teams win 5 and 4 matches, then out of the remaining 6 match results, a team which wins 2 matches can reach the second stage.

12. The top team can win at most 5 games in the first stage, 2 in the second and 2 in the third.

$\therefore$ The amount won by the top team in rupees

= (5 × 50,000) + (2 × 1,00,000) + (2 × 1,50,000)

= 7,50,000

Solutions for questions 13 to 16:

13. The cost incurred would be

(a) 1.2 lakhs + 900 × 500 = 5.7 lakhs

(b) 2.5 lakhs + 900 × 250 = 4.75 lakhs

The least cost incurred per tank would be $\dfrac{4.75 \text{ lakhs}}{900}$

= `528

14. If he uses the machinery which costs 2.5 lakhs per month, he would incur an additional cost of `1.3 lakhs but his variable cost would be less by `250 per tank.

$\therefore$ Minimum tanks that has to be manufactured =

$\dfrac{1.3 \text{ lakhs}}{250} = 520$.

15. For manufacturing 2500 tanks, the cost would be minimum if he rents the machinery which costs `2.5 lakhs. The cost incurred would be = 2.5 lakhs + 700 × 2500 = 20 lakhs.

$\therefore$ Amount per tank = $\dfrac{20 \text{ lakhs}}{2500} = 800$.

For a 15% profit he should sell it at `920.

16. The cost price of Mr. Anand = `1100 per tank.

In case he uses the first machinery, if x tanks are manufactured, 1.2 lakhs + 700x = 1100x

$\therefore x = 300$

If he uses the second machinery, if x tanks are manufactured, 2.5 lakhs + 560x = 1100x

700x = 2.5 lakhs

x = (not an integer).

Solutions for questions 17 to 19:

17. Let the salary of Rama, Hari and Harini be R, A and H, respectively.

R + H = 24000   (1)

R = 1/4(A + H)

$\Rightarrow$ 4R = A + H   (2)

A – H = 15000   (3)

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

A = `28,500.

18. A = `28,500, H = `13,500 and R = `10,500

Savings of Jaya (Mrs. Rama):

$\left(\dfrac{90}{100}\right)\left(\dfrac{1}{10}\right)[(28{,}500 + 13{,}500 + 10{,}500)] = 4725$

19. The amount Jaya donates is 10% of 10% of the salary of all the members of the family, i.e., 1%.

Solutions for questions 20 to 23:

20. Let us consider the HR students at each of the locations. As every Delhi student with a specialization in Retail got a job in Retail sector, 24 students who got jobs in Retail sector must have their specialization as Retail. Now of the 16 persons who got jobs in Banking sector, at most 14 can be from Marketing and the remaining 2 must be from

HR. Hence, a maximum of 8 persons of HR specialization got job in Retail sector.
Similarly,
Hyderabad = 5 students (i.e., 20 – 15 = 5)
Mumbai = 12 students (i.e., 22 – 10)
Bangalore = 4(20 – 16)
Chennai = 2 (i.e., 22 – 20)
Kolkata = As only 16 of the 22 students placed in Banking sector can be with Marketing specialization, remaining 6 must be with specialization in HR.
. Of the total 10 students placed in HR, only four can get the jobs in Retail sector.
. Total = 35

21. The minimum number of persons who specialized in Marketing and got a job in Banking sector at different locations is as follows.
  (i) Delhi = 6
 (ii) Hyderabad = 4
(iii) Mumbai = 0
(iv) Bangalore = 0
 (v) Chennai = 2
(vi) Kolkata = 12
Therefore, there is a total of 24 students.

22. The required number of students at different locations is
Delhi = 8
Hyderabad = 14
Mumbai = 1
Bangalore = 14
Chennai = 10
Kolkata = 4
Therefore, there is a total of 51.

23. Total number of placements in IT or ITES sectors = 168
Number of students specializing not in information systems and placed in IT or ITES sector $= \frac{63}{168} \times 100 = 37.5\%$.

Solutions for questions 24 to 27: As C is the southernmost city and as the cities are in a straight line, we have to find the distance of each city from C.
The corresponding distances are F – C = 65, G – C = 120, H – C = 405, I – C = 195, J – C = 290
To find the distance of cities A, B, D and E from C,
A – C
A – F = 160 and C – F = 65
A – G = 105 and C – G = 120
A – C = 160 – 65 = 95 or 160 + 65 = 225
and 120 – 105 = 15 or 120 + 105 = 225
As the common value is 225, the distance between A – C is 225.
Similarly, we can find the other values as B – C = 345, C – D = 255 and C – E = 370.
The ten cities according to their distance from C as

65	120	195	225	255	290	345	370	405
C 65 F 55 G 75 I 30 A 30 D 35 J 55 B 25 E 35 H

24. The distance between G and I is 75 kms.

25. As C is the southernmost city and the cities are in a straight line the city farthest from C would be the northernmost city, i.e., H

26. As he starts his journey from G, the shortest distance would be when he travels to C first and then travels northwards up to H, i.e., 405 + 120 = 525 kms

27. The least distance between any two cities is that between cities B and E, i.e., 25 kms.

Solutions for questions 28 to 35:

28. Given, 20% of the employees at the Delhi franchisee work in the Operations department and 15% of the employees in the Operations department work at the Delhi franchisee.
⇒ 20% of employees at the Delhi franchisee = 15% of the employees in the Operations department.

$$\frac{\text{Number of employees at the Delhi franchisee}}{\text{Number of employees in the Operations department}} = \frac{3}{4}$$

Let the number of employees in the company except at the Delhi franchisee be $100x$.
Total employees at the Bangalore franchisee = $12x$
Total employees at the Delhi franchisee = $12x$
Total employees at the Mumbai franchisee = $24x$
Total employees in the Operations department = $\frac{4}{3} \times 12x = 16x$

Of the employees in the Operations department, 15% of $16x = 2.4x$ work at the Mumbai franchisee.
Required percentage $= \frac{2.4x}{24x} \times 100 = 10\%$

29. Let the number of employees at all franchisee except at Delhi = $100x$
The employees working at the Mumbai franchisee = $24x$
The employees working at the Chennai franchisee = $10x$
Given that, employees at Mumbai form 15% of the total employees in the company.
Total employees in the company = $\frac{24x}{15} \times 100 = 160x$

Now the employees at the Delhi franchisee = $60x$
The employees in the Operations department = $80x$ (as 20% of the employees at the Delhi franchise form 15% of the employees in the Operations department)
Total employees in all the departments except Operations = $160x – 80x = 80x2$
Employees in the Accounts department = $\frac{20}{100}(80x) = 16x$
Required ratio = $16x : 10x = 8 : 5$

30. As the total number of employees in the company is known, we need either the number of employees in the Operations department or that at the Delhi franchisee. Hence, only (C) will be helpful in finding the required values.

Challenge Your Understanding
Practice Set 2

Directions for questions 1 to 4: Answer the questions on the basis of the information given below.

The table below gives the details about four different machines A, B, C and D. Each of the machines can produce four different types of products, X, Y, Z and W.

Product Machine	X	Y	Z	W
A	(20,2)	(30,3)	(40,1)	(30,2)
B	(30,3)	(40,2)	(60,1)	(30,2)
C	(30,1)	(40,2)	(80,4)	(30,1)
D	(15,1)	(20,1)	(40,2)	(80,4)

Each of the machines is allowed to operate for a total of 8 hours. The first figure in the bracket indicates the quantity (in units) of the product produced while the second numerical figure indicates the time taken (in hrs) to produce that quantity of that product. For example, machine A produces 20 units of X in 2 hrs.

Each machine operates independently and can produce only one type of product at any given point of time and produces the products X, Y, Z and W in that order and for the time period mentioned, i.e., machine A produces X for the first two hours, Y for the next three hours and so on. The same is the case with other machines. The machines produce any product at a uniform rate.

1. In the first 5 hours of operation, find the quantity of Z (in units) produced?
(A) 0
(B) 20
(C) 220
(D) 80

2. The quantity of W produced in the first x hours is at least 20. Which of the following is true?
(A) $x = 5$
(B) x 5
(C) $x = 3$
(D) $x = 4$

3. In the first four hours, by what percentage is the quantity of Y produced by B more or less than that of C?
(A) 50% less
(B) 50% more
(C) 100% more
(D) 62.5% less

4. What is the maximum quantity of any product produced in the first 4 hours?
(A) 90
(B) 95
(C) 100
(D) 110

Directions for questions 5 to 8: Answer the questions on the basis of the information given below.

The following two charts show the costs (in ` cr) and the profitability of six companies in the financial years (FYs) 2011–12 and 2012–13. Profitability is defined as the ratio of profit obtained to the costs, incurred, typically expressed in percentage.

Costs incurred
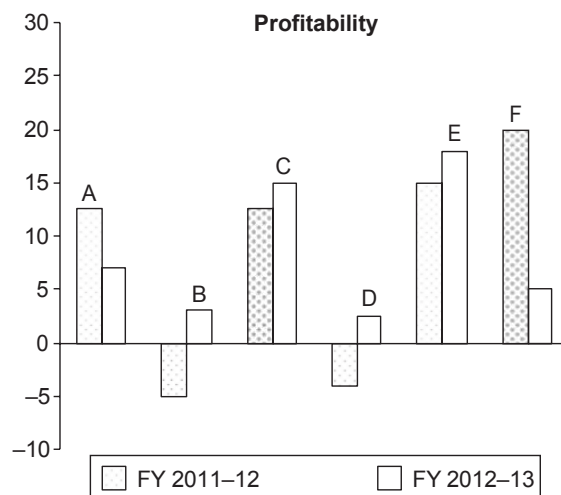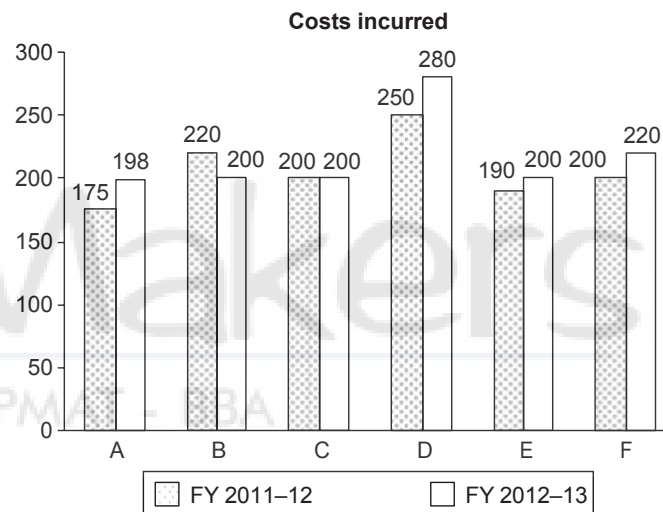
Profitability

The profits of four of these companies are plotted against their respective costs for 2012–13.
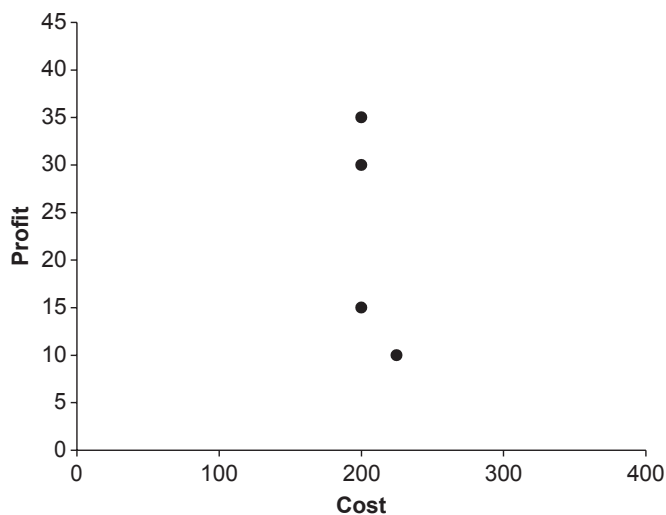
5. Which of the following statements is not true?
- (A) The company with the highest profitability in FY 2011–12 has the highest cost in FY 2012–13.
- (B) The company with the highest cost in the two financial years combined has the highest cost in FY 2012–13.
- (C) Companies with a higher cost in FY 2011–12 than in FY 2012–13 have higher profitability in FY 2012–13 than in FY 2011–12.
- (D) Companies with profitability between 10% and 20% in FY 2011–12 also have costs between 150 crore and 250 crore in FY 2012–13.

6. Which company recorded the highest profit in FY 2012–13?
- (A) A
- (B) E
- (C) F
- (D) C

7. What is the approximate average profit in FY 2011–12 of the companies which are excluded from the third chart?
- (A) –7.5 crore
- (B) 3.5 crore
- (C) –10.5 crore
- (D) –12.0 crore

8. The average profit in FY 2012–13 of the companies with profitability exceeding 10% in FY 2012–13, is approximately
- (A) 17.5 crore
- (B) 25 crore.
- (C) 27.5 crore
- (D) 32.5 crore

Directions for questions 9 to 12: Answer the questions on the basis of the information given below.

The following table gives details about ten business groups in the country.

Business group	No. of companies in the group	Total group turnover (` crore)	% share in group turnover of the largest company	% share in group turnover of the smallest company
A	7	3000	25	8
B	5	2250	32	10
C	4	3100	40	15
D	8	2500	26	7
E	5	5200	32	6
F	6	3700	29	11
G	3	10200	45	25
H	5	6350	30	13
I	6	4200	27	11
J	4	4950	36	10

9. What could be the maximum turnover (in `400 crore) of the third largest company of business group A?
- (A) 570
- (B) 600
- (C) 645
- (D) 672

10. At most how many companies of group D had a turnover of more than `400 crore?
- (A) 4
- (B) 3
- (C) 2
- (D) 1

11. What is the maximum turnover (in `crore) of the second smallest company of business group I?
- (A) 528
- (B) 586
- (C) 620
- (D) 651

12. At most how many companies of business groups B, E or F had a turnover less than `500 crore?
- (A) 6
- (B) 9
- (C) 8
- (D) 10

Directions for questions 13 to 16: Answer the questions on the basis of the information given below.

Business process outsourcing (BPO) companies get their revenue from two sources, such as data processing and voice processing. The average revenue received from each hour of voice processing is called ABRH. In the table below, the revenue received from voice processing as a percentage of total revenue received and the ABRH in US Dollars (USD) are given for twenty companies from A through T.

Company	ABRH (in USD)	Revenue from voice processing as a percentage of total revenue
A	1	9
B	2	8
C	1	11
D	1	17
E	2	15
F	4	13
G	3	13
H	2	22
I	2	42
J	6	12
K	7	15
L	6	18
M	6	21
N	7	25
O	9	11
P	9	20
Q	8	23
R	9	28
S	10	23
T	11	20

13. If it is known that the number of hours of voice processing is the same for companies A and P, then which of the following statements is true?
  (A) Total revenue is the same for both the companies.
  (B) Total revenue of company P is about four times that of company A.
  (C) Total revenue of company A is about four times that of company P.
  (D) Total revenue of company A is about two times that of company P.

14. If the number of hours of voice processing is the same for all the companies given, then which company has the highest total revenue?
  (A) A   (B) J
  (C) K   (D) None of these

15. It is expected that in another two years, i.e., in 2011, revenue from voice processing as a percentage of total revenue will be tripled for company A and doubled for company L. Assume that in 2011, the total revenue of company A is twice that of company L and that the number of hours of voice processing is the same for both the companies. What is the percentage increase of ABRH of company A, if there is no change in ABRH of company L?
  (A) 400   (B) 550
  (C) 800   (D) 950

16. If the total revenue is the same for the pair of companies listed in the choices below, choose the pair that has approximately the same number of hours of voice processing.
  (A) I and P   (B) M and Q
  (C) M and F   (D) B and H

Directions for questions 17 to 19: Answer the questions on the basis of the information given below.

  The following table provides the number of students writing MBA entrance exams in a year and the percentage of students, among those writing a particular exam, who write only that exam. The table gives data of all the MBA entrance exams in a year.

Exam	Students writing	
	That exam	Only that exam
CAT	1,95,000	56%
XAT	93,000	17%
IIFT	42,000	26%
SNAP	70,000	34%
CMAT	82,000	12%
MAT	36,000	24%

17. At most how many students wrote both CAT and XAT?
  (A) 87,280   (B) 85,800
  (C) 77,190   (D) None of these

18. The number of students who wrote all the six exams is at most_____.
  (A) 31,080   (B) 37,180
  (C) 24,820   (D) 27,360

19. What is the minimum number of students who wrote at least one of the six exams?
  (A) 2,48,160   (B) 2,64,010
  (C) 2,94,380   (D) None of these

Directions for questions 20 to 23: Answer these questions on the basis of the information given below.

  There are 100 students in class XII of Model School. The following table gives the break-up of students with respect to the marks scored by them in the three core subjects, such as Maths, Physics and Chemistry and the two language subjects English and Hindi. The maximum marks in each subject is 100 and a student needs to score at least 50 marks to pass.

Number of students with marks	Maths	Physics	Chemistry	English	Hindi
90 or above	18	24	28	21	26
80 or above	35	42	39	42	38
70 or above	52	58	55	58	47
60 or above	61	75	72	65	60
50 or above	87	93	88	88	82

20. What is the maximum number of students who failed in all the five subjects?

(A) 5   (B) 7
(C) 9   (D) 12

21. The number of students who passed in all the five subjects is at least_____.

(A) 93   (B) 87
(C) 82   (D) None of these

22. Students who score 90 or more marks in at least two of the core subjects and at least one of the language subjects are eligible for a scholarship. At most how many students would be eligible for the scholarship?

(A) 33   (B) 24   (C) 28   (D) 35

23. At most how many students scored 60 or more marks in at least four of the five subjects?

(A) 83   (B) 76   (C) 75   (D) 61

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

The pie charts show the distribution of the annual expenses and savings of Mr. and Mrs. Iyer and also the distribution of investment of their combined savings.

Mr. Iyer

Mrs. Iyer

Distribution of Savings
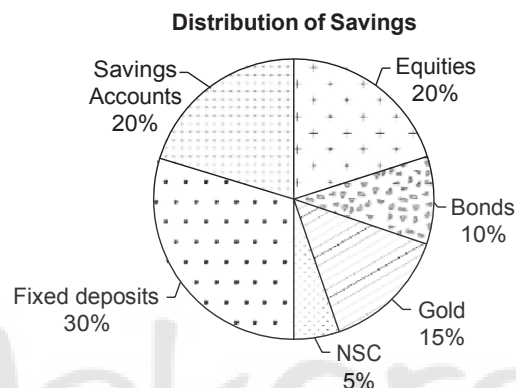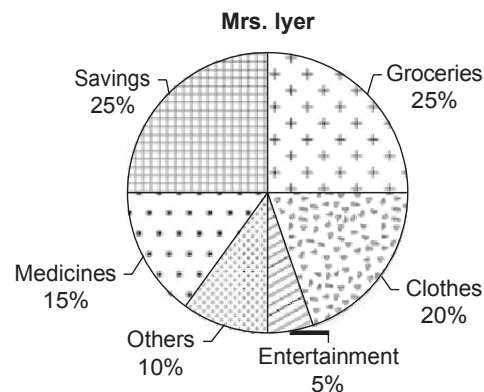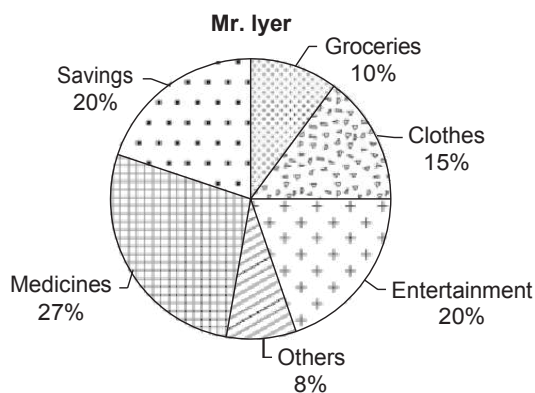
The total expenditure on any of the heads and also of the savings is the sum of the values of both the persons on that particular item.

24. If the total money invested by them in fixed deposits forms 15% of Mrs. Iyer's income, then what is the ratio of the incomes of Mr. and Mrs. Iyer?

(A) 4 : 5   (B) 3 : 2
(C) 7 : 5   (D) None of these

25. If the amount spent on clothes by Mr. Iyer is more than that by Mrs. Iyer, then the amount spent by Mr. Iyer on which of the following is definitely more than that by Mrs. Iyer?

(1) Groceries   (2) Medicines
(3) Others   (4) Entertainment
(A) Only 1 and 2   (B) Only 1, 3 and 4
(C) Only 2, 3 and 4   (D) Only 2 and 3

26. If the amount they invested in equities forms 4.55% of their combined total income, then Mrs. Iyer's salary is what percentage of Mr. Iyer's salary?

(A) 66.66   (B) 81.81
(C) 122.22   (D) 75

27. If the amount that is invested in savings accounts is the same as what Mr. Iyer spent on groceries, then the ratio of the amounts spent by Mr. and Mrs. Iyer towards entertainment is

(A) 10 : 3   (B) 3 : 1
(C) 5 : 3   (D) 2 : 1

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

While selecting the team for the Twenty20 World Cup, the selectors of the Indian team could not make up their mind regarding four batsmen namely B1, B2, B3 and B4 and five bowlers namely P1, P2, P3, P4 and P5 in the selection camp. Hence, they decided to conduct selection trials for these nine players. The trials were conducted in four sessions, such as S1, S2, S3 and S4 in a single day. The trials were conducted such that each batsman had to face the bowling of all the five bowlers in each of the four sessions. The following bar graphs exhibits the runs scored by the four batsmen in each session and the number of balls bowled by the five bowlers in each session.

Runs scored

Balls bowled
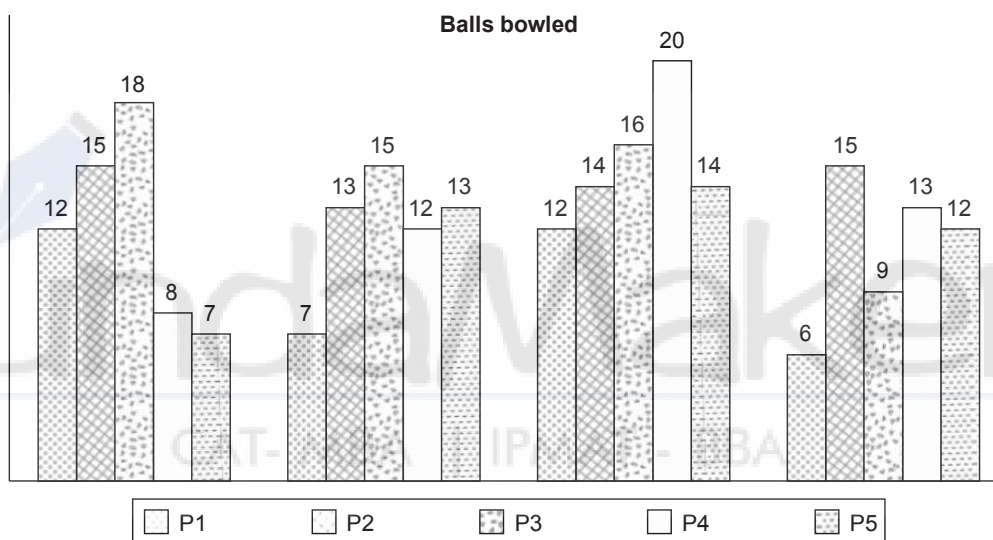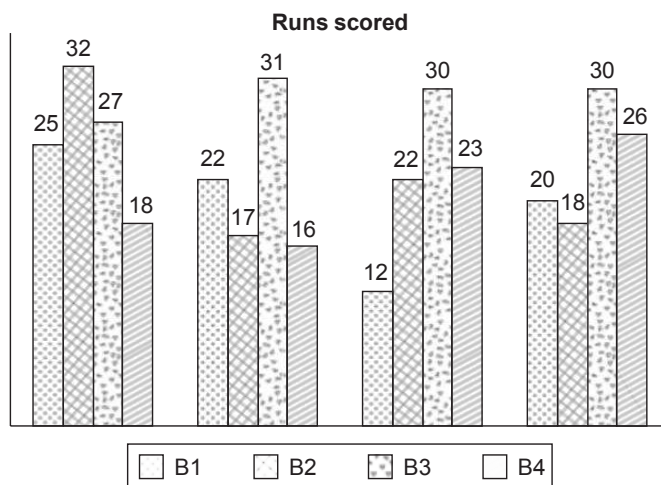
Further, the following information is also known:

(1) Strike rate of a batsman = $\dfrac{\text{Runs Scored}}{\text{Balls faced}} \times 100$

(2) Only 0, 1, 2, 3, 4 or 6 runs can be scored off a single ball and if 0 runs are scored off a ball, it is called a dot ball.

(3) In none of the sessions did any of the bowlers bowl more than one dot ball to a batsman.

(4) The bowlers bowl only to these four batsmen and the batsmen face the bowling of only these five bowlers.

Directions for questions 28 to 30: Type your answer in the space provided below the question.

28. The number of sixers (6 runs off a ball) scored off the bowling of P1 was at most. _____

29. The number of balls faced by batsman B2 was at least _____ .

30. The number of balls off which a single run (i.e., 1 run) was scored was at least _____ .

Directions for question 31: Select the correct alternative from the given choices.

31. If it is known that in each session, each of the bowlers bowled one dot ball to each batsman, then the minimum possible strike rate of B3 is _.
(A) 80.5   (B) 85.5
(C) 89.0   (D) 92.2

Directions for questions 32 to 35: Answer these questions on the basis of the information given below.

The cricket magazine Wisden, in its survey of the best one-day batsmen of the century, shortlisted six players, and then ranked them based on seven different parameters. In any parameter, these persons were ranked from 1 to 6 based on the decreasing order of the corresponding values for the players. In the following table, some of the values have been intentionally removed.

Batsman	Total innings played	Total runs scored	Total balls faced	Number of times not out	Number of times out	Average	Strike rate
Ponting		6	2	1		6	
Richards		5		6		4	
Sachin	6		1		3		2
Inzamam	4		6		4	2	4
Lara	2				6		3
Dravid		2	4	5			

The above header spans "Parameter" across all parameter columns.

In the above table, in any parameter, the person with rank 1 has the highest value and the person with rank 6 has the least value in the corresponding parameter. For example, Sachin faced the highest number of balls and Inzamam faced the least.

For any player:

(i) Total Innings played = Number of times out + Number of times not out

(ii) Average = $\dfrac{\text{Total runs scored}}{\text{Number of times out}}$

(iii) Strike rate = $\dfrac{\text{Total runs scored}}{\text{Total balls faced}}$

Further, these six players are allotted points such that the player with the highest 'Average' will get 12 points, the second highest is 10, the third highest is 8 and so on. Similarly, the person with the highest 'Strike Rate' will get 6 points, the second highest 5 points and so on.

In the end, the points obtained by them in both the parameters put together, are considered as total points.

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.

32. Which player has the highest number of total points?
  (A) Richards (B) Sachin
  (C) Inzamam (D) Lara

33. Which player has the least number of total points?
  (A) Ponting (B) Richards
  (C) Lara (D) Inzamam

34. In how many of the given seven parameters did Sachin get rank 1? _____

35. In how many of the given seven parameters did Sachin get a better (numerically lower) rank than Dravid? _____

Directions for questions 36 to 39: Answer these questions on the basis of the information given below.

The following table gives the details of 100 boys and 100 girls who take a test. The test consisted of three areas, such as Quant, Reasoning and English. The tables give the breakup of the students according to their marks in each area. The maximum marks in each area is 100.

Quant

Boys	Girls
17 (7 – 25)	21 (6 – 20)
31 (26 – 49)	32 (24 – 60)
15 (54 – 75)	27 (63 – 80)
37 (76 – 100)	20 (81 – 98)

Reasoning

Boys	Girls
15 (11 – 27)	22 (7 – 32)
19 (29 – 48)	29 (35 – 61)
31 (51 – 72)	30 (62 – 78)
35 (74 – 95)	19 (80 – 97)

English

Boys	Girls
21 (7 – 27)	15 (11 – 32)
36 (29 – 53)	27 (34 – 58)
27 (57 – 74)	21 (62 – 77)
16 (77 – 88)	37 (78 – 92)

For example, the table under Quant shows that there are 17 boys who scored marks in the range of 7 to 25 with the lowest mark being 7 and the highest being 25 and there are 21 girls who scored marks in the range of 6 to 20, with the lowest marks being 6 and the highest being 20.

36. The average score of the given students in the quant section is at least
(A) 42.17   (B) 44.66
(C) 47.32   (D) 49.65

37. The number of students who scored more than 70 marks in each section is at most
(A) 88   (B) 92
(C) 99   (D) None of these

38. The average score of the girls in the English section is at most
(A) 67.26   (B) 69.93
(C) 61.84   (D) 72.35

39. The average score of the boys in the reasoning section is at least
(A) 48.13   (B) 48.76
(C) 49.64   (D) 50.27

Directions for questions 40 to 43: Answer these questions on the basis of the information given below.

A school has a total of 6720 students. The ratio of the number of boys to that of girls in the school is 9 : 7. All the students are enrolled in at least one of the three classes among painting, dancing and singing. One-twelfth of the boys are enrolled only for painting classes. Twenty-five per cent of the girls are enrolled in only singing classes whereas one-tenth of the boys are enrolled in only singing classes. Twenty per cent of the girls are enrolled in both painting and singing classes only. The number of girls enrolled only for painting classes is 100 per cent more than the number of boys enrolled in the same. One-ninth of the boys are enrolled in all the three classes together. The ratio of the number of boys enrolled in both singing and dancing classes only to the girls enrolled in the same is 7 : 5. One-tenth of the girls are enrolled in only dancing classes whereas $8\frac{1}{3}$ per cent of the girls are enrolled in both singing and dancing classes together but not in painting. None of the girls are enrolled in both painting and dancing classes only. The number of boys enrolled in both painting and singing classes only is equal to half the number of girls enrolled in the same. None of the boys are enrolled in both painting and dancing classes only.

40. Find the total number of boys enrolled in painting.
(A) 1008
(B) 996
(C) 1058
(D) None of these

41. The total number of boys enrolled in dancing forms approximately what percentage of the total strength of the school?
(A) 36%   (B) 42%
(C) 48%   (D) 54%

42. Find the total number of students enrolled in all the three classes.
(A) 820   (B) 836
(C) 848   (D) 868

43. The number of boys enrolled in only singing forms what percent of the girls enrolled in the same?
(A) 51.43%   (B) 45.28%
(C) 56.57%   (D) 62.63%

*Directions for questions 44 to 46:* These questions are based on the following information.

A car manufacturer has three race cars, such as car I, car II and car III. He fields them in car races. If car I wins he gets 80% more than the amount he had deposited on that car for the race. If car II wins, he gets 40% more and if car III wins he gets 40% more, then the respective amounts deposited.

If a car does not win a race, the manufacturer loses 20% of the money he had deposited on that car. In each race he fields only two cars and deposits an equal amount on each and in each race only one car wins. On a certain day there are three races. Car I wins race 1, car III wins race 2 and car II wins race 3. money deposited for races 2 and 3 is equal to the amount with the manufacturer at the end of races 1 and 2 respectively. He ends up with `31,460 in the end.

44. How much amount did the car manufacturer deposit for race 1?
(A) `10,000        (B) `30,000
(C) `15,000        (D) `20,000

45. In which race did the car manufacturer get the maximum amount as profit?
(A) Race 2   (B) Race 1
(C) Race 3   (D) Race 1 or Race 3

46. If the manufacturer had fielded only car I in race 1, only car II in race 2 and only car III in race 3 and the performance (winning or losing) of these cars that are fielded remains the same (as given earlier), what would be his net profit by the end of race 3? (Assume that in each race he deposits all the money he has)
(A) `1520        (B) `3040
(C) `4320        (D) `2160

Directions for questions 47 to 50: Answer these questions on the basis of the information given below.

The bar graph gives details of the marks scored by ten students – P, Q, R, S, T, U, V, W, and X in an exam. The graph gives details of the difference in marks of P, Q, R, S, and T with respect to U, V, W, X and Y.
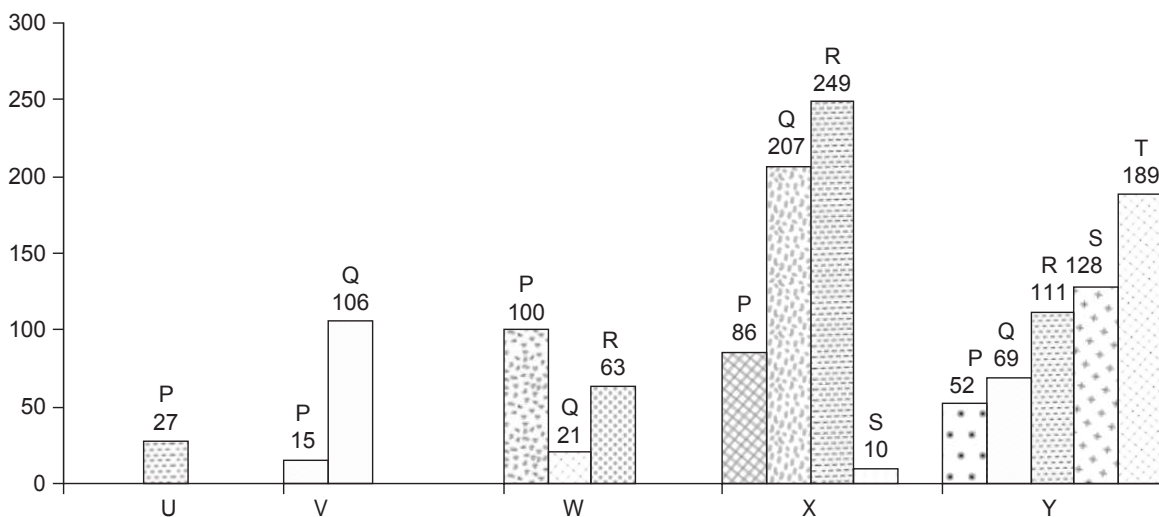
It is known that student Q had the second highest marks among all the ten students.

47. Who scored the highest marks among the ten students?
    (A) W   (B) R
    (C) P   (D) Cannot be determined

48. If Q scored 450 marks, what is the sum of the marks scored by P and R?
    (A) 821   (B) 786
    (C) 852   (D) Cannot be determined

49. Who among U, V, W, X and Y scored the highest marks?
    (A) U
    (B) W
    (C) Y
    (D) Cannot be determined

50. If it is known that P scored 565 marks, which of the following can be the marks scored by U?
    (A) 538
    (B) 567
    (C) 592
    (D) Cannot be determined

Directions for questions 51 to 54: Answer these questions based on the following data.

In a hockey tournament, each one of the five teams named as A, B, C, D and E played exactly one match with every other team. For a team, if the number of goals made in a match is greater than that conceded, then the match is a win. If the number of goals made is equal to that conceded, then it is a draw. If the number of goals made is less than that conceded, it is a loss. For a win, a team gets 10 points, for a draw the team gets 4 points, while for a loss, the team loses 5 points. In addition, for every goal made, a team gets 2 points and for every goal conceded, it loses one point. The team getting the greatest number of total points wins the tournament.

		Goals conceded			
Team	**A**	**B**	**C**	**D**	**E**
A	–	5	3	2	6
B	3	–	4	2	3
C	5	2	–	5	4
D	3	4	3	–	2
E	4	3	6	6	–

(left axis label: Goals made)

Note: For example, A made 3 goals against B while conceding 5 goals to 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.

51. How many points did team E score in the tournament?
    (A) 13   (B) 15
    (C) 18   (D) 20

52. Which team won the tournament?
    (A) A   (B) B
    (C) C   (D) D

53. What is the total number of draws in the tournament?
_____

54. How many teams have two wins each? _____

Directions for questions 55 to 58: These questions are based on the following data.

A die, with the numbers 1 to 6 marked on its six faces was cast repeatedly. The table below gives the number of times that each individual number on the faces of the die turned up, in the first n casts, where $n = 20, 40, ..., 140$.

	Number of times each number turned up					
Casts	1	2	3	4	5	6
First 20	4	3	4	2	2	5
First 40	10	8	5	7	3	7
First 60	12	15	10	8	8	7
First 80	14	17	17	13	10	9
First 100	14	18	22	20	13	13
First 120	19	23	23	22	17	16
First 140	19	24	24	32	18	23

It was also observed that in no two consecutive casts did the same number turn up.

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.

55. If the number 4 turned up in the 140th cast, then which number/s could not have turned up in the 131st cast?

(A) 2   (B) 1
(C) 4   (D) 3

56. Which of the following numbers must have turned up for the maximum number of times in the first 65 casts?

(A) 2   (B) 1
(C) 5   (D) 3

57. What is the least number of times the number 4 could have turned up in the first 95 casts? _____

58. What is the maximum number of times any of the even numbers could have shown up from the 81st cast to the 130th cast? _____

Directions for questions 59 to 62: These questions are based on the following information.

In an examination, there are 100 questions. A student is awarded 12 marks for each correct answer. He loses 3 marks for each wrong answer and loses 2 marks for each unanswered question.

The net score of Hari in that test is 625.

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.

59. The number of ways in which Hari could have attempted the exam is .

60. The maximum number of questions attempted by Hari could be .

61. The number of questions that Hari got wrong if the number of correct answers that he got is a multiple of 5 is

(A) 12   (B) 15
(C) 20   (D) 25

62. Which of the following could be the number of questions Hari left unanswered?

(A) 5   (B) 15
(C) 25   (D) 35

Directions for questions 63 to 66: These questions are based on the following information.

Eight players from P to W take part in a double round robin chess tournament, in which each player plays every other player twice, once with white and once with black pieces. 3 points are awarded for a win, 1 point for a draw and 0 points for a loss. At the end of all the matches, the player with the highest points is awarded the first rank, the next one second and so on. If two or more players end up with the same number of points, they are given the same rank.

63. If it is known that player R was the sole winner of the tournament, then at least how many points did he score?

(A) 14   (B) 16
(C) 15   (D) 17

64. If all players end up with distinct points, what is the maximum points scored by player P, if it is known that he finished last?

(A) 16   (B) 15
(C) 14   (D) 17

65. Which of the following cannot be the points scored by all the players together at the end of the tournament?

(A) 108   (B) 121
(C) 132   (D) 164

66. If it is known that player R won the tournament and all players scored distinct points, then at least how many points did R score?

(A) 17   (B) 18
(C) 19   (D) 20

Directions for questions 67 to 70: The following table gives the national market share of an automobile company, ABC Ltd in different segments in the year 2011.

Segment	National share (%)
LCV	36
CV	42
Multi-axle	25
Hatchback	33
Sedan (compact)	56
Sedan (Luxury)	35
SUV	44

67. If the overall national sales of LCVs were 280% more than that of CVs, then for ABC Ltd, the sales of CVs was what percentage of LCVs?
(A) 40.5   (B) 38.1
(C) 35.2   (D) 30.7

68. If the sales of luxury sedans by ABC Ltd was 20% of its compact sedan sales, then the national sales of compact sedans forms what percentage of the national sales of compact and luxury sedans?
(A) 71.2%   (B) 75.8%
(C) 68.2%   (D) 67.2%

69. If all automobiles are classified in one of the seven segments and for ABC Ltd, multi-axle vehicles form 10% of its total sales, then the overall national sales of multi-axle vehicles form at least what percentage of the national sales of all vehicles?
(A) 15.1%   (B) 12.8%
(C) 10%   (D) 7%

70. If only Hatchbacks, Sedans (both compact and Luxury) and SUVs come under the category of cars and the national share of ABC Ltd in cars is 47%, then what is the least percentage share of compact Sedans in total car sales in the country?
(A) 20   (B) 25
(C) $33\frac{1}{3}$ (D) 40

Directions for question 71 to 74: These questions are based on the following data.

The table shows the religion-wise break-up of the number of women per 1000 men in a locality in 2011.

Jains	802
Hindus	900
Muslims	875
Christians	795
Sikhs	1020

The line graph shows the number of women for every 1000 men in the locality, over the years.
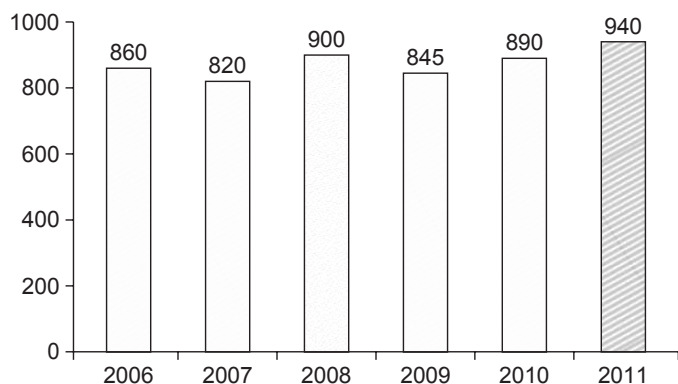
71. If in 2011, the difference between the number of men and the number of women among Hindus is same as that among Muslims, then what is the ratio of the number of men who are Muslims to the number of women who are Hindus?
(A) 10 : 9   (B) 9 : 10
(C) 35 : 36   (D) 8 : 9

72. In 2011, at least what percentage of the people in the locality are Sikhs?
(A) 25   (B) 30
(C) $33^{1}/_{3}$ (D) 37.5

73. If the total number of Christians and Muslims in the locality in 2011 is the same, then by what percentage is the number of Christian men more then the number of Muslim men?
(A) 4.5   (B) 5.3
(C) 5.6   (D) 6.2

74. In 2011, the percentage of Sikhs in the locality was definitely less than_____.
(A) 52.8   (B) 59.6
(C) 64.4   (D) Cannot be determined

Directions for questions 75 to 78: These questions are based on the following data.

The following table gives the time taken (in hrs) by four machines, namely M_1, M_2, M_3 and M_4 to process four subtasks, such as T_1, T_2, T_3 and T_4 which constitute task T. Each machine can do any of the four subtasks and the only condition is that a machine cannot do more than one subtask at the same time and no subtask can be done simultaneously by two machines.

Machine \ Task	T_1	T_2	T_3	T_4
M_1	7	6	4	9
M_2	5	3	7	8
M_3	7	7	6	2
M_4	5	8	5	6

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. What is the minimum time (in hrs) in which the task can be completed if the subtasks can only be done one after the other in the order T_1, T_2, T_3 and T_4? _____

76. If machine M_3 is not working, then what is the minimum time required (in hrs) to finish the task, if the subtasks can be done simultaneously? _____

77. If only two machines can be used, then what is the shortest time (in hrs) in which all the subtasks can be completed? _____

(A) 10   (B) 9

(C) 8   (D) 7

78. If the subtasks can be done simultaneously, i.e., if two or more machines could work on a subtask at the same time, then what would be the approximate minimum time in which all the subtasks can be completed?

(A) 3.5 hrs   (B) 3.7 hrs

(C) 4 hrs   (D) 4.25 hrs

Directions for questions 79 to 82: Answer these questions on the basis of the following information.

50,000 units of brand X are being sold in the market at a price of `10 per unit. A competitive brand, Y enters the market. The courses of action available for the company marketing brand X are as follows:

(1) Cut the price of X by 50%, which would result in an increase in the number of units sold of X by 30% with a probability of 0.5 and by 20% with a probability of 0.5.

(2) Advertise, which would cost `2,00,000, but would result in an increase in the number of units of X sold by 50% with a probability of 0.1, by 20% with a probability of 0.5 and by 10% with a probability of 0.4.

(3) Remain silent, in which case, the probability of losing the market by 40% is 0.5 and the probability of retaining its market is 0.5.

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. Which is the best course of action to follow?

(A) Cut down the price   (B) Advertise

(C) Remain silent   (D) Insufficient data

80. In which of the cases does the market of X (number of units sold) increase the most?

(A) Cut down the prices

(B) Advertising

(C) Remain silent

(D) None of these

81. What is the net loss (in `) if course 1 is followed?

(Net Loss = Money realized originally – Money realised now) _____

82. What is the revenue realised (net of advertising expenses) if course 2 is followed (in `)? _____

Directions for questions 83 to 86: Answer these questions on the basis of the information given below.

The following table gives the average scores of the students of classes I to V.

Class	Average score of top 20% of the students	Average score of the lowest 20% of the students
I	82	36
II	76	31
III	68	24
IV	86	19
V	80	38

83. If there are 60 students in class IV and the average score of the class is 60, then the score of the student who got the 48th rank in the class is at most.

(A) 30   (B) 45

(C) 55   (D) 65

84. For how many of the given classes can the average score of the remaining 60% of the class be more than 45, if the average score of each class is 50?

(A) 1   (B) 2

(C) 3   (D) 4

85. If each class has the highest possible average, then the highest average is for which class?

(A) I   (B) II

(C) III   (D) IV

86. The least possible average marks of any class would be at least

(A) 28.6   (B) 30.4

(C) 32.4   (D) 34.6

Directions for questions 87 to 90: These questions are based on the following information.

In a school there are 135 students who play at most three sports, such as cricket, football and hockey. There is at least one student who plays all the three, at least one student who plays exactly two, and at least one student who plays exactly one of the above-mentioned sports.

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. If the number of students who play all three sports is less than the number of students who play exactly two and if the number of students who play cricket is more than those who play hockey which in turn is more than the those who play football, while the number of students who play football is more than those who play exactly two sports, then what is the maximum number of students who do not play any of the given sports? _____

88. Using the data from the previous question, what is the maximum number of students who play all the three sports? _____

89. If the number of students who play the sports are as follows, only cricket < only hockey < only football < exactly two sports < exactly three sports, then the maximum number of people who play exactly two sports is

(A) 65   (B) 62

(C) 60   (D) 67

90. Using data from the previous question, the minimum number of people who play all the three sports is

(A) 1   (B) 2

(C) 3   (D) 4

ANSWER KEYS

1. (D)	16. (C)	31. (D)	46. (B)	61. (B)	76. 8
2. (B)	17. (C)	32. (D)	47. (B)	62. (C)	77. (C)
3. (A)	18. (D)	33. (A)	48. (A)	63. (B)	78. (B)
4. (C)	19. (B)	34. 2	49. (B)	64. (D)	79. (C)
5. (A)	20. (B)	35. 4	50. (D)	65. (A)	80. (A)
6. (B)	21. (D)	36. (B)	51. (B)	66. (C)	81. 187500
7. (C)	22. (D)	37. (A)	52. (B)	67. (D)	82. 395000
8. (D)	23. (A)	38. (B)	53. 1	68. (B)	83. (D)
9. (C)	24. (D)	39. (C)	54. 4	69. (B)	84. (C)
10. (B)	25. (C)	40. (D)	55. (B)	70. (B)	85. (A)
11. (D)	26. (C)	41. (B)	56. (A)	71. (D)	86. (C)
12. (D)	27. (A)	42. (D)	57. 17	72. (C)	87. 127
13. (B)	28. 30	43. (A)	58. 14	73. (A)	88. 68
14. (D)	29. 21	44. (D)	59. 3	74. (C)	89. (A)
15. (C)	30. 25	45. (B)	60. (C)	75. 14	90. (D)

SOLUTIONS

Solutions for questions 1 to 4:

1. The quantity of Z produced by different machines is as follows:

Machine	Quantity of Z
A:	0
B:	0
C:	$\frac{80}{4}(2) = 40$
D:	40
	Total : 80

2. In the first 5 hours, the quantity of W produced by A, B, C is 0. 20 units of W is produced by D. Thus, x 5 .

3. In the first 4 hours,
the quantity of Y produced by B = 20
by C = 40.

Percentage less = $\frac{20}{40}(100) = 50$

4. In the first 4 hours, the quantity of X produced
= 20+30+30+15 = 95
Quantity of Y produced
=20+20+40+20 = 100.

Solutions for questions 5 to 8:

5. By observation we can say that option 1 is not true.

6. Profit for company

$A = \frac{7.5}{100} \times 198 = 15$ crore

$C = \frac{15}{100} \times 200 = 30$ crore

$E = \frac{17.5}{100} \times 200 = 35$ crore

$F = \frac{5}{100} \times 220 = 11.0$ crore

$D = \frac{2.5}{100} \times 280 = 7.0$ crore

7. Required is the average profit of B and D profit in 2011–12 for

$B = \frac{-5}{100} \times 220 = -11$

$D = \frac{-4}{100} \times 250 = -10$

. Average profit = $-\dfrac{21}{2}$ = –10.5 crore

8. Required is the average profit of C and E in 2012–13 which is $\dfrac{30+35}{2}$ = 32.5 crore

Solutions for questions 9 to 12:

9. The maximum turnover for the third largest company occurs when the share of all companies from fourth to seventh has nearly the same values, i.e., 8% of group turnover and the remaining two companies, i.e., those ranked 2nd and 3rd have nearly the same share, i.e.,

   $100 - (25 + 32) = \dfrac{43}{2} = 21.5$

   . Maximum turnover = $\dfrac{21.5}{100}$ × 3000

   = 645 crore

10. For maximum companies in group D to have a turnover of more than `400 crore, i.e., 16% of group turnover, we should assume that the smallest companies in the group have nearly the same turnover and those companies exceeding a turnover of 400 crores, had a turnover which is only slightly more than 400 crore. It can be seen that if we have four companies with 7% share, three companies with 16% share and one company with 26% share, the total adds up to 102% and so only two more companies (other than the largest company) can have turnover more than 400 crores.

11. For maximum turnover of the second smallest company, all companies of business group I ranked from second to fifth should have nearly the same turnover, i.e.,
   $\dfrac{100 - (27 + 11)}{4}$ = 15.5%.

   . Maximum turnover = $\dfrac{15.5}{100}$ × 4200 = 651 crores

12. For business group B, 500 crore is 22.22% of the group turnover.
   As the largest and smallest company accounts for 32 + 10 = 42% of the group turnover, the remaining 58% (100 – 42) can be distributed among the remaining three companies such that all the three are less than 22.22%.
   . At most, four companies of business group B could have a turnover of less than `500 crore.
   Similarly, we can find for others also.
   For business group E, 500 crores is 9.65% of the group turnover.
   . At most, two companies could have a turnover less than `500 crore.
   For business group F, 500 crores is 13.5% of the group turnover.
   . At most, four companies could have a turnover which is less than `500 crore.
   . A total of 4 + 2 + 4 = 10 companies.

Solutions for questions 13 to 16:

13. Assume that the number of hours of voice processing for companies A and P is 1. The total revenue of company A would be 11.11. For company P it would be $\dfrac{9}{20}$ ×100 = 45 .

   Therefore, revenue for company P would be about four times that of company A.

14. Assume that the number of hours of voice processing in all the companies is one. The revenue earned by the companies would be equal to the ABRH. For company A, the revenue would be 9% of total revenue or the total revenue would be 11.11. Similarly, we can find the total revenue of all the companies and it can be found that the total revenue would be the highest for company 'O'.

15. In 2011, for company A, revenue from voice processing as a percentage of total revenue = 27.
   For company L, it would be 36.
   Let the total revenue in 2011 for companies A and L be 200 and 100, respectively. ABRH of company L = 6.
   . Number of hours of voice processing for company L
   = $\dfrac{36}{6} = 6 \, hrs$
   The revenue from voice processing for company A =
   $\dfrac{27}{100}$ × 200 = 54. . ABRH of company A = $\dfrac{54}{6}$ = 9.
   . Percentage increase = $\dfrac{9-1}{1}$ ×100 = 800%

16. Given that the total revenue received is the same for the pair of companies given.
   Choice (A) I and P: Let the total revenue be 100. The number of hours of voice processing for I and P are $\dfrac{42}{2} \, and \, \dfrac{20}{9}$, respectively which is not equal.
   Choice (B) M and Q: Let the total revenue be 100. The number of hours of voice processing for M and Q are $\dfrac{21}{6}$ = 3.5 and $\dfrac{23}{8}$ = 2.87, respectively.
   Choice (C) M and F: The values for M and F would be $\dfrac{21}{6} = 3.5 \, and \, \dfrac{13}{14}$ = 3.25, respectively, i.e., nearly equal. It can be seen that the options in choice (D) do not give approximately equal value.

Solutions for questions 17 to 19:

17. The maximum number of students who wrote both CAT and XAT is the minimum of 44% of 1,95,000 and 83% of 93,000.
   44% of 1,95,000 = 85,800 and
   83% of 93,000 = 77190

18. The numbers of students who wrote the exams are as follows:

Exam	Total	Only	Others
CAT	1,95,000	1,09,200	85,800
XAT	93,000	15,810	77,190
IIFT	42,000	10,920	31,080
SNAP	70,000	23,800	46,200
CMAT	82,000	9,840	72,160
MAT	36,000	8,640	27,360

The maximum numbers of students who wrote all the six exams would be the minimum value in the 'others' column – 27360.

19. The minimum numbers of students who wrote at least one of the six exams would be the sum of the students who wrote only one exam and the maximum value in the 'others' column = 1,09,200 + 15,810 + 10,920 + 23,800 + 9,840 + 8,640 + 85,800 = 2,64,010.

Solutions for questions 20 to 23:

20. The number of students who failed in the different subjects are Maths – 13, Physics – 7, Chemistry – 12, English – 12 and Hindi – 18. The maximum number of students who failed in all the seven subjects is the minimum of these values, i.e., 7.

21. If we consider that the students who failed in the subjects are all unique, then we get the maximum number of students who failed, i.e., 13 + 7 + 12 + 12 + 18 = 62.
∴ At least 38 (100 – 62) students passed in all the five subjects.

22. The maximum number of students who scored 90 marks or more in at least two of the core subjects

$$= \frac{18 + 24 + 28}{2} = 35$$

The maximum number of students who scored 90 marks or more in at least one of the language subjects = 21 + 26 = 47
∴ Maximum number of students eligible for the scholarship = 35.

23. The number of students who scored 60 or more marks in at least four of the five subjects is the largest number less than $\frac{61 + 75 + 72 + 65 + 60}{4}$, i.e., 83.

Solutions for questions 24 to 27:

24. Let the total savings of the family be `100.
The money invested in fixed deposits = `30

Mrs. Iyer's income = $\frac{30}{15} \times 100$ = `200

∴ Savings of Mrs. Iyer = $\frac{25}{100} \times 200$ = `50

Savings of Mr. Iyer = `100 – `50 = `50

∴ Income of Mr. Iyer = $\frac{50}{20} \times 100$ = `250

Ratio of their incomes = 5 : 4

25. Let the income of Mr. Iyer be $100x$ and Mrs. Iyer be $100y$.
Given that, $15x > 20y$
⇒ $3x > 4y$
Multiplying the above inequality with 9, we get
$27x > 36y$ ⇒ $27x > 15y$ (medicines)
Multiplying $3x > 4y$ with 2.66, we get
$8x > 10.64y$
⇒ $8x > 10y$, (others)
Multiplying $3x > 4y$ with 6.66, we get
$20x > 26.66y$
⇒ $20x > 5y$ (Entertainment)

26. Let the total incomes of Mr. Iyer and Mrs. Iyer be $100x$ and $100y$, respectively.
Now their total savings will be
∴ 20% of $100x$ + 25% of $100y$
Now the amount invested in equities from 20% of total savings, i.e., 20% of $(20x + 25y) = 4.55 (x + y)$

∴ $0.45y = 0.55x$ ⇒ $\frac{y}{x} \times \frac{11}{9}$

∴ Mrs. Iyer's salary forms $\frac{11}{9} \times 100$ = 122.22% of that of Mr. Iyer's.

27. Let the total savings be `100.
Money invested in savings accounts = 20
∴ Money spent by Mr. Iyer on Groceries = 20

Total income of Mr. Iyer = $\frac{20}{10} \times 100$ = `200

Total savings of Mr. Iyer = `40
Total savings of Mrs. Iyer = `60

Required ratio is $\frac{20}{20} \times 40 : \frac{5}{25} \times 60$

= 40 : 12 = 10 : 3

Solutions for questions 28 to 31:

28. The runs scored by the batsmen in the four sessions are 102, 86, 87 and 94, respectively. The number of balls bowled by the bowlers other than P_1 are 48, 53, 64 and 49, respectively. As a bowler bowled at most one dot ball to a batsman in a session, the number of balls off which runs were scored against bowlers other than P, was at least 48 – 16 = 32 (a bowler could have bowled at most four dot balls in a session. Therefore, four bowlers bowled at most 4 × 4 = 16 dot balls, 53 – 16 = 37, 64 – 16 = 48 and 49 – 16 = 33, respectively.

As at most 70 extra runs were scored in the first session it could have been due to a maximum of 11 sixers in the bowling of P_1, similarly it is 7, 6 and 6 in sessions 2, 3 and 4, respectively.

∴ At most 11 + 7 + 6 + 6 = 30 sixers were scored off the bowling of P_1.

29. The number of balls faced is the least when we assume that he has scored the maximum number of runs every ball, but as each batsman faced the bowling of each of the five bowlers in a session, he would have faced at least five balls in a session.

∴ The minimum number of balls faced by him was at least 6 (as he scored 32 runs) + 5 + 5 + 5 = 21 balls.

30. The number of runs scored, balls bowled and minimum number of balls in which runs were scored in different sessions are as follows.

Session	S_1	S_2	S_3	S_4
Runs	102	86	87	94
Balls	60	60	76	55
Min scoring balls	40	40	56	35

It can be seen that in all the sessions other than S_3, the minimum number of singles is zero, while in session 3, there were at least 25 singles.
(31 × 2 + 25 × 1 = 87)

31. For the minimum possible strike rate, we have to calculate the maximum number of balls he could have faced. As in each session each of the bowlers bowled a dot ball to each batsman, the minimum number of balls off which runs were scored in different sessions and the minimum number of balls faced by other batsmen in different sessions are as follows.

Session	S_1	S_2	S_3	S_4
Minimum scoring balls	40	40	56	35
Minimum balls faced by other batsmen	5 + 6 + 3 = 14	4 + 4 + 3 = 11	2 + 4 + 5 = 11	4 + 3 + 5 = 12
Maximum balls faced by B_3	40 – 14 = 26	40 – 11 = 29	30 (as he scored only 30 runs)	35 – 12 = 23

∴ Maximum number of balls faced by him = 26 + 5(dot balls) + 29 + 5 + 30 + 5 + 23 + 5 = 108 + 20 = 128

∴ Strike rate = $\dfrac{27 + 31 + 30 + 30}{128} \times 100 = \dfrac{118}{128} \times 100 = 92.2\%$.

Solutions for questions 32 to 35: Consider the 'strike rate' of Inzamam, i.e., rank 4. Now both Ponting and Richards scored less runs than Inzamam but faced more number of balls than Inzamam. Hence, both Ponting and Richards must be ranked worse (numerically higher) than Inzamam on 'strike rate'. Hence, Ponting and Richards must have ranks 6 and 5, respectively (since Ponting scored less runs, but definitely faced more number of balls than Richards). Now, Dravid must be ranked 1 in 'strike rate'.

Now, consider the total runs scored = Strike rate × Total balls faced. Though Inzamam faced the least number of balls, he was ranked 4th in strike rate. Therefore, at least three players must be ahead of Inzamam. Hence, Inzamam is ranked 4 in 'runs scored'. Similarly, it can be observed that Sachin and Lara must be ranked 1 and 3, respectively in 'runs scored'.

Now consider the 'Average'. Lara scored more runs than Inzamam and also was out for the least number of times. Hence, his average must be better than that of Inzamam. Hence, Lara is ranked 1 in 'average'. Therefore, Sachin and Dravid got ranks 3 and 5 (in any order) in 'average'.

Now the possible points for the six players are as follows:
Ponting = 2 + 1 = 3
Richards = 6 + 2 = 8
Sachin = (4 or 8) + 5 = 9 OR 13
Inzamam = 10 + 3 = 13
Lara = 12 + 4 = 16
Dravid = (8 or 4) + 6 = 14 OR 10
The final table obtained is as follows:

	Parameter						
Batsman	Innings played	Runs scored	Balls faced	Not outs	Outs	Average	Strike rate
Ponting	1	@		CD	5	@	6
Richards	5	@	3/5	@	2		5

	Parameter						
Batsman	Innings played	Runs scored	Balls faced	Not outs	Outs	Average	Strike rate
Sachin	@	1	CD	4		3	
Inzamam		4	@	3			
Lara		3	5/3	2	@	1	
Dravid	3				@	1	5	1

Now points scored by them are as follows:

Player	Points
Ponting	3
Richards	8
Sachin	13
Inzamam	13
Lara	16
Dravid	10

Clearly, Lara and Ponting had the highest and the least number of points respectively. Using only this information, three of the questions (16, 17 and 18) can be answered. Now considering the relation 'Total innings played = Number of times out + Number of times not out' we get the ranks in 'number of times out', for Sachin, Inzamam and Lara as 4, 3 and 2, respectively.

Now considering the rank of Sachin in 'average', he got 3rd rank despite scoring the highest and getting out for the 3rd highest number of times. Hence, there are at least two players who scored less runs than Sachin and were out more number of times than Sachin. Hence, Sachin's rank in 'average' must be such that it has at least two ranks below it. Hence, Sachin is ranked 3 in 'average' and Dravid is ranked 5.

Now, similarly, it can be found that neither Richards nor Dravid can have fifth rank in 'number of times out'. Hence, Ponting is ranked fifth in 'number of times out'. Further, we get the ranks of Richards and Dravid in 'number of times out' as 2 and 1, respectively.

Hence, all the values, except the ranks of Richards and Lara in 'balls faced', are determined using which, the other two questions (i.e., 19 and 20) can be answered.

32. Lara got 16 points, which is the highest.

33. Ponting got 3 points, which is the lowest.

34. Sachin was ranked 1 in only 'runs scored' and 'balls faced'.

35. Sachin was ranked better than Dravid in 'runs scored', 'balls farced', 'not outs' and 'average'. Hence, four parameters.

Solutions for questions 36 to 39:

36. The minimum total score of the boys in the quant section is

= 7 × 16 + 25 × 1 + 26 × 30 + 49 × 1 + 54 × 14 + 75 × 1 + 76 × 36 + 100 × 1

= 112 + 25 + 780 + 49 + 756 + 75 + 2736 + 100 = 4633

The minimum total score of the girls in the quant section is

= 6 × 20 + 20 × 1 + 24 × 31 + 60 × 1 + 63 × 26 + 80 × 1 + 81 × 19 + 98 × 1

= 120 + 20 + 744 + 60 + 1638 + 80 + 1539 + 98 = 4299

The required average = $\dfrac{8932}{200}$ = 44.66

37. The number of students who scored more than 70 marks in the different sections are

Quant

Boys	Girls
51	46

Reasoning

Boys	Girls
65	48

English

Boys	Girls
42	57

. At most 42 boys and 46 girls could have scored more than 70 marks in each section.

38. The maximum total marks scored by the girls in the English section is

= 1 × 11 + 14 × 32 + 1 × 34 + 26 × 58 + 1 × 62 + 20 × 77 + 1 × 78 + 36 × 92

= 11 + 448 + 34 + 1508 + 62 + 1540 + 78 + 3312

= 69.93

39. The minimum total marks of the boys in the reasoning section is

14 × 11 + 1 × 27 + 18 × 29 + 1 × 48 + 30 × 51 + 1 × 72 + 34 × 74 + 1 × 95

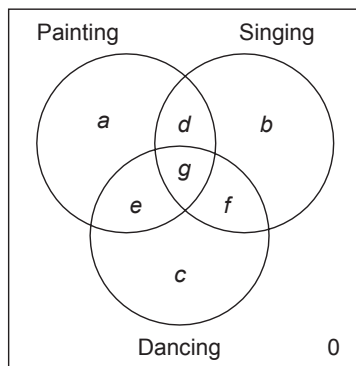= 154 + 27 + 522 + 48 + 1530 + 72 + 2516 + 95

= 4964

Average = 49.64

Solutions for questions 40 to 44:

Total number of boys $= \dfrac{9}{16}(6720) = 3780$

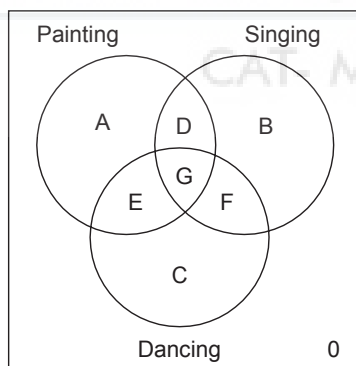Total number of girls $= 6720 - 3780 = 2940$

Boys

Total = 3780

$a = \dfrac{3780}{12} = 315$

$b = \dfrac{3780}{10} = 378$

$g = \dfrac{1}{9}(3780) = 420$

Girls

Total = 2940

$B = \dfrac{25}{100}(2940) = 735$

$D = \dfrac{20}{100}(2940) = 588$

$A = \left(1 + \dfrac{10}{100}\right)A = 2a = 630$

$\dfrac{f}{F} = \dfrac{7}{5}$

$C = \dfrac{1}{10}(2940) = 294$

$F = \dfrac{8\frac{1}{3}}{100}(2940) = \dfrac{2940}{12} = 245$

$f = \dfrac{7}{5}(245) = 343$

$G = 2940 - (A + B + C + D + E + F)$ where $E = 0$

∴ $G = 448$

$d = \dfrac{D}{2} = 294$

$c = 3780 - (a + b + d + e + f + g)$ where $e = 0$

∴ $c = 2030$

40. $P = a + d + e + g = 315 + 294 + 0 + 420 = 1029$

41. Required % $= \dfrac{c + e + f + g}{6720} \times 100\%$

$= \dfrac{2030 + 0 + 343 + 420}{6720} \times 100\% = 41.56\%$ z 42%

42. Total number of students enrolled in all the three classes together $= g + G = 420 + 448 = 868$

43. Percentage that b forms of B $= \dfrac{b}{B} \times 100\%$

$= \dfrac{378}{735} \times 100\%$ z 51.43%

Solutions for questions 44 to 46: Let `100x be the amount deposited by the car manufacturer on each car in race 1. Since car I won race 1, he gets `180x on that and only `80x on the other car that participated. The amount he wins at the end of the race 1 = `180x + `80x = `260x. Then he deposits `130x on each of the two cars that participated in race 2. Since car II won the race 2, he gets 130x (1.4), i.e., `182x on that and only 130 × (0.8), i.e., `104x on the other car that participated. The amount with him at the end of the race 2 = `182x + `104x = `286x. Then he deposits `143x on each of the two cars that participated in the race 3. Since car II won race 3, he gets 143 (1.4), i.e., `200.2x on that and only 143(0.8), i.e., `114.4x on the other car that participated.

. The amount with him at the end of race 3 = `200. 2x + `114.4x = `314.6x. Given that `314.6x = `31460
⇒ x = 100

44. The total amount he deposited in race 1 = `200x
= `200 × 100 = `20,000.

45. Amount gained in race1 = `260x – `200x = `60x
Amount gained in race2 = `286x – `260x = `26x
Amount gained in race3 = `314.6x – `286x = `28.6x
Hence, he gained the most in race 1.

46. At the end of race 3, he would have = 20000 (1.8) (0.8) (0.8) = `23040. Total money gained by the end of the three races would have been = `23040 – `20000
= `3040.

Solutions for questions 47 to 50: It is given that student Q had the second highest marks among all the students. As the difference between the marks of Q and R is always 42 with R being higher, it can be concluded that R scored the highest marks and it was 42 marks more than Q. Now comparing P and Q and as we know P scored less then Q, the difference between P and Q has to be 121, the common value among (106 + 15, 106 – 15), (100 + 21 or 100 – 21),(86 + 207 or 207 – 86) and (52 + 69 or 69 – 52).

In the same way we can get the value of S as Q – 197 (207 + 10 or 207 – 10), (69 + 128 or 128 – 69)

Similarly, V = Q – 106

W = Q – 21

X = Q – 207 and

Y = Q – 69.

Now taking the value of Q as A, we can get the other values as follows:

P – (A– 121)

Q – A

R – (A + 42)

S – (A – 197)

T – (A – 120) or (A – 258)

U – (A – 121) – 27 or (A – 121) + 27

V – (A – 106)

W – (A – 21)

X – (A – 207)

Y – (A – 69)

47. R scored the highest marks among the ten students.

48. If X = 450, P + R = X – 121 + X + 42 = 2X – 79 = 900 – 79 = 821.

49. Student 'W' scored the highest marks among U, V, W, X and Y.

50. U is P – 27, or P + 27, i.e., 538 or 592.

Solutions for questions 51 to 54:

51. Team E lost to teams C and D, drew against team B and won against team A.

. The points scored = 10 + 4 – (2 × 5) = 4 points.

For goals = 15 × 2 – 19 × 1 = 11.

. Total = 4 + 11 = 15 points.

52. Team A has conceded 16 goals.

16 × (–1) = –16 points

Team A made 15 goals.

15 (2) = 30 points

A has won against C and D.

Points won = 2 (10) = 20 points.

A loses two matches, points lost = (2) (5) = 10

Number of points won by A = 30 + 20 – 16 – 10 = 24

In this way.

The total points for B

= (14 × 2) – (12 × 1) + 2 (10) + (14) – 1 (5)

= 25 – 12 + 20 + 4 – 5 = 35

Total points for C

= (16 × 2) – 16 (1) + 2 (10) – 2 (5)

= 32 – 16 + 20 – 10 = 26

Total points for E

= (15 × 2) – (19 × 1) + (4 × 1) + (10 × 1) – (5 × 2)

= 30 – 19 + 4 + 40 – 10 = 15

Total points for D

= (15 × 2) – (12 × 1) + 2 (10) – 2 (5)

= 30 – 12 + 20 – 10 = 28

. B has won the tournament.

53. B has drawn with E. There is only one draw.

54. A, B, C and D have 2 win each.

Solutions for questions 55 to 58:

55. The number 4 appeared in cast 140.

The number 4 must appear 10 times from cast no. 121 to cast no. 140.

The cast numbers in which (4) must happen are

(1) 121, 123, 125, 127, 129, 131, 133, 135, 137,140.

(or)

(2) 122, 124, 126, 128, 130, 132, 134, 136, 138,140.

It can be observed that the number 4 may or may not appear in cast no. 131.

However, it is evident that the number 1 must not have appeared from cast no. 121 to 140.

56. The number 2 had already turned up for 15 times by the end of the first 60 casts. So, in the first 65 casts, the number 2 cannot appear for less than 15 times. However, other numbers must appear for less than 15 times.

57. To calculate the minimum possible number of times 4 turned up in 95 casts

= Number of times 4 turned up in 100 casts – Maximum possible number of times 4 could have turned up from cast 96 to cast 100 (both inclusive).

This maximum is 3 (i.e., in casts 96, 98 and 100).

⇒ Required answer = 20 – 3 = 17.

58. We only need to check for number 4 as it is the highest among 2, 4 and 6. 4 can turn up a maximum of 5 times between the 121st and 130th cast.

. The maximum possible value is (22 + 5) – 13 = 14 times.

Solutions for questions 59 to 62: Let x = Number of correct answers

z = Number of wrong answers

y = Number of unanswered questions

Given, $x + y + z = 100$ (1)

$12x - 2y - 3z = 625$ (2)

$3(1) + (2) : 15x + y = 925$

$y = 925 - 15x = 5(185 - 3x)$

. y must be divisible by 5. Least y = 0.

When y = 0 or 5, x is not an integer.

When $y = 10$, $x = 61$.

. Least $y = 10$. This also means greatest $x = 61$.

. $x :S 61$.

When $x = 61$, $y = 10$ and $z = 29$.

When $x = 60$, $y = 25$ and $z = 15$.

When $x = 59$, $y = 40$ and $z = 1$.

For every decrease of 1 in x, y increases by 15 and z decreases by 14.

. For $x < 59$, $z < 0$, but this is not possible.

. x 59.

59. $(x, z, y) = (59, 1, 40)$ or $(60, 15, 25)$ or $(61, 29, 10)$.

There are three ways in which Hari could have attempted the exam.

60. Number of questions attempted = $x + z$. This is 60 or 75 or 90.

. Max$(x + z) = 90$.

61. x is a multiple of 5 only when $x = 60$.

. $z = 15$.

62. The three ways by which Hari could have scored 625 marks is as follows.

(1) 60 correct, 15 wrong and 25 unanswered.

(2) 59 correct, 1 wrong and 40 unanswered.

(3) 61 correct, 29 wrong, and 10 unanswered.

. The number of unanswered questions could be 10, 25 or 40.

Solutions for questions 63 to 66:

63. The total points would be the minimum, when all the matches are draws and each player scores 14 points. If one player scores one win, he will have 16 points and the player who lost would have 13 points. Therefore, if R is the sole winner, he should have at least 16 points.

64. The maximum points happen when the maximum number of matches produce a result. So, try to keep the number of draws to minimum starting with 7 wins and 7 loses for each player and assigning, we get the points as 24(8W), 23(7W, 2D), 22(7W, 1D), 21(7W), 20(6W, 2D), 19(6W, 1D), 18(6W) and 17(5W, 2D), with only 4 draws. **Note:** We cannot take maximum points (168) and distribute as the points would be of the form 25,24, 23, 22, 20, 19, 18 and 17 as points like 25, 23 and so on can be obtained only with draws and for 168 points in total, there cannot be any draws.

65. The total points has to be between 56 (2) = 112 and 56 (3) = 168. It cannot be 108.

66. The minimum points for the winner would be 19 as follows:

3W	1L	10 D = 19
2W	0L	12 D = 18
2W	1L	11 D = 17
2W	2L	10 D = 16

1W	1L	12 D = 15
OW	OL	14 D = 14
OW	2L	12 D = 12
OW	3L	11 D = 11
10W	10L	

Solutions for questions 67 to 70:

67. Let the national sales of LCVs be 380 units and that of CVs be 100 units.

Sales of LCVs by ABC Ltd = 36% of 380 = 136.8

Sales of CVs by ABC Ltd = 42% of 100 = 42

Required percentage = $\dfrac{42}{136.8} \times 100 = 30.7$

68. Let the sales of luxury sedans by ABC Ltd be 35 units.

. Sales of compact sedans by ABC Ltd = 175 units

National sales of luxury sedans = 100

National sales of compact sedans

$= \dfrac{175(100)}{56} = 312.5$

Required percentage $= \dfrac{312.5}{312.5 + 100}$ (100)

$= \dfrac{312.5}{412.5}$ (100) = 75.8

69. Let the number of units of multi-axle vehicles sold by ABC Ltd be 10.

. National sales of multi-axle vehicles = 40.

The vehicles sold by ABC Ltd in all other segments (other than multi-axle) is 90. As the share of all other segments of vehicles sold by ABC Ltd is at least 33, the national sales of all vehicles (other than multi-axle) would be a maximum of $\dfrac{90}{33} \times 100 = 273$

. Multi-axle vehicles form at least $\dfrac{40}{313} \times 100$

$= 12.8\%$

70. If the number of SUVs sold is much more than hatchbacks and luxury sedans, then the national share of ABC Ltd in these three categories together would be very close to 44%. In this case the share of compact sedans can be as low as 25% and still the total share would be 47.

Solutions for questions 71 to 74:

71. Let the number of men and women among Hindus be $1000x$ and $900x$, respectively. And let the number of men and women among Muslims be $1000y$ and $875y$, respectively.

$\Rightarrow 1000x - 900x = 1000y - 875y$

$\Rightarrow 100x = 125y$

$\Rightarrow \dfrac{x}{y} = \dfrac{5}{4}$

. Required ratio $1000y : 900x$

$= 1000 \left(\dfrac{4}{5}\right) x : 900x = 8 : 9$.

72. Assume that in 2011, the number of Christians, Muslims and Jains in the locality is negligible compared to that of Hindus and Sikhs.

∴ The number of women per 1000 men (excluding Sikhs) would be 900 (same as that of Hindus). As the overall value is 940, the number of Sikhs and Hindus here should be in the ratio 1 : 2 or Sikhs form 1/3rd of the total number of people in the locality.

73. Let the number of Christian men be $100x$ and the number of Muslim men be $100y$.

Given $179.5x = 187.5y$

$x = \dfrac{187.5}{179.5}y$ or $x = 104.46$.

74. For the percentage of Sikhs to be maximum, we have to assume that Christians and Sikhs are significant in number while all others are close to zero.
The required percentage would be

```
1020 \         / 145
       \  940  /
       /       \
  795 /         \ 80
```

$\dfrac{145}{145+80} \times 100 = \dfrac{145}{225} \times 100 = 64.4\%$

Solutions for questions 75 to 78:

75. To complete the task in the minimum time we should assign each subtask to the machine which will do it in the least possible time, i.e., $T_1 – M_4$, $T_2 – M_2$, $T_3 – M_1$ and $T_4 – M_3$. The time taken is $5 + 3 + 4 + 2 = 14$ hrs.

76. If machine M_3 is not working, to do in the shortest possible time, M_2 must be assigned subtasks T_1 and T_2, with M_1 doing T_3 and M_4 doing T_4. The total time would be the time taken by M_2 to finish T_1 and T_2 by which time the other machines would have finished T_2 and T_4, i.e., 8 hrs.

77. We have to select two machines which could finish the four subtasks in the shortest possible time. Since M_2 does task T_2 and M_3 does task T_4 in much less time compared to other machines, these two machines must be selected. So M_2 would do tasks T_1 and T_2 and M_3 would do tasks T_3 and T_4. Time taken = $5 + 3 = 8$ hrs.

78. First assign T_1 to M_4, T_2 to M_2 T_3 to M_1 and T_4 to M_3. After 2 hrs T_4 would be over and M_1 and M_3 can finish T_3 in 3.2 hrs. T_2 would be over in 3 hrs and M_2 can join in doing T_1 and it would be completed in slightly under 3.7 hrs.

Solutions for questions 79 to 82: Originally money realised by sales = $10 \times 50000 = 5,00,000$
Money realised from (3)
= $5,00,000 – 0.5 \times 0.4 \times 5,00,000 = 4,00,000$

Money realised from (2)
= $5,00,000 [0.1 \times 0.5 + 0.2 \times 0.5 + 0.1 \times 0.4] – 2,00,000$
+ $5,00,000 = 3,95,000$
Money realised from (1)
= $0.5 \times 50000 [1 + 0.5 \times 0.3 + 0.5 \times 0.2] = 3,12,500$

79. Hence, the most profitable option would be to remain silent.

80. Decreases in (3); increases by 19% in (2); increases by 25% in (1).

81. Loss = $5,00,000 - 3,12,500 = 1,87,500$

82. As calculated above, it is `3,95,000.

Solutions for questions 83 to 86:

83. The total score of the class = $60 \times 60 = 3600$
The total score of top 20% and the bottom 20% students

= $(86 + 19) \times \dfrac{20 \times 60}{100} = 105 \times 12$

∴ The total score of other students = $3600 – 105 \times 12$
The 48th ranker will get the maximum possible rank when all these (except for 20% and bottom 20%) students get equal marks.

∴ Required score = $\dfrac{3600 – 105 \times 12}{36} = 65$.

84. Average scores of 40% students (i.e., top 20% and bottom 20%) for class.

I – $\dfrac{82 + 36}{2} = 59$

II – 53.5

III – 46

IV – 52.5

V – 59

For I, let the remaining students get an average score of x.

$\dfrac{59 \times 2 + x \times 3}{5} = 50$

$\Rightarrow x = 44$

Similarly, we can find the values for other classes among which classes II, III and IV have an average more than 45.

85. For I, the highest possible average of the remaining 60% students is 82.

∴ Average of the class = $\dfrac{82(4)+ 36}{5} = 72.8$

Similarly, the averages for II, III, IV and V are 67, 59.2, 72.6 and 71.6.

86. The least possible average of I = $\dfrac{82 + 36(4)}{5} = 45.2$.

The values for II, III, IV and V are 40, 32.8, 32.4 and 46.4.

Solutions for questions 87 to 90:

87. There must be at least one student who played all the three. The Venn diagram for the minimum possible case satisfying all the given conditions can be as follows.

Cricket   Hockey

Football
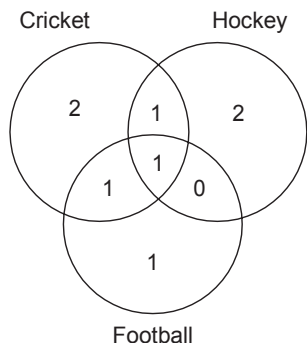
So, at least 8 students must play at least one of the three games. Maximum number of students who do not play any of the games is 135 − 8 = 127.

88. Since a maximum of 135 students play, considering the number of people playing all the sports is the least, it should be less than half. Maximum possible value is 66. 67, it is not possible as there should be 68 playing exactly two and at least one playing exactly one, making a total of 67 + 68 + 1 = 136. The following is one of the many possible cases that satisfy the above conditions.

Cricket   Hockey
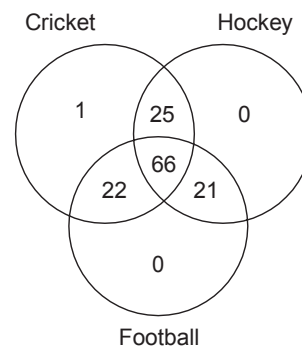
Football

Students playing all the three sports = 66
Students playing two sports = 68
Students playing football = 110
Students playing hockey = 112 and
Students playing cricket = 114, which satisfies all the conditions, including the condition that there are students who play exactly one sport.

89. The number of students who play only cricket can be zero, the number of students who play only hockey can be 1 and only football can be 2. Of the remaining 132, as people playing exactly two is less than people playing exactly three, the maximum number of people playing exactly two games is 65.

90. Here, consider the students who play only cricket to be 0, only hockey is 1, only football is 2 and exactly two is 3.
. The minimum value of students who play all the three is 4.

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