

ANSWER KEYS

Exercise-1

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

Exercise-2

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

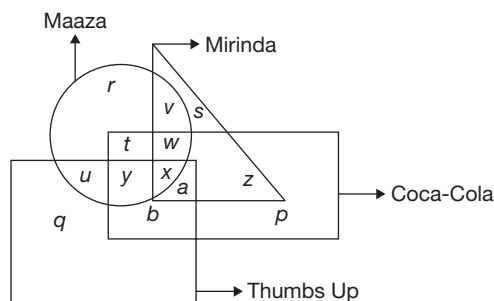
Exercise-3

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

SOLUTIONS

EXERCISE-1

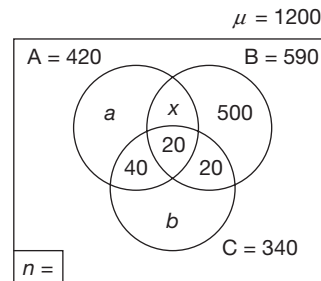
Solutions for questions 1 to 5:



- In the diagram, b represents the people who like only Coca-Cola and Thumbs Up.
- ' v ', ' s ', ' w ' and z are in the triangle but not in square. Hence, those represent the people who like Mirinda but not Thumbs Up.
- u , y , x belongs to both circle and square. Hence, they like Maaza and Thumbs Up.

- The letter ' v ' belongs to circle and triangle but neither to square nor rectangle. Hence, v represents the people who like Maaza and Mirinda but not the other 2.
- w belongs to circle and rectangle but not square. Hence, w represents the people who like Maaza, Mirinda, Coca-Cola but not Thumbs Up.

Solutions for questions 6 to 10:



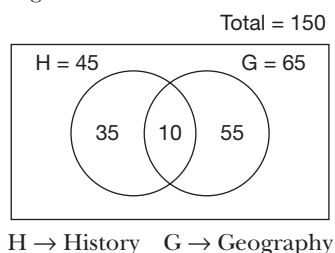
$$C = b + 40 + 20 + 20 = 340$$

$$\Rightarrow b = 260$$

$$\begin{aligned} B &= 500 + 20 + 20 + x = 590 \\ \Rightarrow x &= 50 \\ A &= a + x (= 50) + 40 + 20 = 420 \\ \Rightarrow a &= 310 \\ n &= 0 \text{ [given]} \end{aligned}$$

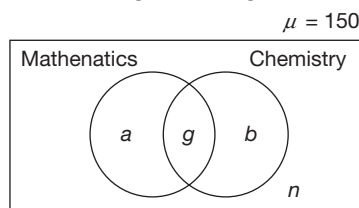
6. Number of employee that are member of Club C only = $b = 260$.
7. Number of members of Club A and B = $x + 20 = 50 + 20 = 70$.
8. $a + 40 + b + n = 310 + 40 + 260 + 0 = 610$ are not the members of Club B.
9. Members of Club A or Club C = $a + x + 40 + 20 + b + 20 = 310 + 50 + 40 + 20 + 260 + 20 = 700$.
10. $x + 40 + 20 = 50 + 40 + 20 = 110$ are the members of exactly two clubs.

Solutions for questions 11 to 15: As per the given data, we get the following diagram:



11. 55 students take only Geography.
12. 35 students take only History.
13. 10 students take both History and Geography out of a total of 150 students. Hence, $150 - 10 = 140$ students do not take either History or Geography.
14. $35 + 10 + 55 = 100$ students take at least one subject.
15. $(150 - 100) = 50$ students take neither of the two subjects.

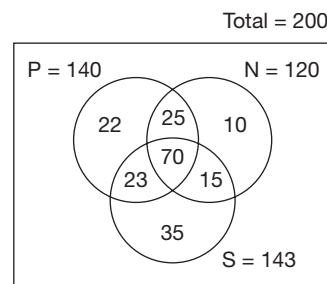
Solutions for questions 16 to 18: Let us represent the given information in the following Venn diagram.



Given, $a + g = 50$.
 The number of students who failed only in Chemistry = $a = 40$
 $\Rightarrow g = 10$
 $n = 20$
 $\therefore b = 150 - (40 + 10 + 20) = 150 - 70 = 80$
 $b = 80$

16. The number of students who passed in both the subjects, $g = 10$.
17. The number of students who passed in exactly one subject, $a + b = 40 + 80 = 120$
18. The number of students who failed in at least one subject = $a + b + n = 40 + 80 + 20 = 140$ or $\mu - g = 150 - 10 = 140$

Solutions for questions 19 to 23: From the given data, we get the following the diagram.



P → Panasonic
 S → Siemens
 N → Nokia

1. 22 families use only Panasonic phones.
2. 10 families use only Nokia phones.
3. 35 families use only Siemens phones.
4. 25 families use both Panasonic and Nokia but not Siemens.
5. 15 families use both Nokia and Siemens but not Panasonic.
6. 23 families use both Panasonic and Siemens but not Nokia.
7. All the 200 families use mobile-phones of at least one company.
19. 35 families use mobile phones of only Siemens.
20. 25 families use mobile phones of both Panasonic and Nokia but not Siemens (Region common to Panasonic and Nokia but not Siemens).
21. Exactly one company
 = Only Panasonic + Only Nokia + Only Siemens
 = $22 + 10 + 35 = 67$ families
22. Neither Panasonic nor Siemens implies only Nokia.
 So, 10 families use mobile phones of neither Panasonic nor Siemens.
23. All the families use mobile phones of at least one out of the three mentioned companies. So, there is no family which did not use any mobile phone.

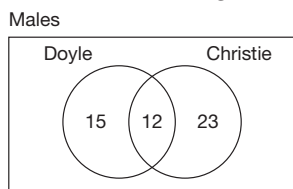
Solutions for questions 24 to 28: Given that 100 students were surveyed who read novels of Christie or Doyle or both.

From the given table we get the information that 40 females read Doyle and 70 students read Christie.

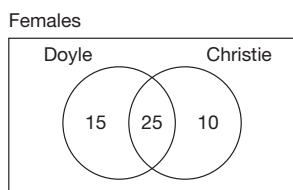
Further, we derive the following:

- 37% of the total students read both, i.e., 37 students.
- The ratio of males and females is 1 : 1, i.e., number of males = number of females = 50.
- 50% of the females, i.e., 50% of 50 = 25 females read both.

With the above information, we get the following data:



So, Doyle = 27
Christie = 35
Both = 12



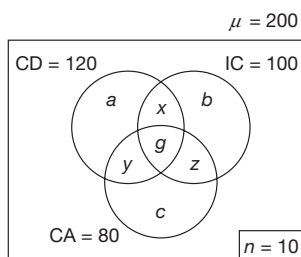
So, Doyle = 40
Christie = 35
Both = 25

Now after filling the gaps in the table, we get the following data:

	Doyle	Christie	Both	Total
Male	27	35	12	50
Female	40	35	25	50
Total	67	70	37	100

- 12 males read the books by both the authors.
- The number of students who read books by only Christie is $23 + 10 = 33$.
- 15 females read books by only Doyle.
- 37 students read the books by both the authors. Hence, those who do not read both the books is $100 - 37 = 63$.
- 27 males read books by Doyle.

Solutions for questions 29 to 33: The given information can be represented in the following Venn diagram.



CD – Cool drink

IC – Ice Cream

CA – Cake

It is given that, $a + b + c = 100$

$$a + b + c + x + y + z + g + n = \mu = 200$$

$$100 + (x + y + z) + g + 10 = 200$$

$$x + y + z + g = 90$$

(A)

$$CD + IC + CA = (a + b + c) + 2(x + y + z) + 3g = 300$$

$$\Rightarrow 2(x + y + z) + 3g = 200$$

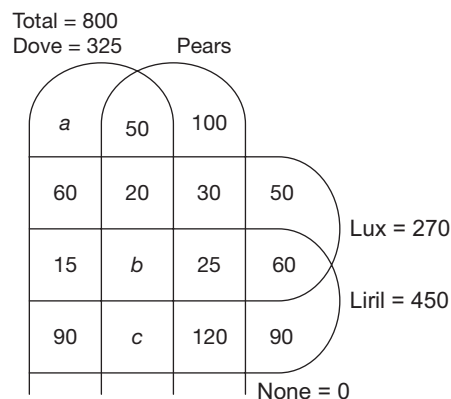
(B)

From (A) and (B), we get $g = 20$

$$\therefore x + y + z = 70$$

- The number of people who had exactly two of the three = 70
- It is given that $x = 20$.
 $\therefore y + z = 50$
The number of people who had only cake = $80 - 50 - 20 = 10$
- 15 people who had only cool drink had cake also, value of x reduces by 15 and value of y increases by 15.
5 people who had only ice cream and cake had cool drink also, i.e., value of z decreases by 5 and that of g increases by 5.
The number of people who had at least two of the three items = $x + y + z + g = x + (y + 15) + (z - 5) + (g + 5)$
 $= x + y + z + g + 15 = 70 + 20 + 15 = 105$.
- It is given that $b = 30$
 $\Rightarrow x + z = IC - b - g = 100 - 30 - 20 = 50$
 $y = 70 - (x + z) = 20$ as,
 $a + b + c = 100$, $a + c = 100 - b = 70$
 $\therefore a + c + y = 70 + 20 = 90$
- What is the maximum possible value of a .
The value of a can be maximum when $x + y$ is minimum.
 $x + y$ can be minimum when z is maximum.
As $g = 20$ and $y + g + z + c = 80$
 $z_{\max} = 60$ ($c_{\min} = 0$)
As $x + y + z = 70$, $x_{\min} + y_{\min} = 10$
 $a_{\max} = CD - y_{\min} - x_{\min} - g = 120 - (10) - 20 = 90$.

Solutions for questions 34 to 37: The given data can be represented in the following diagram.



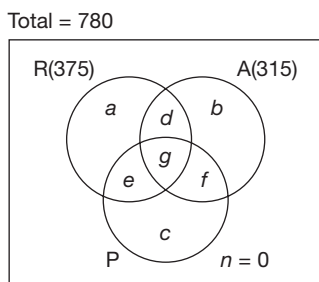
$$b = 270 - (60 + 20 + 30 + 50 + 15 + 25 + 60) = 10$$

$$c = 450 - (15 + b + 25 + 60 + 90 + 120 + 90) = 40$$

$$a = 325 - (50 + 20 + b + c + 90 + 15 + 60) = 40$$

34. 50 people liked only Dove and Pears.
40 people liked only Dove, Pears and Liril.
50 + 40 = 90 people liked Dove and Pears but not Lux.
35. A total of 280, i.e., (40 + 100 + 50 + 90) people liked exactly one product. The remaining 520 people liked at least two products.
36. 50 people liked only Lux.
90 people liked only Liril.
60 people liked only Lux and Liril.
(50 + 90 + 60) = 200 people liked neither Dove nor Pears.
37. The number of people who liked Lux = 270
The number of people who liked Liril but not Lux = 90 + 40 + 120 + 90 = 340
The number of people who liked either Lux or Liril = 270 + 340 = 610

Solutions for questions 38 to 40:



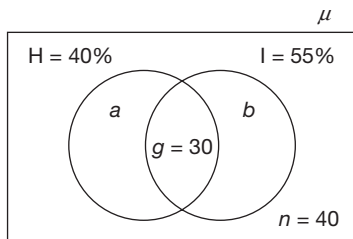
$$a + b + c + d + e + f + g = 780$$

$$d + g = 75, e + g = 90, f + g = 45$$

38. The number of bags which contain exactly two of raisins, almonds and peanuts = $d + e + f$.
Max $(d + e + f) = \text{Max } (75 - g + 90 - g + 45 - g) = \text{Max } (210 - g)$
210 - g is maximum, when each of $75 - g$, $90 - g$, $45 - g$ is maximum, i.e., when g is 0.
The maximum possible number of bags which contain exactly two of raisins, almonds and peanuts is 210.
39. The number of bags which contain either peanuts or almonds = $315 + c + e$
 $c = 78 (R + A - 75) = 165$
For Peanuts or Almonds to be minimum e must be minimum. Since $e + g = 90$, to get minimum value for e , should be maximum. g cannot be more than 45.
 $\therefore e = 45$
The minimum possible number of bags which contain either peanuts or almonds = $315 + 165 + 45 = 525$.
40. $d + e + f = 4g$
 $75 - g + 90 - g + 45 - g = 4g$
 $g = 30$
The number of bags which contain only raisins
 $a = 375 - (d + e + g) = 375 - (75 - g + 90 - g + g) = 240$

EXERCISE-2

Solutions for questions 1 to 4: The given information can be represented in a Venn diagram as follows.



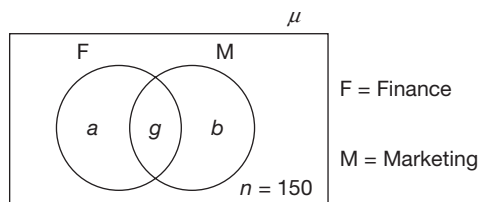
H - The Hindu
I - Indian Express
 $a + g = 40\%$
 $b + g = 55\%$
 $a + b + 2g = 95\% \rightarrow (A)$
 $a + b + n + g = 100\% \rightarrow (B)$
(B) - (A)
 $\Rightarrow n - g = 5\%$
 $\therefore 40 - 30 = 5\%$ of μ

$$\Rightarrow \mu = 200$$

$$a = 50, b = 80$$

- There are 200 families in the colony.
- The number of families that read at least one of the news papers = $a + b + g = 50 + 80 + 30 = 160$.
- The number of families that read at most one news paper = $a + b + n = 170 = 85\%$ of μ .
- The number of families that read only Hindu, $a = 50 = 25\%$ of μ .

Solutions for questions 5 to 8:



Let us represent the given information in the following Venn diagram.

Given, $n = 150$ and $F = \frac{6\mu}{10}$

$$g = \frac{1}{3} \times \frac{6\mu}{10} = \frac{2\mu}{10}$$

passed in marketing = M
out of them $1/3^{\text{rd}}$ failed in Finance.
i.e., passed only in Marketing = b .

$$\therefore b = \frac{1}{3} M \Rightarrow g = \frac{2}{3} M$$

$$\therefore g = 2b$$

$$b = \frac{\mu}{10}$$

Among the students who passed in Finance, $33\frac{1}{3}\%$ passed in Marketing also.

$$\therefore g = \frac{a+g}{3} \Rightarrow a = 2g \Rightarrow a = \frac{4\mu}{10}$$

$$a + b + g = \frac{4\mu}{10} + \frac{\mu}{10} + \frac{2\mu}{10} = \frac{7\mu}{10}$$

$$a + b + g + n = \mu$$

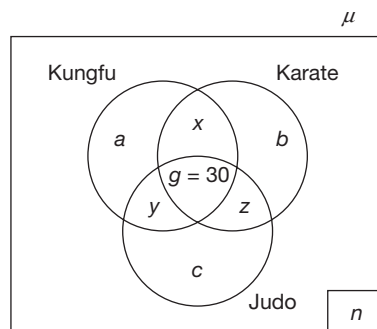
$$\frac{7\mu}{10} + 150 = \mu$$

$$\frac{3\mu}{10} = 150 \Rightarrow \mu = 500$$

$$\therefore b = 50, a = 200, g = 100, n = 150$$

5. There are 500 students in the class.
6. There are 200 students, who failed in Finance only.
 $\therefore b = 50 = 10\%$ of μ
7. The students who failed in at least one subject are a, b and n .
 n is decreased by 60%, i.e., these 60% of n passed in at least one of the subjects.
 $\therefore n = \frac{60 \times 150}{100} = 90$
 $a + b$ increased by 20%, i.e., these 20% = (50) is transferred from n .
 \therefore The remaining 40 (transferred from n) is added to g .
 $g = 100 + 40 = 140$.
8. The number of students who failed in exactly one subject = $a + b$.
 g is increased by 60. This 60 is transferred from a and b .
Failed only in Marketing, $a = 200$.
By transferring 60 from a alone, the value of a will be the least.
 $\therefore a = 140$, i.e., 28% of μ

Solutions for questions 9 to 13: Let us represent the given information in the following Venn diagram.



It is given that half of the students learn exactly one martial art.

$$\therefore a + b + c = \frac{\mu}{2} \rightarrow (A)$$

Half of the students learning Karate are not learning any other martial art.

$$\therefore b = x + g + z \rightarrow (B)$$

The number of students learning all the three arts = $\frac{50}{3}\%$ of those who learn exactly two.

$$g = \frac{50}{3} \times \frac{x + y + z}{100} = \frac{x + y + z}{6} \Rightarrow x + y + z = 6g \rightarrow (C)$$

and also, it is given that $g = \frac{1}{3} n \Rightarrow n = 3g$

$$\text{As } a + b + c = \frac{\mu}{2}, x + y + z + g + n = \frac{\mu}{2}$$

$$6g + g + 3g = \frac{\mu}{2} \Rightarrow g = \frac{\mu}{20}, x + y + z = \frac{6\mu}{20}, n = \frac{3\mu}{20}$$

9. It is given that $g = 50 \Rightarrow \mu = 20 \times 50 = 1000$ and $a + b + c = \frac{1000}{2} = 500$
10. It is given that $n = 30 \Rightarrow \mu = 200$ then $(b + x + g + z)_{\max} = ?$
 $x + y + z = \frac{6 \times 200}{20} = 60$
 $(x + z)_{\max} = 60, g = \frac{\mu}{20} = 10 (\because y_{\min} = 0)$
From (B), $b_{\max} = (x + z)_{\max} + g = 70$
The maximum possible number of students who learn Karate = $70 + 70 = 140$.
11. The value of $a + x + y + g$ can be maximum, when a is maximum and x, b, c and z are minimum, i.e., $c = 0, z = 0$ but, b cannot be zero.
($\because b = x + g + z$)

$$g = \frac{\mu}{20} = 25, b_{\min} = 25 \text{ and } x = 0$$

$$a + b + c = \frac{\mu}{2} = 250$$

$$a_{\max} + b_{\min} + c_{\min} = 250$$

$$a_{\max} = 250 - 25 - 0 = 225$$

$$x + y + z = \frac{6\mu}{20} = \frac{6 \times 500}{20} = 150$$

As $x = 0$ and $z = 0$, $y = 150$.

\therefore The maximum possible number of students who learn Karate = $a + x + y + g = 225 + 0 + 150 + 25 = 400$.

12. It is given that $x + y + z = 90 \Rightarrow \frac{6\mu}{20} = 90 \Rightarrow \mu = 300$.

13. It is given that $\mu = 600$

$$b + x + z + g = 150$$

$$\Rightarrow x + z + g = 75 \text{ and } b = 75 \Rightarrow x + z + \frac{\mu}{20} = 75$$

$$\Rightarrow x + z = 75 - 30 = 45 \text{ and we have } x + y + z = \frac{6\mu}{20} = 180$$

$$\therefore y = 180 - 45 = 135$$

14. From the 15 – 34 years age category in the table:
Number of males who do not read either BW or BT
= $265 - [175 + 105 - 40] = 25$

15. Total BT readers = Total males + Females reading BT = $380 + 250 = 630$.

$$\text{Number of BT readers over 15 years} = 225 + 185 = 410$$

\therefore The percentage of BT readers over 15 years

$$= \frac{410}{630} \times 100 = 65\%$$

16. Females who do not read any of the 2 magazines

$$\text{in } < 15 \text{ years group} = 115 - [65 + 65 - 130] = 15$$

$$15 - 34 \text{ years group} = 190 - [125 + 85 - 50] = 30$$

$$> 35 \text{ years group} = 195 - [135 + 100 - 45] = 5$$

\therefore The percentage of females (below 15 years) who do not read any magazine

$$= \frac{15}{15 + 30 + 5} \times 100 = 30\%$$

Solutions for questions 17 to 20: This is a 5-set/variable Venn diagram puzzle, which can be solved without illustrating the sets – P, SW, D, S, K.

Let us assume that:

X denote – Number of students engaged in exactly 1 activity.

Y denote – Number of students engaged in exactly 2 activity.

Z denote – Number of students engaged in exactly 3 activity.

A denote – Number of students engaged in exactly 4 activity.

B denote – Number of students engaged in exactly 5 activity.

Note the following for a n -set Venn diagram:

Name of the region (pocket of intersection of the sets)	Number of regions (pockets of intersections of the sets)	For a 5-set situation
Exactly 1, X	nC_1	5
Exactly 2, Y	nC_2	10
Exactly 3, Z	nC_3	10
Exactly 4, A	nC_4	5
Exactly 5, B	nC_5	1
None, N	nC_0	1
Total number of regions	2^n	32

Note: ${}^nC_r = \frac{n!}{(n-r)!r!}$ and ${}^nC_r = {}^nC_{n-r}$

From the given information, we have the following:

$$X + Y + Z + A + B + N = 1000$$

Also, $X = N = 0$ (a)

So, $Y + Z + A + B = 1000$ (1)

Also, it is given that:

$$Y = 3Z \quad (2)$$

Since there are 10 pockets of Y and the above Equation (2) is based on the given information that each of the pockets in Y is three times that of each of the pockets in Z.

This is possible only if all the pockets in Y are equal and all the pockets in Z are equal.

$$B = \frac{A}{3} \quad (3)$$

Substituting (2) and (3) in (1), we get

$$Z + B = 250 \quad (4)$$

17. $B = 100 \Rightarrow$ From (4), $Z = 150$ and

From (2), $Y = 450$,

Hence, each pocket in Y is 45.

18. $Z = \frac{3}{2} B$ or $B = \frac{2}{3} Z$

\Rightarrow From (4), $Z = 150$, $B = 100$ and

From (2) and (3), $Y = 450$, $A = 300$

Choice (A) — Any one pocket of Exactly 3 = $\frac{150}{10} = 15$ is true

Choice (B) — is true.

Hence Both A and B are true

19. $P = 750$

$SW = 800$

$D = 400$

$S = 900$

$K = 600$

These numbers imply that

$$X + 2Y + 3Z + 4A + 5B = 3450$$

Or $9Z + 17B = 3450 \rightarrow (5)$, From (a), (2) and (3)

Solving (4) and (5), we get

$B = 150$, $Z = 100$ and $A = 450$, $Y = 300$

Choice (A) — Any one pocket of Exactly $4 = \frac{450}{5} = 90$

Choice (B) — $Y = 300$ is true.

Choice (C) — $Z = 100 > 90$ is false.

Choice (D) — $B = 150$ is true.

20. From (5) in the previous question,

$9Z + 17B = 2700 + x$;

$x \rightarrow$ Number of students

From (4), $Z + B = 250$ engaged in painting

Solving the above two equations,

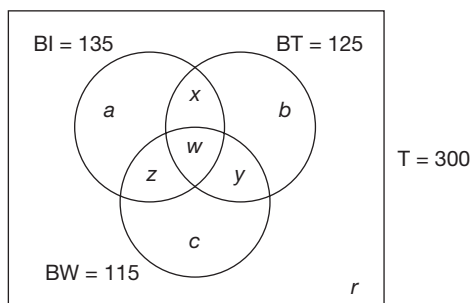
$8B = 450 + x$

Or $B = \frac{1}{8}(450 + x)$

Hence, B is a multiple of 8.

So, from the choices only $x = 270$ satisfies.

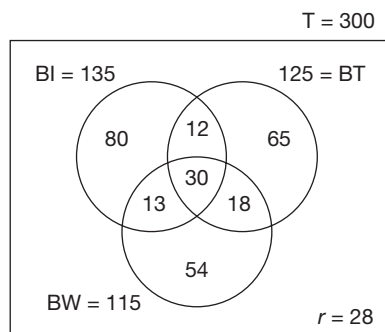
Solutions for questions 21 to 24: Referring to the Venn diagrams given below, we derive the following:



$$\begin{aligned} \text{Also, } w &= 30 & (1) \\ x + w &= 42 & (2) \\ y + w &= 48 & (3) \\ z + w &= 43 & (4) \end{aligned}$$

So, we get $x = 12$; $y = 18$; $z = 13$

Redrawing the diagram, we get:



Number of respondents reading at least one magazine = $135 + (125 - 42) + (115 - 43 - 18) = 272$.

Number of respondents reading none of the magazines = $T = 300 - 272 = 28$.

21. Business India or Business World is

$80 + 12 + 13 + 30 + 54 + 18 = 207$.

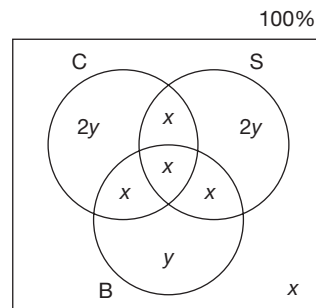
22. When 7 respondents reading Business India alone, start reading a second magazine also, it does not affect the number of respondents reading Business India because those 7 respondents read Business India plus one more magazine.

But, when 5 people who read Business India alone stop even reading that magazine, then the number of respondents reading Business India will come down by 5. Hence, the answer is 130.

23. The respondents, who shift from Business India to Business Today can be from those who were previously reading Business India alone or Business India and Business World alone. If we want the maximum number of respondents reading Business India alone (which was 80 initially) after the shift, the least number should shift from the category 'Business India alone', i.e., the maximum possible number should shift from the category 'Business India and Business World alone'. In this category, there are 13 respondents and maximum number of shifting means 13 respondents are shifting. Since the total number of respondents shifting is 15, at least 2 respondents reading Business India alone should shift. Hence, the maximum number of respondents reading Business India after the shift = $80 - 2 = 78$.

24. By the similar logic which is explained in the above problem, the maximum number of respondents reading Business India and Business World will come if the maximum number of respondents reading Business India and Business Today alone shift and that is 12. So, the maximum number of respondents reading Business India and Business World = $43 + 12 = 55$ (Because already, $30 + 13 = 43$ respondents read Business India and Business World).

Solutions for questions 25 to 27:



The first three statements can be represented as shown in the diagram, and hence, $5x + 5y = 100$ (because we have taken x and y as percentages)

or $x + y = 20$ (1)

From the fourth condition, we get $(y + 3x) = B$

i.e., $y = 3x$ (2)

From equations (1) and (2), we get
 $x = 5\%$ and $y = 15\%$

25. $y = 15\% = 150$.

Hence, total number % of residents

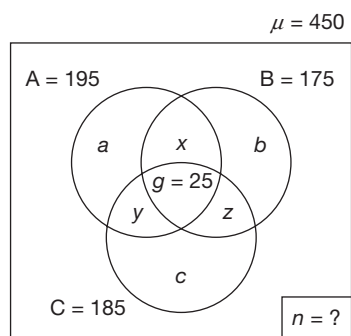
$$= x = \frac{150 \times 100}{15} = 1000$$

26. $x = 5\% = 15$

Hence, total = $\frac{15}{0.05} = 300$

27. $2y + 2x + x = 65\%$

Solutions for questions 28 to 30: The given data can be taken in the form of Venn diagram as follows.



Given, $x + g = 55 \Rightarrow x = 30$,

$z + g = 40 \Rightarrow z = 15$

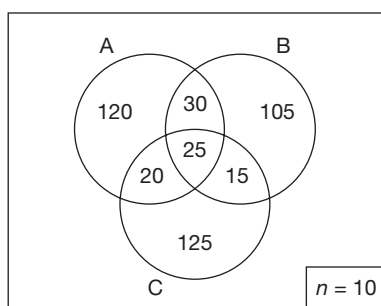
$y + g = 45 \Rightarrow y = 20$

$\therefore A = a + x + y + g = 195$

$\Rightarrow a + 30 + 20 + 25 = 195 \Rightarrow a = 120$

Similarly, $b = 105$, $c = 125$ and $n = 10$

\therefore The complete Venn diagram is as follows.



28. 10 employees of Club A did not withdraw from it, but 15 members of A withdrew from their membership.

\therefore Members of Club A = $195 - 15 = 180$.

29. These 50 can be taken from b or x . The value taken from b gets added to c and the value taken from x gets added to y .

\therefore To maximize $y + g$, take 30 from x .

$y + g = 20 + 25 + 30 = 75$.

30. These 20 can be taken from a or x . The value taken from a is shifted to c and the value taken from x is shifted to z . To minimize the number of members of clubs A and B, take as much value as possible from x . The entire 20 can be taken from x .

\therefore The minimum possible number of employees who are members of clubs A and B = $(x + g) - 20 = 35$

Solutions for questions 31 to 33: Out of the four newspapers, reading exactly two newspapers is possible in six different combinations.

$({}^4C_2 = 6)$. They are ET – BS; ET – BL; ET – FE; BS – BL; BS – FE and BL – FE). Since each of these is 20 students, number of students reading exactly 2 newspapers = $6 \times 20 = 120$.

Also, there is nobody who reads exactly three out of the four newspapers. There are 30 students who read all the four newspapers.

To get the number of students reading one particular newspaper alone, we have to subtract 3 times 20 (because students reading two newspapers is 20 in number and for each newspaper, there will be three ways of pairing with one more newspaper) and 30 (which is the number of students reading all four newspapers).

Number of students reading only ET

= $230 - 3 \times 20 - 30 = 140$.

Number of students reading only BS

= $180 - 3 \times 20 - 30 = 90$.

Number of students reading only BL = $180 - 3 \times 20 - 30 = 90$.

Number of students reading only FE

= $220 - 3 \times 20 - 30 = 130$.

Total number of students reading exactly one newspaper = $140 + 90 + 90 + 130 = 450$.

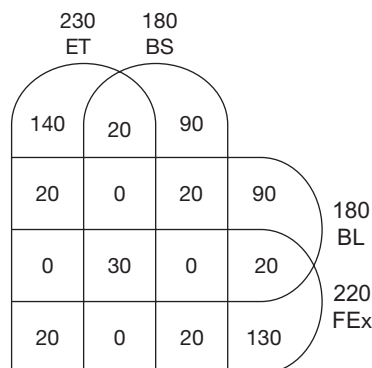
Total number of students reading at least one newspaper = $450 + 120 + 30 = 600$.

This represents 80% of the total number of the students.

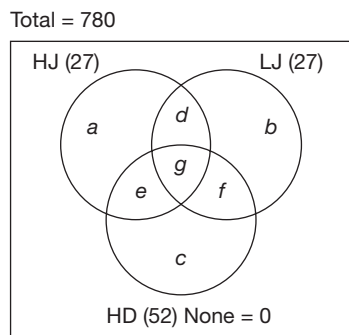
So, total number of students = $600/0.8 = 750$

\therefore Number of students who do not read any newspaper = $0.2 \times 750 = 150$

This set can be solved with the help of the following diagram.



Solutions for questions 34 to 36:



34. $a + b + c = 51$
 $HJ + LJ + HD - 2(d + e + f) - 3g = 51$
 $2(d + e + f) + 3g = 27 + 27 + 52 - 51 = 55$
 $d + e + f$ is maximum when g is minimum.
 When $g = 0$, $d + e + f$ is not an integer.
 When g is 1, $d + e + f = 26$
 \therefore The maximum possible number of students who participated in exactly two of the three events is 26.
35. $a + b + c \geq d + e + f \geq g$
 $27 + 27 + 52 - (2(d + e + f) + 3g) \geq d + e + f$ and $d + e + f \geq g$
 $3(d + e + f + g) \leq 106$ and $d + e + f \geq g$
 $d + e + f + g \leq 35\frac{1}{3}$ and $d + e + f \geq g$
 $g + g \leq d + e + f + g \leq 35\frac{1}{3}$
 $g \leq \frac{106}{6}$
 As g is an integer, $\max(g) = 17$
 \therefore The maximum possible number of students who participated in all the three events is 17.

36. $d + e + f + g = 26$
 $n = 27 + 27 + 52 - (d + e + f + 2g) = 106 - (26 + g) = 80 - g$
 N is minimum when g is maximum
 Maximum value of g is 26.
 \therefore Minimum value of $n = 54$

Solutions for questions 37 to 40: 40 students participated in each of the 400 m dash and 800 m dash — (1)

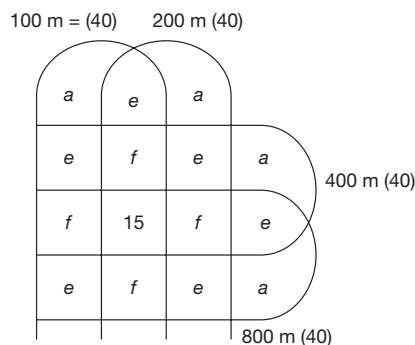
No participant of the 3000 m dash participated in the 100 m dash — (2)

No participant of the 1500 m dash participated in the 200 m dash — (3)

60 students participated in each of 1500 m dash and 3000 m dash — (4)

From (2), (3) and (4), 40 students participated in each of 100 m dash and 200 m dash — (5)

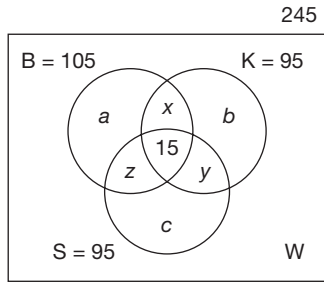
From (1), (5) and the given data, we obtain the diagram below.



37. $a + 3e + 3f + 15 = 40$
 $a + 3(e + f) = 25$
 Here, a is maximum when $e + f$ is minimum, i.e., 0
 $\max(a) = 25$
 The maximum possible number of students who participated in only the 400 m dash is 25.
38. The number of students who participated in the 100 m dash, 200 m dash and 150 m dash = $f + 15$.
 From the previous solution, $a + 3(e + f) = 25$
 f is maximum when e and a are both minimum.
 $\min(e) = 0$ and $\min(a) = 1$
 $\therefore \max(f) = 8$
 The maximum possible number of students who participated in the 100 m dash, 200 m dash and 400 m dash = $8 + 15 = 23$.
39. 16 students participated in only the 100 m dash.
 All the other students who participated in the 100 m dash participated in atleast one other.
 24 students participated in the 100 m dash and atleast one other.
40. $16 + 3(e + f) + 15 = 40$
 $e + f = 3$
 Number of students who participated in only the 100 m dash and 200 m dash = e
 $\max(e) = 3$

EXERCISE-3

Solutions for questions 1 to 3:



$$x + y + z = 3w, a + b + c = 190$$

We have: $105 + \{95 - (x + 15)\} + \{95 - (y + z + 15)\} + w = 245$

$$\Rightarrow x + y + z - w = 20$$

$$2w = 20$$

$$\Rightarrow w = 10$$

$$x + y + z = 30$$

1. $S + K - (S \cap K) = S \cup K$

$$95 + 95 - p = 165$$

Here, $p = (\text{only } S \text{ and } K) + (S, K \text{ and } B) = y + 15$

$$p = 25$$

$$\text{Since } S, K \text{ and } B = 15, y = 25 - 15 = 10.$$

2. $105 + 95 - q = 180$

Here, $q = x + 15 = (\text{only } B \text{ and } K) + (S, K \text{ and } B)$

$$q = 20$$

$$\text{Hence, } x = 20 - 15 = 5$$

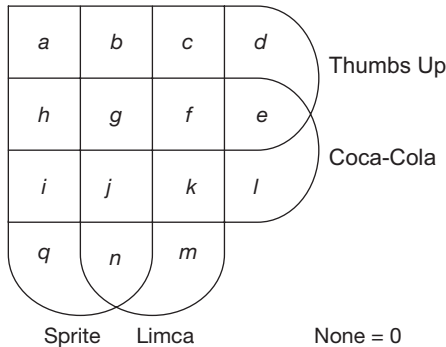
$$\text{So, } y + z = 30 - 5 = 25$$

$$\begin{aligned} \text{Only Somnath} &= 95 - 15 - (y + z) \\ &= 95 - 15 - 25 = 55 \end{aligned}$$

3. Given $z = 0$

$$\begin{aligned} \text{Only Kedarnath} &= 95 - 15 - x - y \\ &= 95 - 15 - 30 = 50 \end{aligned}$$

Solutions for questions 4 to 7:



The given information is as follows.

$$h + g + f + e = 65$$

$$a + b + g + h = 77$$

$$g + f + j + k = 73$$

$$b + c + g + f = 76$$

$$h + g + i + j = 74$$

It is also given that $h = f = x$ (assume)

$$b = j = y \text{ (assume)}$$

\therefore The equations we can be written in the following way.

$$g + 2x + e = 65 \quad \text{(i)}$$

$$g + x + y + a = 77 \quad \text{(ii)}$$

$$g + x + y + k = 73 \quad \text{(iii)}$$

$$g + x + y + c = 76 \quad \text{(iv)}$$

$$g + x + y + i = 74 \quad \text{(v)}$$

The other information given is:

$$\text{Exactly } 1 = 67 = d + l + m + q$$

$$i = 14$$

$$e = 15$$

$$n = 10$$

$$\begin{aligned} \text{Exactly } 1 + 2 &= 557 \\ \text{Exactly } 2 + 3 &= 557 \\ \text{Exactly } 3 + 4 &= 557 \\ \text{Exactly } 4 &= 557 \end{aligned} \quad \text{(vi)}$$

Now substituting the value of i in equation (v), we get:

$$g + x + y = 60 \quad \text{(vii)}$$

Now from (vii), substituting the value of $g + x + y$ in equation (ii), (iii) and (iv), respectively, we get

$$a = 17$$

$$k = 13$$

$$c = 16$$

$$\therefore \text{Exactly } 2 = 17 + 14 + 10 + 13 + 15 + 16 = 85$$

$$\text{Exactly } 3 = 2(x + y) = 2(60 - g).$$

Substituting the above values in equation (vi), we get:

$$67 + 2 \times 85 + 3 \times 2(60 - g) + 4g = 557$$

$$\Rightarrow 67 + 170 + 360 - 6g + 4g = 557$$

$$\Rightarrow 597 - 557 = 2g$$

$$\Rightarrow g = 20$$

Now substituting the values of e and g in equation (i), we get:

$$20 + 2x + 15 = 65$$

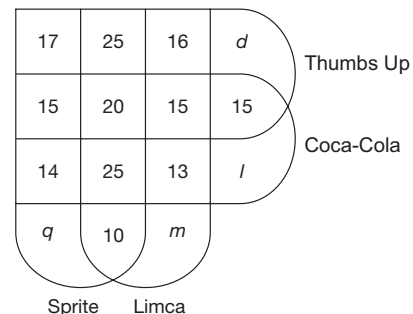
$$\Rightarrow 2x = 30$$

$$\Rightarrow x = 15$$

Now, from equation (vii), we get

$$y = 60 - 15 - 20 = 25$$

\therefore The final Venn diagram will be as follows:





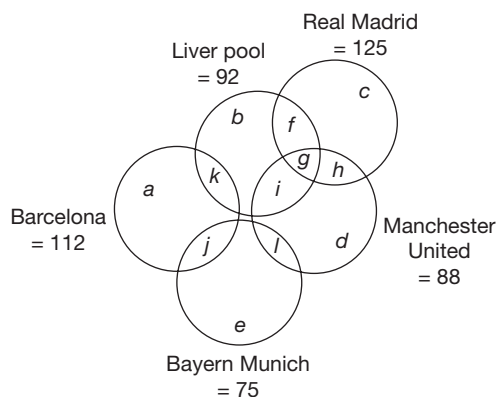
4. The number of students who like both Sprite and Limca but not all the four = $2y + n = 25 \times 2 + 10 = 60$.
5. The total number of students
 = Exactly 1 + Exactly 2 + Exactly 3 + Exactly 4
 = $67 + 85 + 2(15 + 25) + 20$
 = $67 + 85 + 80 + 20 = 252$
6. The number of students who like only Coca-Cola and Limca is 13.
7. Given, $d + q = 25$

$$m + l = 67 - 25 = 42$$

\therefore The required number of students

$$\begin{aligned} &= 25 + 20 + 25 + 10 + m + 13 + 15 + 16 + 15 + 14 + 15 + l \\ &= 168 + l + m \\ &= 168 + 42 = 210 \end{aligned}$$

Solutions for questions 8 to 12: From the given information it is clear that the set of people who like Barcelona has no intersection with Real Madrid or Manchester United. Similarly, the set of people who like Bayern Munich has no intersection with Liverpool or Real Madrid. Intersection between other sets of people is possible. Thus, we get the following Venn Diagram.



From (i), $h + g = 57$ and from (ii), $g = 10$ and $b = 10$
 Hence, $h = 47$

From (ii), $j = h = 47$ and $j = k + 4$

Hence, $k = 43$

From (iv), $l = f = 1/3$ of c

It is given that Real Madrid = 125.

We know that $h = 47$ and $g = 10$.

Hence, $c + f = 68$.

Since, $f = 1/3$ of c , $f = 17$ and $c = 51$. Thus $l = 17$.

$a = \text{Barcelona} - (j + k) = 22$

$e = \text{Bayern Munich} - (j + l) = 11$

$i = \text{Liverpool} - (b + f + g + k) = 12$

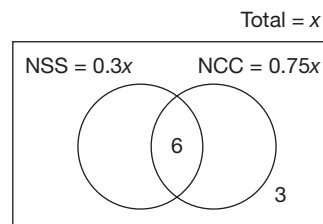
$d = \text{Manchester United} - (g + h + i + l) = 2$

8. Exactly two clubs = $f + i + l + j + k = 183$.
9. Only Bayern Munich or only Barcelona = $a + e = 33$
10. Manchester United but not Liverpool = $h + d + l = 66$

$$11. \text{ Exactly one club} = a + b + c + d + e = 96$$

12. No one among the Barcelona fans likes at least two more clubs.

Solutions for questions 13 to 16:



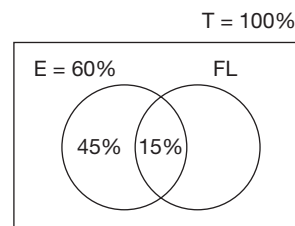
If x is the total number of students in the class, then the number of students participating in NSS and NCC is $0.3x$ and $0.75x$, respectively.

$$\text{Then, } \{0.3x + 0.75x - 6\} + 3 = x \Rightarrow 0.05x = 3 \Rightarrow x = 60$$

13. Total number of students = $x = 60$
14. Percentage of students who want to participate only in

$$\text{NSS} = 30\% - \frac{6}{60} \times 100 = 20\%$$
15. Only in one programme
 = 20% only in NSS + 75% - $6/60 \times 100$
 Only in NCC = 85%.
16. At least in one programme = Total - Number of students participated in neither of these two
 $\Rightarrow 60 - 3 = 57$

Solutions for questions 17 to 20:



- 25% of 60%, i.e., 15% of the school passed in both English and foreign language.
- Since 66% of the students who passed in foreign language failed in English, $33\frac{1}{3}\%$ of students who passed in foreign language passed in English also, i.e., $\frac{1}{3}$ Foreign Language = 15%

$$\Rightarrow \text{Foreign language} = 45\%$$

So, we have only passed in (English) = $60 - 15 = 45\%$,

Only foreign language passed = $45 - 15 = 30\%$

Passed both in English and foreign language = 15%

A total of 90% passed in at least one of the subjects.

So, 10% failed in both.

$$\text{Number of students in the school} = \frac{2}{0.10} = 200$$

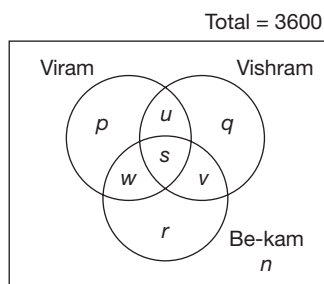
$$17. 200$$

$$18. 45\% + 30\% = 75\%$$

19. 20% of 15% = 3% increase in pass in both subjects.
Hence, the least value of pass only in English will come when all the new people who pass in both subjects are from the group which passed only in English.
 $45 - 3 = 42\%$
20. 40% of 20 students = 8 students. Out of this 4 students passed in exactly one subject. Hence, the remaining 4 students (which is 2% of the school strength) pass in both subjects.
So, pass in both the subjects = $15 + 2 = 17\%$.

Solutions for questions 21 to 25:

Representation of various segments as in the following diagram:



- Members of at least two Unions = $u + v + w + s = 500$ (1)
Vishram members = $q + s + u + v = 1400$ (2)
Only Viram and Be-kam = $w = 100$ (3)
Vishram and Be - kam = $s + v = 200$ (4)
Only Be - kam = $r = 550$ (5)

Members of Viram who are members of only one more union = $w + u = 20\%$ of $(p + u + s + w)$ (6)
 $u + v + w = \frac{1}{8}$ (Total workers) = 450. (7)
From (1), (3) and (4), $u = 200$.
From equation (2), we get
 $q = 1400 - u - (s + v)$
 $= 1400 - 200 - 200 = 1000$.
From (7), $v = 450 - 200 - 100 = 150$
From (4), $s = 200 - 150 = 50$
From (6), $p = 1150$
 $n = 3600 - (p + q + r + s + u + v + w)$
 $= 3600 - (1150 + 1000 + 550 + 50 + 200 + 150 + 100)$
 $= 3600 - (3200) = 400$
Now, we have all figures and the questions can be answered.

21. $s = 50$.
22. $n = 400$.
23. $p + r = 1150 + 550 = 1700$.
24. Since 10 workers have given up their Be-kam membership and taken Vishram membership, it means these 10 workers were initially Be-kam members but not Vishram members, i.e., they must be a part of r or w . When they give up Be-kam and take up Vishram, they will move to q or u , respectively. So, s does not undergo any change at all. Hence, 50 is the answer.
25. $q + u = 1000 + 200 = 1200$

8

Cubes

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn to visualize a cube and how to cut a cube across different axes.
- Be able to relate the number of cuts to the number of smaller cubes/pieces that arise.
- Understand the different colored faces which form a part of a bigger cube.
- Understand how to deal with questions based on folding and unfolding of a cube.
- Learn how to get a given number of pieces using minimum number of cuts and how to get maximum number of pieces using a given number of cuts.

A cube is a three-dimensional solid having 6 faces, 12 edges and 8 corners. All the edges of a cube are equal, and hence, all the faces are square in shape.

In competitive exams a few questions may be asked based on cubes.

The questions on cubes may belong to any one of the following categories.

1. A cube is cut by making certain specified number of cuts. The directions in which the cuts are made may or may not be given. We are to find the number of identical pieces resulting out of the given cuts.

2. The number of identical pieces, into which a cube is cut is given and we need to find the number of cuts.
3. A cube could be painted on all or some of its faces with the same colour or different colours and then cut into a certain specified number of identical pieces. Then questions of the form 'How many small cubes have 2 faces painted?'. 'How many smaller cubes have only one face painted?' could then be framed.

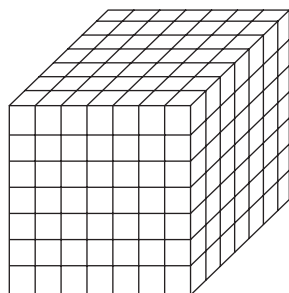
SOLVED EXAMPLES

Directions for questions 8.01 to 8.04: A cube is painted and cut into 343 smaller but identical pieces by the minimum possible number of cuts.

- 8.01:** How many smaller pieces have exactly three painted faces?
- 8.02:** How many smaller pieces have exactly two painted faces?
- 8.03:** How many smaller pieces have exactly one painted face?
- 8.04:** How many smaller pieces have no painted face?

Solutions for questions 8.01 to 8.04: A cube's outer surface is painted and then it is cut into smaller pieces. Now the smaller pieces obtained have paint on some surfaces and the surfaces generated after the cut do not have any paint on them.

When a cube is cut into 343 smaller pieces by applying minimum number of cuts, it appears as follows



The given cube $7 \times 7 \times 7 = 343$	No. of smaller pieces which have	Generalisation $n \times n \times n$
1. 8 corner pieces	(i) exactly three painted surfaces	8 corner pieces
2. 5 pieces at each edge i.e. $(7-2) \times 12$ edges = 60	(ii) exactly two painted surfaces	$(n-2) \times 12$ $= 5 \times 12$
3. 25 pieces at the middle of each surface i.e. $(7-2)^2 \times 6$ surfaces = 150	(iii) exactly one painted surfaces	$(n-2)^2 \times 6$ $= 5^2 \times 6$
4. $5 \times 5 \times 5$ i.e., $(7-2)^3 = 125$	(iv) no painted surfaces	$(n-2)^3 = 125$

Directions for questions 8.05 to 8.08: A cube is painted and cut into 210 smaller but identical pieces by making the minimum possible number of cuts.

8.05: How many smaller pieces have exactly three painted faces?

8.06: How many smaller pieces have exactly two painted faces?

8.07: How many smaller pieces have exactly one painted face?

8.08: How many smaller pieces have no painted face?

Solutions for questions 8.05 to 8.08: To cut a cube into 210 pieces i.e., 5, 6, 7 will be the number of pieces in each direction.

8.05: The number of pieces with exactly three painted surfaces is 8.

8.06: The number of pieces with exactly two painted surfaces:

$$\text{For X-plane} \quad 4(5-2)+$$

$$\text{For Y-plane} \quad 4(6-2)+$$

$$\text{For Z-plane} \quad 4(7-2)+$$

$$\text{Total} = \underline{\underline{48}}$$

8.07: The number of pieces with exactly one painted surface:

$$\text{For X-Y plane} \quad 2(5-2)(6-2)+$$

$$\text{For Y-Z plane} \quad 2(6-2)(7-2)+$$

$$\text{For Z-X plane} \quad 2(7-2)(5-2)$$

$$\text{Total} = \underline{\underline{94}}$$

8.08: The number of pieces having no painted face
 $= (5-2)(6-2)(7-2) = 60$

Directions for questions 8.09 to 8.14: A pair of opposite faces of a cube is painted is yellow, another pair of opposite faces, orange and the remaining two faces are painted white. The cube is then cut into 343 smaller but identical cubes.

8.09: How many of the smaller cubes have all the three colours on them?

8.10: How many of the smaller cubes have only white and orange on them?

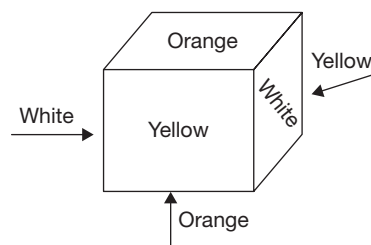
8.11: How many of the smaller cubes have exactly two colours on them?

8.12: How many of the smaller cubes have only white colour on them?

8.13: How many of the smaller cubes have exactly one colour on them?

8.14: How many of the smaller cubes have no colour on them?

Solutions for questions 8.09 to 8.14: The cube after cutting, has $7 \times 7 \times 7 = 343$ pieces. The patten of painting is as follows.





8.09: Since no two adjacent surfaces have the same colour, each corner piece has three painted faces and each face has a different colour. Hence the number of smaller cubes with all the three colours on them is 8.

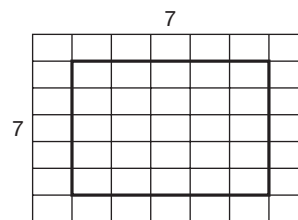
8.10: We find the smaller cubes with only white and orange colours on them at the edges which are common for white and orange surfaces. The number of smaller pieces with only white and orange on them is (white — orange edges) \times 5 (at each edge) = 20.

Similarly, the number of small pieces with only white and yellow colours on them and those with only yellow and orange are 20 each.

8.11: The number of small pieces with exactly two colours is $(20 + 20 + 20) = 60$.

This can also be obtained by applying the formula $(n - 2) \times 12$ i.e. $5 \times 12 = 60$.

8.12: We find that the smaller pieces with only white colour on them, are at the middle of the surfaces painted in white.



i.e. $5 \times 5 = 25$ pieces on one white surface $\times 2 = 50$ pieces. Similarly, the number of small pieces with only blue colour and those with only yellow colour are 50 each.

8.13: The number of small pieces with exactly one colour is $(50 + 50 + 50 = 150)$.

This can also be obtained by applying the formula $(n - 2)^2 \times 6$.

8.14: The number of small pieces with no colour on them is $(n - 2)^3$ i.e. $(7 - 2)^3 = 125$.

EXERCISE-1

Directions for questions 1 to 11: Select the correct alternative from the given choices.

- What will be the maximum possible number of pieces when a cube is cut into 5 cuts?
(A) 18 (B) 6
(C) 25 (D) 5
- What will be the maximum possible number of pieces when a cube is cut into 6 cuts?
(A) 37 (B) 36
(C) 42 (D) 27
- What will be the maximum possible number of pieces when a cube is cut into 17 cuts?
(A) 250 (B) 160
(C) 270 (D) 294
- What will be the maximum possible number of pieces when a cube is cut into 8 cuts?
(A) 36 (B) 48
(C) 45 (D) 40
- What will be the maximum possible number of pieces when a cube is cut into 11 cuts?
(A) 100 (B) 90
(C) 84 (D) 54
- What is the least possible number of cuts required to cut a cube into 80 identical pieces?
(A) 21 (B) 12
(C) 19 (D) 10
- What is the number of ways in which two faces of a cuboid of dimensions $6\text{ cm} \times 7\text{ cm} \times 8\text{ cm}$ can be painted in green colour?
(A) 2 (B) 3
(C) 4 (D) 6
- How many cubes of dimensions $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ are required to cover a cube of dimensions $7\text{ cm} \times 7\text{ cm} \times 7\text{ cm}$ completely?
(A) 169 (B) 294
(C) 386 (D) 488
- How many cubes of dimensions $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ are required to cover a cuboid of dimensions $6\text{ cm} \times 8\text{ cm} \times 9\text{ cm}$ when it is placed at the corner of a room such that three faces of the cuboid are covered by two walls and the floor of the room?
(A) 288 (B) 261
(C) 198 (D) 448

- 125 smaller cubes of dimensions $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ are stacked together to form a larger cube and then the cube is cut along two diagonals. How many of the smaller cubes are cut into smaller pieces?
(A) 10 (B) 25
(C) 45 (D) 50

- 1000 smaller cubes of dimensions $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ are stacked together to form a larger cube and then the cube is cut along a diagonal. How many of the smaller cubes are cut into two pieces?
(A) 25 (B) 50
(C) 90 (D) 100

Directions for questions 12 to 14: These questions are based on the following information.

A large cube painted on all six faces is cut into 27 smaller but identical cubes.

- How many of the smaller cubes have no faces painted at all?
(A) 0 (B) 1
(C) 3 (D) 4
- How many of the smaller cubes have exactly one face painted?
(A) 3 (B) 6
(C) 12 (D) 15
- How many of the smaller cubes have exactly two faces painted?
(A) 36 (B) 6
(C) 12 (D) 15

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

A large cube is painted on all six faces and then cut into a certain number of smaller but identical cubes. It was found that among the smaller cubes, there were eight cubes which had no face painted at all.

- How many smaller cubes was the original large cube cut into?
(A) 27 (B) 48
(C) 64 (D) 125
- How many small cubes have exactly one face painted?
(A) 12 (B) 24
(C) 16 (D) 32
- How many small cubes have exactly two faces painted?
(A) 6 (B) 12
(C) 18 (D) 24

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

There is a cube in which one pair of adjacent faces is painted red, the second pair of adjacent faces is painted blue and a third pair of adjacent faces is painted green. This cube is now cut into 216 smaller but identical cubes.

18. How many small cubes are there with one face painted red?
 (A) 64 (B) 81
 (C) 60 (D) 120
19. How many small cubes are with both red and green on their faces?
 (A) 8 (B) 12
 (C) 16 (D) 32
20. How many small cubes are there showing only green or only blue on their faces?
 (A) 64 (B) 72
 (C) 81 (D) 96

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

A cube is painted in black and green, each on three faces such that any two faces with same colour are adjacent to each other. Now this cube is cut into 60 identical pieces using 2, 3 and 4 cuts parallel to different faces.

21. How many smaller pieces have exactly two faces painted in black?
 (A) 5 (B) 9
 (C) 18 (D) 27
22. How many smaller pieces have both the colours on them?
 (A) 9 (B) 18
 (C) 6 (D) 24
23. How many smaller pieces have no face painted?
 (A) 6 (B) 9
 (C) 11 (D) 1

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

Two opposite faces of a cube are painted in blue, another pair of opposite faces are painted green and the remaining faces are painted in red. The cube is now cut into 210 smaller but identical pieces using minimum possible number of cuts.

24. How many smaller pieces have exactly two colours on them?
 (A) 48 (B) 36
 (C) 24 (D) Cannot be determined
25. What is the maximum possible number of smaller piece, which have green and red colour on them?

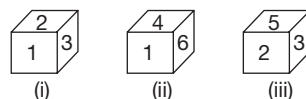
- (A) 20 (B) 24
 (C) 26 (D) 28

26. What is the minimum possible number of pieces which have only blue colour on them?

- (A) 24 (B) 12
 (C) 30 (D) 60

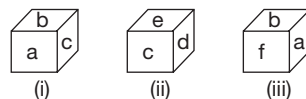
Directions for questions 27 to 33: In each of the following questions, three different views of a cube are given. Based on these diagrams answer the following questions.

27. Which of the following statements is true?



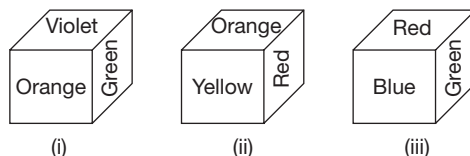
- (A) 3 is opposite to 6 (B) 5 is opposite to 4
 (C) 4 is opposite to 3 (D) 2 is opposite to 2

28. Which of the following indicates the correct pair of opposite faces?



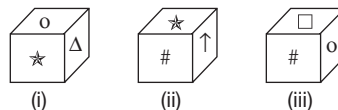
- (A) a – d (B) a – f
 (C) f – e (D) b – d

29. Which colour is at the bottom of the second figure?



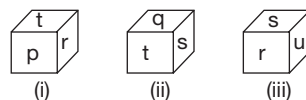
- (A) Blue (B) Green
 (C) Orange (D) Red

30. Which of the following are adjacent to Δ ?



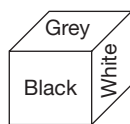
- (A) star, # (B) up arrow, #
 (C) o, up arrow (D) o, #

31. Which of the following are opposite to r and t , respectively?

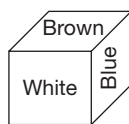


- (A) u and q (B) p and s
 (C) s and p (D) q and u

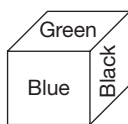
32. Which of the following is at the bottom of figure (i)?



(i)



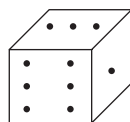
(ii)



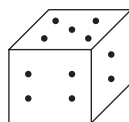
(iii)

- (A) Blue (B) Green
(C) Black (D) Brown

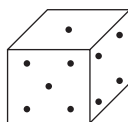
33. What is the sum of the dots on the two faces which are adjacent to both the faces with two dots and five dots, if the number of dots on the six faces is 1, 2, 3, 4, 5 and 6, respectively?



(i)



(ii)

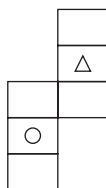


(iii)

- (A) 10 (B) 7
(C) 5 (D) 4

Directions for questions 34 and 35: In the following questions the figure is folded to form a box. Select from among the given alternatives, the box or boxes that can be formed by folding the figure.

34.



I



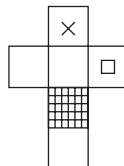
II



III

- (A) Only I (B) Only II
(C) Only I and II (D) Only III

35.



I



II

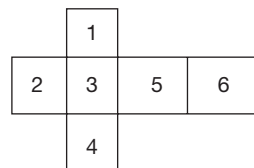


III

- (A) Only I
(B) Both II and III
(C) Both I and III
(D) All of them

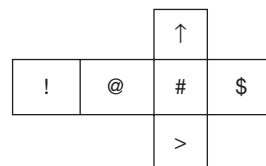
Directions for questions 36 to 40: Select the correct alternative from the given choices.

36. If the following figure is folded to form a cube, then what is the number on the face opposite to the face marked 3?



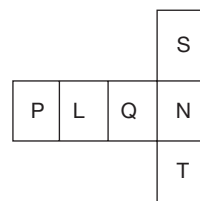
- (A) 6 (B) 5
(C) 1 (D) 2

37. If the following figure is folded to form a cube, then what is the symbol on the face opposite to the face marked '@'?



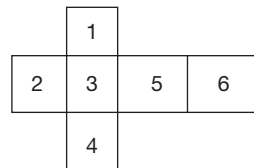
- (A) ! (B) ^
(C) > (D) \$

38. If the following figure is folded to form a cube, what would be the letter on the face opposite to the face marked 'L'?



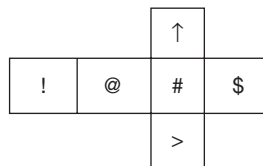
- (A) Q (B) N
(C) T (D) S

39. If the following figure is folded to form a cube, then what is the number on the face opposite to the face marked 3?



- (A) 6 (B) 5
(C) 1 (D) 2

40. If the following figure is folded to form a cube, then what is the symbol on the face opposite to the face marked '@'?



- (A) ! (B) ↑
(C) > (D) \$

EXERCISE-2

Directions for questions 1 and 2: Select the correct alternative from the given choices.

- 216 small and identical cubes are placed together to form a big cube. What is the number of small cubes that get cut when the big cube is cut by one diagonal cut and two diagonal cuts, respectively?
(A) 64, 70 (B) 36, 70
(C) 36, 72 (D) 70, 64
- 729 small and identical cubes are placed together to form a big cube. What is the number of small cubes that get cut by one diagonal cut and two diagonal cuts, respectively?
(A) 85, 150 (B) 81, 105
(C) 82, 162 (D) 81, 153

Directions for questions 3 to 7: These questions are based on the following information.

A cube is painted in such a way that a pair of adjacent faces is painted in green; a pair of opposite faces is painted in yellow and another pair of adjacent faces is painted in red. This cube is now cut into 125 small but identical cubes.

- How many small cubes have exactly two faces painted in green?
(A) 10 (B) 7
(C) 5 (D) 8
- How many small cubes have at least two different colours on their faces?
(A) 30 (B) 38
(C) 36 (D) 42
- How many of the small cubes have exactly one colour on them?
(A) 60 (B) 45
(C) 54 (D) 15
- How many of the small cubes do not have green colour but have yellow or red colours on them?
(A) 40 (B) 75
(C) 80 (D) 53

7. How many small cubes have exactly two painted faces and have exactly two colours on them?

- (A) 36 (B) 30
(C) 24 (D) 34

Directions for questions 8 to 11: These questions are based on the following information.

One face of a cube is painted in green, two faces are painted in yellow and three faces are painted in white. This cube is now cut into 512 small but identical cubes.

- What is the minimum possible number of small cubes that have two faces painted in yellow?
(A) 0 (B) 9
(C) 7 (D) 16
- What is the maximum possible number of smaller cubes that have only green and yellow colours on them?
(A) 12 (B) 6
(C) 14 (D) 13
- What is the maximum possible and the minimum possible number of small cubes, respectively that have exactly one colour on them?
(A) 241, 228 (B) 234, 228
(C) 241, 234 (D) 241, 226
- What is the least possible number of small cubes that have at least two painted faces but have only white colour on them?
(A) 18 (B) 15
(C) 17 (D) 12

Directions for questions 12 to 16: These questions are based on the following information.

A cube is painted such that one of its faces is painted in black, one face is painted in white and one face is painted in red. The other three faces are left unpainted. The cube is now cut into 729 small and identical cubes.

- What is the maximum possible number of small cubes that have all the three colours on them?
(A) 1 (B) 2
(C) 4 (D) 5

13. What is the minimum possible number of small cubes that have only black and white colours on them?
 (A) 1 (B) 5
 (C) 6 (D) 0
14. What is the minimum possible number of small cubes that have only red colour on them?
 (A) 72 (B) 81
 (C) 63 (D) 80
15. How many small cubes have white colour on them?
 (A) 75 (B) 85
 (C) 72 (D) 81
16. What is the minimum possible number of small cubes that have no colour on them?
 (A) 343 (B) 512
 (C) 504 (D) 269

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

A cube has all the six faces painted in six different colours, such as white, blue, red, yellow, green and pink in such a way that pink and green are on two opposite faces. The cube is placed on a table with the pink face touching the top of the table. Red is facing you, whereas white and blue faces are opposite to each other. The cube is cut into 120 identical pieces by making the least number of cuts possible where all the cuts are parallel to the faces of the cube. The least number of possible cuts are made in the horizontal direction and maximum number of possible cuts are made parallel to the red face.

17. How many small pieces have white colour on their faces?
 (A) 36 (B) 42
 (C) 30 (D) 24
18. How many small pieces have at least two different colours on their faces?
 (A) 44 (B) 28
 (C) 38 (D) 30
19. How many small pieces have no colour on their faces?
 (A) 42 (B) 24
 (C) 36 (D) 27

Directions for questions 20 to 22: These questions are based on the following information.

Two identical wooden cubes P and Q placed on a table facing you, have their faces painted as follows. One pair of opposite faces of cube P is painted with the same colour, i.e., red colour and another pair of opposite faces is painted blue. One of the remaining faces is painted yellow, whereas the other one is painted brown.

One pair of opposite faces of cube Q is painted blue. A second pair of opposite faces of Q are painted in such a way that the opposite face of brown is green. The other two

opposite faces are painted black and yellow, respectively. In the following questions, 'two faces touch each other' implies that the complete area of one face touches the complete area of the second face.

20. The two cubes are placed next to each other on the table touching each other such that, whether the positions of P and Q are interchanged or left as they are, the two faces of P and Q touching each other are of the same colour. If the top faces of both P and Q have to be of the same colour, then which of the following must be true?
 (A) The front faces of cube P and Q are red and yellow, respectively.
 (B) The two faces of cube P and Q which are touching the table top are of brown and black colours, respectively.
 (C) The front face of cube P is of red colour.
 (D) The top faces of cubes P and Q are of red and yellow colours, respectively.
21. Q is placed on the top of P such that no blue face of either cube is horizontal. If brown and blue are the front faces of P and Q, respectively, then which of the following statements must be false?
 (A) The faces of the two cubes touching each other are of red and green colour.
 (B) The faces of two cubes which are touching each other are of red and brown colours.
 (C) If blue and green are the colours on the right side faces of two cubes, respectively, then the left side faces of two cubes will be blue and brown, respectively.
 (D) The faces of the two cubes which are touching each other are yellow and brown.
22. If cube Q is kept behind cube P in such a way, that the yellow face of P faces the brown face of cube Q and the faces touching the table are of red and black colours, then which faces of both the cubes have same colour?
 (A) Top faces
 (B) Top and bottom faces only.
 (C) The faces to the left and the right only.
 (D) Both top and front faces only.

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

Two colours, red and blue are used to paint a cube. Red is painted on three faces, each of which is adjacent to the other two and blue is painted on the remaining faces. Assume that one can see exactly three faces when the cube is kept on a plane.

23. What is the total number of ways in which the blue colour is not seen at all when the cube is kept on a table?
 (A) 4 (B) 3
 (C) 2 (D) 1



24. What is the total number of ways in which exactly one face painted blue is seen?
 (A) 2 (B) 4
 (C) 3 (D) 5

25. What is the total number of ways in which exactly two faces painted blue are seen?
 (A) 3 (B) 2
 (C) 5 (D) 1

Directions for questions 26 and 27: These questions are based on the following information.

Two faces of a cube are painted red, two faces are painted green and the remaining faces are painted blue. Now the cube is cut into 216 smaller but identical pieces with minimum possible number of cuts.

26. What is the minimum possible number of smaller pieces with exactly two different colours on them?
 (A) 36 (B) 42
 (C) 48 (D) 56
27. What is the maximum possible number of smaller pieces which have at most one colour on them?
 (A) 160 (B) 172
 (C) 198 (D) 208

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

Three different faces of a cube are painted in three different colours, such as red, green and blue. This cube is now cut into 216 smaller but identical cubes.

28. What are the least and the largest numbers of small cubes that have exactly one face painted?
 (A) 75 and 86 (B) 64 and 81
 (C) 64 and 72 (D) 75 and 84
29. What is the maximum number of small cubes that have one face painted green and one face blue and no other face painted?
 (A) 2 (B) 4
 (C) 6 (D) 8
30. What are the least and the maximum numbers of cubes that have no face painted at all?
 (A) 125 and 130 (B) 120 and 125
 (C) 115 and 120 (D) 100 and 125

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

Each face of a cube is painted in green, red or blue.

31. Totally in how many different ways can the cube be painted?
 (A) 49 (B) 56
 (C) 64 (D) 81
32. In how many different ways can the cube be painted with at least two faces blue?

- (A) 24 (B) 30
 (C) 34 (D) 42

33. In how many different ways can the cube be painted such that all three colours are there on the cube?

- (A) 32 (B) 29
 (C) 25 (D) 30

34. In how many different ways can the cube be painted such that no two adjacent faces have the same colour?

- (A) 3 (B) 1
 (C) 2 (D) 4

Directions for questions 35 to 37: These questions are based on the following information.

A cube is painted red, blue and green in such a way that each face is painted with a single colour and each colour is painted on two adjacent faces. The cube is placed on a table and one can see exactly three faces of the cube.

35. What is the total number of distinct corners from where red and blue colours are visible?

- (A) 5 (B) 4
 (C) 6 (D) 8

36. What is the total number of ways in which all three colours can be seen?

- (A) 2 (B) 3
 (C) 1 (D) 5

37. What is the total number of distinct possible combinations of three colours that can be seen?

- (A) 8 (B) 9
 (C) 7 (D) 6

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

Each face of a die is marked with a different number from 1 to 6. The numbers on the faces of the die are marked in such a way that the sum of the numbers on any pair of opposite faces is seven. Two such dice are thrown. Assume that one can always see exactly three faces of each die.

38. What is the total number of distinguishably different ways in which the sum of the numbers on the visible faces of both the cubes together is 20?

- (A) 2 (B) 6
 (C) 3 (D) 5

39. What is the total number of distinguishably different ways in which the sum of numbers on visible faces is exactly 10 on at least one die?

- (A) 12 (B) 17
 (C) 15 (D) 19

40. What is the total number of ways in which a specified number is visible on both the dice?

- (A) 32 (B) 16
 (C) 14 (D) 18

EXERCISE-3

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

A large cube is painted on only three of its faces with three different colours, such as red green and black. This cube is now cut into 125 smaller but identical faces.

1. What is the minimum number of cubes that have no face painted?
2. What is the maximum number of cubes that have exactly two faces painted?
3. What is the minimum number of cubes (respectively) that have exactly one face painted?

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

The faces of the cuboid are painted with three different colours, such as black, red, and yellow such that each colour is painted on at least one face. Now 4, 5 and 6 cuts are made in three different directions.

4. What is the maximum possible number of smaller pieces that have only black on their faces?
5. What is the maximum possible number of smaller pieces that have only black and yellow painted on their faces?
6. What is the maximum number of smaller pieces with three colours painted on them, respectively?

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

A large cube is formed by stacking 64 smaller and identical cubes. These smaller cubes are numbered 1 to 64 in the following manner. The four cubes in the front row of the bottom layer are numbered 1 to 4 from left to right. The cubes in the second row of the bottom layer are numbered 5 to 8. This pattern of numbering continued till all the 16 cubes in the bottom layer are numbered. The numbering of the second layer is done in a similar fashion, by numbering the cubes in the front row from 17 to 20 from left to right. This pattern of numbering continues for all the layers from the bottom layer to the top layer

7. What is the sum of numbers on all the cubes in the front row of the bottom layer?
8. What is the sum of numbers on all the cubes in the left column of the front face?
9. What is the sum of the numbers on the cubes along the left column of the back layer?
10. What is the sum of the numbers on the cubes along the second row of the top layer?

Directions for questions 11 to 14: These questions are based on the following information.

A large cube is formed by stacking 125 smaller and identical cubes. These smaller cubes are numbered 1 to 125 in the following manner. The five cubes in the front row of the bottom layer are numbered 1 to 5 from left to right. The cubes in the second row of the bottom layer are numbered 6 to 10. This pattern of numbering continues till all the 25 cubes in the bottom layer are numbered. The numbering of the second layer is done in a similar fashion, by numbering the cubes in the front row from 26 to 30 from left to right. This pattern of numbering continues for all the layers from the bottom layer to top layer.

11. What is the sum of numbers on the cubes along the column which has its base in the cube which is second from the left end of the bottom row of the layer behind the front layer?
12. What is the sum of the numbers on the cubes along the diagonal from the cube at the left end of the front row of the top layer to the cube at the right end of the last row of the top layer?
13. What is the sum of the numbers on the cubes along the diagonal from the cube at the left end of the bottom row of the front face to the cube at the right end of the last row of the top layer?
14. What is the sum of the numbers on the cubes along the diagonal from the cube at the right end of the bottom row of the front layer to the cube at the left end of the top row of the back layer?

Directions for questions 15 to 18: These questions are based on the following information.

A large wooden cube is painted with three different colours such that opposite faces are painted with the same colour. The cube is now entirely cut into 455 small and identical pieces by making the lowest possible number of cuts on the cube. All the completely unpainted smaller pieces are thrown away.

15. What is the total number of cuts made on the larger cube?
16. What is the highest possible number of pieces that have exactly one face painted with a particular colour?
17. What is the highest possible number of pieces that have exactly two faces painted with a particular combination of colours?
18. What is the lowest possible number of pieces which are painted with exactly one combination of two colours?



Directions for questions 19 to 22: These questions are based on the following information.

A large cube is built using 216 identical cubes which are engraved with numbers 1 to 216. The large cube is built in the following pattern.

- (i) The cubes are stacked to form a large cube.
 - (ii) The cubes engraved 1 to 6 are placed in a column, one behind the other such that the smallest number is to the front. The six cubes numbered 7 to 12 are placed in the second column to the right of the cubes in the first column such that the smallest number is in the front. The same pattern is followed until the bottom layer is completely built.
 - (iii) Each other layer is built in the same pattern as the bottom layer. In these layers, smaller cubes are placed starting with the smallest available number being placed on the left most cube on the front row of the previous layer.
 - (iv) After the large cube is built with 216 cubes, its five visible faces are painted in blue.
19. What is the sum of the numbers on the cubes that have three sides painted?

20. What is the sum of the numbers on the small cubes that are resting on the floor but have no sides painted?
21. The two end cubes of one of the edges on the front face of the large cube have three sides painted. What is the sum of the numbers on the cubes that form this edge?
22. What is the sum of the numbers on the cubes that form the diagonal that connects the two corner cubes having three sides painted?

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

A cube is painted with blue on two adjacent faces. One of the remaining faces is painted with red colour such that its opposite face remain unpainted. The remaining two faces are painted with green colour. Now the cube is cut into 512 smaller and identical cubes.

23. How many smaller cubes have exactly one of their faces painted?
24. How many smaller cubes have at most two faces painted?
25. How many smaller cubes have only one colour painted on them?

ANSWER KEYS

Exercise-1

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

Exercise-2

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

Exercise-3

- | | | | | | | |
|-------|--------|---------|---------|---------|----------|---------|
| 1. 60 | 5. 32 | 9. 148 | 13. 315 | 17. 44 | 21. 1176 | 24. 508 |
| 2. 12 | 6. 8 | 10. 218 | 14. 315 | 18. 12 | 22. 1191 | 25. 218 |
| 3. 48 | 7. 10 | 11. 285 | 15. 22 | 19. 794 | 23. 204 | |
| 4. 90 | 8. 100 | 12. 565 | 16. 110 | 20. 296 | | |

SOLUTIONS

EXERCISE-1

1. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
2, 2, 1	$3 \times 3 \times 2 = 18$

2. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
2, 2, 2	$3 \times 3 \times 3 = 27$

3. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
6, 6, 5	$7 \times 7 \times 6 = 294$

4. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
3, 3, 2	$4 \times 4 \times 3 = 48$

5. The number of pieces obtained would be the maximum possible when the given number of cuts are made as equally as possible in the three directions.

Distribution	Number of pieces
4, 4, 3	$5 \times 5 \times 4 = 100$

6. We get the least possible number of cuts when the given number of pieces is factorized in such a way that the factors are as equal as possible.

$$80 = 4 \times 4 \times 5 \Rightarrow 3 + 3 + 4 = 10 \text{ cuts}$$

\therefore 10 is the minimum possible number of cuts required to cut the cube into 80 identical pieces.

7. The two faces of a cube to be painted can be either adjacent or opposite to each other.

The number of ways in which two adjacent faces of a cuboid can be chosen is 3 ways.

The number of ways in which two opposite faces of a cuboid can be chosen is 3.

\therefore The total number of ways in which two faces of a cuboid to be painted in green colour = $3 + 3 = 6$ ways.

8. After covering the cube of dimensions $7 \text{ cm} \times 7 \text{ cm} \times 7 \text{ cm}$, the dimension of the cube will be $9 \text{ cm} \times 9 \text{ cm} \times 9 \text{ cm}$.

\therefore A total of $(9 \times 9 \times 9) - (7 \times 7 \times 7) = 729 - 343 = 386$.

9. The dimensions of $6 \times 8 \times 9$ cube which is kept at corner of a room, after covering with $1 \times 1 \times 1$ cubes will be $7 \times 9 \times 10$.

\therefore A total of $(7 \times 9 \times 10) - (432) = 198$ are required.

10. $125 = 5 \times 5 \times 5$, here $n = 5$, which is odd.

When a cube is cut along two diagonals, the number of pieces that get cut = $2n^2 - n = 2 \times 5^2 - 5 = 45$ (as n is odd).

11. $1000 = 10 \times 10 \times 10$. Here $n = 10$.

When a cube is cut along a diagonal, the number of pieces that get cut = $n^2 = 10^2 = 100$

12. Cutting the large cube into 27 smaller cubes will give us a $3 \times 3 \times 3$ configuration. Out of these, if we remove all the outer cubes to get the number of cubes not having any face painted at all, we have to remove one layer of cubes on each of the faces so that we are left with a $1 \times 1 \times 1$ cube which is not painted at all. Hence, the answer is one cube.

13. The cubes which are not along any edge are the ones that have only one face painted. On each face of the original cube, if we do not count the faces along the edges, then we have only one face at the middle which is painted only on one face. Hence, for six faces of the original cube, we get six cubes that have only one face painted.

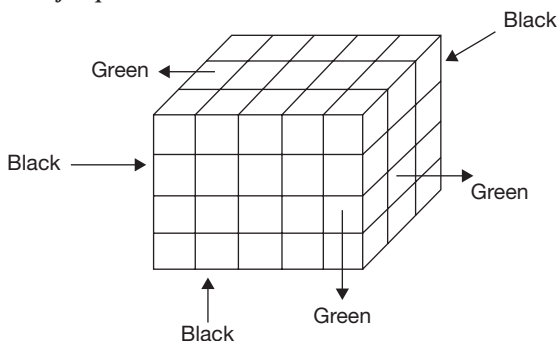
14. The cubes along the edges but not at the corners will have two faces painted. Along each edge, if we remove the corner cubes, there is one cube that has two faces painted. Hence, for 12 edges of the cube, there will be 12 cubes which have only two faces painted.

15. When a cube is painted and cut into n number of smaller pieces along each edge, the total number of smaller cubes that we get will be $n \times n \times n$. From these, if we remove the complete outer layer of the cubes on all faces, we will have all smaller cubes with paint on them removed and we will be left with $(n - 2) \times (n - 2) \times (n - 2)$ cubes. In this case, if the number of cubes that do not have any face painted is 8, it is a $2 \times 2 \times 2$ cube. so, before painting, it must have been a $4 \times 4 \times 4$ cube so the original cube was cut into 64 smaller cubes.

16. On each face of the original large cube, if we remove the outer row of cubes along all the four edges, the remaining 2×2 ($= 4$) cubes will have exactly one face painted. On all six faces together, there will be 24 cubes that will have exactly one face painted.
17. Along each edge, if we remove the corner cubes, the remaining cubes have two faces painted; since the original cube is cut into $4 \times 4 \times 4$ cubes, on each edge, we will have 2 cubes with exactly two faces painted on all twelve edges we have $2 \times 12 = 24$ cubes.
18. One face red \Rightarrow out of $36 + 30 = 66$ cubes (on both the red faces together), we need to remove 6 common cubes which have two faces painted red. Hence, $66 - 6 = 60$.
19. There are 3 common edges giving $6 + 6 + 4$ cubes which have green and red, i.e., 16.
20. Only one colour (blue or green) \Rightarrow We have to consider two possibilities:
- The central 4×4 square on a face (which gives 16 cubes).
 - The four middle-cubes along the common edge of two faces having the same colour (i.e., two green faces have a common edge of 6 cubes out of which four cubes have only green colour).

Thus, if we take the cubes which have only green colour on their faces, there are 16 cubes for each of the two green faces plus four common cubes – a total of $(16 + 16 + 4) = 36$ cubes with only green on their faces. Similarly, there will be 36 cubes which have only blue on their faces. Hence, a total of 72 cubes.

Solutions for questions 21 to 23:



Corners (8)	Edges (12)	Faces (6)
BBB – 1	BB – 3	B – 3
GGG – 1	GG – 3	G – 3
GGB – 3	BG – 6	
BBG – 3		

21. At the corners, three such pieces are there. On the edges, the number of such pieces = 1 (along the plane with 2 cuts) + 2 (along the plane with 3 cuts) + 3 (along the plane with 4 cuts) \therefore Required number of pieces = $3 + 6 = 9$.

22. Except two corners, all the corners have both the colours $\Rightarrow 6$ pieces.

On the edges, the number of pieces having both the colours according to the three different cuts in each plane. \therefore Required number of pieces = $6 + 12 = 18$.

23. The number of pieces with no face painted = 1 (along the plane with 2 cuts) + 2 (along the plane with 3 cuts) + 3 (along the plane with 4 cuts) = $1 + 2 + 3 = 6$.

24. $210 = 7 \times 6 \times 5$

The number of pieces that have exactly two colours on them = $4 [(7 - 2) + (6 - 2) + (5 - 2)] = 48$.

25. The maximum possible number of pieces with green and red are obtained, when the pieces with green and red are along the side where the length is the highest.

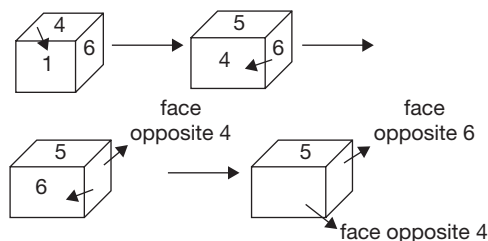
Here, the maximum length is 7 cm.

\therefore The number of pieces, in this case, with green and red = $4 \times 7 = 28$ pieces.

26. The minimum number of pieces with only blue colour on them is obtained when the smaller pieces are at the centre of the face with dimensions 5×6 .

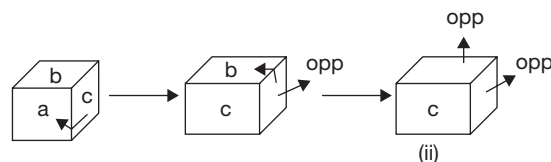
\therefore The minimum possible number of required pieces = $2 \times (5 - 2) (6 - 2) = 24$.

27. From figures (i) and (ii), we understand that 1 is opposite to 5, because 2, 3, 4 and 6 are adjacent to 1. We obtain figure (iii) by rotating the die in figure (ii) as follows:



Hence, 2 is opposite to 4 and 3 is opposite to 6. The first option is correct.

28. From (i) and (ii), c is opposite to f . The second figure is obtained by rotating the first figure as follows:



Hence, e is opposite to a and d is opposite to b . Therefore, $b - d$ is the correct pair of opposite faces.

29. From (ii) and (iii), red is opposite to violet, from (i) and (ii), blue is opposite to orange. Hence, yellow is opposite to green. The colour at the bottom in the second figure is blue.

30. From (i) and (ii), ★ is opposite to □. From (i) and (iii), ↑ is opposite to o. Hence, Δ is opposite to #. The faces adjacent to Δ are o and ↑.

31. From (i) and (ii), t is opposite to u and from (ii) and (iii), s is opposite to p . Hence, r is opposite to q . q and u are opposite to r and t , respectively.

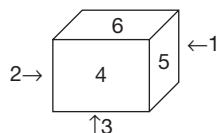
32. From (i) and (ii), 'White' is opposite to 'Green'. From (i) and (iii), 'Black' is opposite to 'Brown'. Hence, 'Grey' is opposite to 'Blue'. 'Blue' is at the bottom of figure (i).

33. From (i) and (ii), five dots are opposite to three dots. From figures (i) and (iii), two dots are opposite to one dot. Hence, six dots are opposite to four dots. The faces adjacent to both the faces with two dots and five dots are opposite to each other. Hence, they are faces with six dots and four dots, whose total is ten.

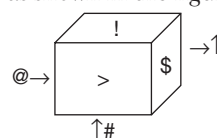
34. From the given figure, it is known that the circle and the triangle are opposite each other. Hence, Only III is correct.

35. From the given figure, it is known that the hatched face and the face with x on it, are opposite each other. Hence, Only I is correct.

36. It forms a cube as shown in the figure below. So, 6 is opposite to 3.

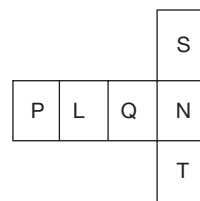


37. It forms a cube as shown in the figure below.



So, '\$' is opposite to '@'.

38.



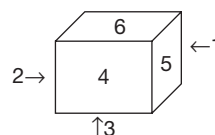
By folding the above figure, the alternate faces are opposite.

P is opposite to Q.

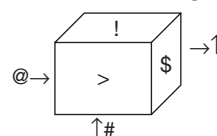
L is opposite to N.

S is opposite to T.

39. It forms a cube as shown in the figure below. So, 6 is opposite to 3.



40. It forms a cube as shown in the figure below.



So, '\$' is opposite to '@'.

EXERCISE-2

1. $216 = 6 \times 6 \times 6$

Here, $n = 6$, i.e., even.

(i) With one diagonal cut, the number of pieces that get cut $= n^2 = 6 \times 6 = 36$.

(ii) With two diagonal cuts, the number of pieces that get cut $= 2n^2 = 2 \times 6 \times 6 = 72$.

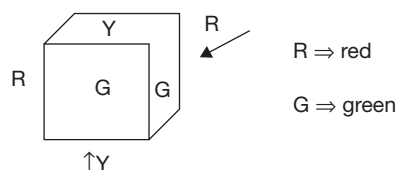
2. $729 = 9 \times 9 \times 9$

Here, $n = 9$, i.e., odd.

(i) With one diagonal cut, the number of pieces that get cut $= n^2 = 9 \times 9 = 81$.

(ii) With two diagonal cuts the number of pieces that get cut $= 2n^2 - n = 2 \times 9 \times 9 - 9 = 153$.

Solutions for questions 3 to 7: The cube can be painted in the following pattern:



$R \Rightarrow$ red

$G \Rightarrow$ green

The colour combination for the corners: GGY-2 pieces, RRY-2 pieces, RGY-4 pieces

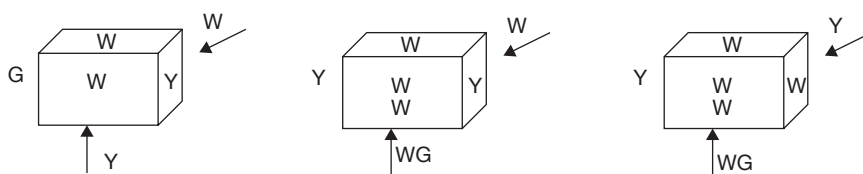
Edges: GG-1 edge, RR-1 edge, GY-4 edges, RY-4 edges, RG-2 edges

Middle of the face: G-2 faces, R-2 faces, Y-2 faces
Since the cube is cut into 125 small and identical cubes the number of small cubes along each edge is 5.

3. The number of small cubes with exactly two faces painted in green are found along the GG-edge, i.e., 5 small cubes.
4. The small cubes with at least two different colours on their faces = Pieces at the corners with two colours or three colours + Pieces along the GY, RY and RG edges.
= 8 (corner pieces) + 10×3 (pieces along the edges) = 38.

5. The number of small cubes having exactly one colour on them = Pieces at the GG and RR edges + Pieces at the middle of the faces = $2 \times 3 + 6 \times 9 = 60$.
6. The number of small cubes with yellow or red but not green = Total number of small cubes – The number of small cubes with only green – The number of small cubes with no colour = $125 - (25 + 20) - 27 = 53$.
7. The number of small cubes having exactly two painted faces and have exactly two colours = The smaller cubes along the GY, RY and RG edges
= $10 \times 3 = 30$.

Solutions for questions 8 to 11: The cube can be painted in the following patterns:



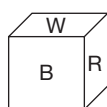
The cube is cut into 512 small and identical cubes, i.e., each edge is cut into eight pieces. The colour combination for the pieces along the surface is as following:

	(i)	(ii)	(iii)
Corners	WWY-2, WYG-2, YYW-2, YWG-2	WWY-4, YWG-4	WWW-1, WWY-2, YYW-1, WYG-1, YYG-1, YWG-2
Edges	WW-2, WY-5 WG-3, GY-1 YY-1	WW-2, WY-6 GY-2, GW-2	WW-3, WY-4 YY-1, YG-2, GW-2
Middle of surface	W-3, Y-2, G-1	W-3, Y-2, G-1	W-3, Y-2, G-1

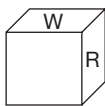
8. The number of small cubes with two faces painted in yellow is:
Case (i):
Corner: (WWY) 2 Cubes + Edge: (YY) 1 edge \times 6 cubes = 8
Case (ii):
No such small cube is available.
Case (iii):
Corners: (YYW) 1 cube + (YYG) 1 cube + Edge: (YY) 1 edge \times 6 Cube = $1 + 1 + 6 = 8$
 \therefore The minimum possible number of small pieces with two faces painted in yellow is zero.
9. The number of small cubes with only green and yellow colours.
Case (i):
(GY) edge 1×6 Cubes = 6
Case (ii):
(GY) edge 2×6 Cubes = 12
Case (iii):
(YYG) corner: 1 cube + (GY) edge $2 \times 6 = 13$
 \therefore The maximum possible number of small cubes with only yellow and green colour is 13.
10. The number of small cubes with exactly one colour on them:
Case (i):
[(WW) edges 2 + (YY) edge 1] \times 6 + middle part of surfaces $6 \times 36 = 234$
Case (ii):
(WW) edges 2×6 + middle parts of surface: $6 \times 36 = 228$
Case (ii):
(WW) corner 1 cube + [(WW) edge 3 + (YY) edge 1] \times 6 + middle part of surface $6 \times 36 = 241$
 \therefore The maximum and the minimum possible number of small cubes that have exactly one colour is 241 and 228, respectively.
11. The number of small cubes that have at least two painted surfaces but have only white colour on them:
Case (i):
(WW) edges $2 \times 6 = 12$
Case (ii):
(WW) edges $2 \times 6 = 12$
Case (ii):
(WWW) corner 1 cube + (WW) edges $3 \times 6 = 19$

∴ The minimum possible number of small cubes that have only white colour on them is 12.

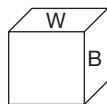
Solutions for questions 12 to 16: The painting can be done in the following patterns:



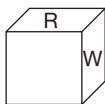
(i)



(ii)



(iii)

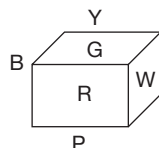


(iv)

The cube is cut into 729 pieces by $(8 + 8 + 8) = 24$ cuts.

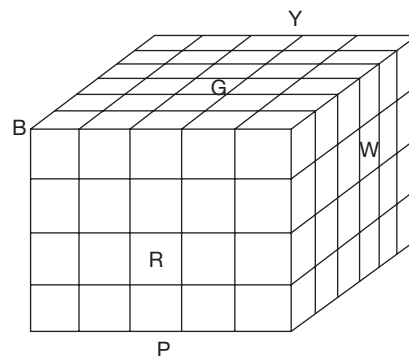
12. The maximum possible number of small cubes with all the three colours can be obtained in figure (i). The corner cube is having all the three colours on it.
13. In figure (ii), white and black colours are on opposite faces. Hence, the minimum possible number of small cubes that have only white and black colours is zero.
14. The minimum number of the small cubes with only red face can be obtained from the figure (ii), i.e., $(9 - 2) \times 9 = 63$ cubes.
15. From any one of the figures (i), (ii) (iii) and (iv), cubes with white face are $= 9 \times 9 = 81 \Rightarrow 81$.
16. The number of small pieces with no colour = The pieces lying inside + The pieces from the three surfaces which have no colour.
 From figure (i): $(9 - 2)^3 + (8 \times 8) + (7 \times 8) + (7 \times 7) = 512$.
 From any one of the figures (ii), (iii) and (iv):
 $(9 - 2)^3 + (7 \times 8) + (7 \times 8) + (7 \times 7) = 504$
 ∴ The minimum possible number of small pieces that have no colour on them is 504.

Solutions for questions 17 to 19: As per the given directions, the coloured cube will look as follows.

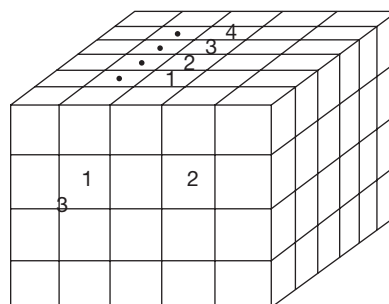


The first letters of all the colours are used in the above diagram.

Now this cube has to be cut into 120 identical pieces by using minimum possible cuts, so the combination can be 4, 5 and 6, i.e., $4 \times 5 \times 6$ and the cuts will be 3, 4 and 5. Now the cut figure will be as follows.



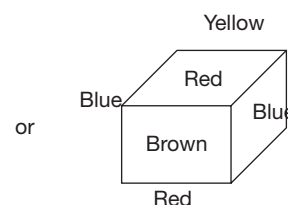
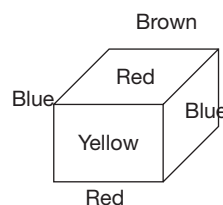
17. Now the white colour pieces will be 6×4 as per the above diagram, i.e., 24.
18. At least two different colours, means two different colours or more than two colours. We know that more than two colours will be at 8 corners and two colours will be at the 12 edges, so 44 pieces at the edges including 8 pieces at the corners.
19. It is better to study the cube properly. Let's see the cube given below.



If we see the cube drawn above, then it is clear that the outer faces of the pieces will definitely be painted but the inner faces of the pieces will not be painted at all. So, the simplest approach is to count the pieces from outside to know how many pieces are to be considered, i.e., they are numbered from 1 to 6, leaving the pieces at the edges as they will be painted. Now the number of layers parallel to the front face, on which 1 to 6 are numbered inside will be 4 as shown above. So, 6×4 pieces will have no paint on their faces at all, i.e., 24 pieces.

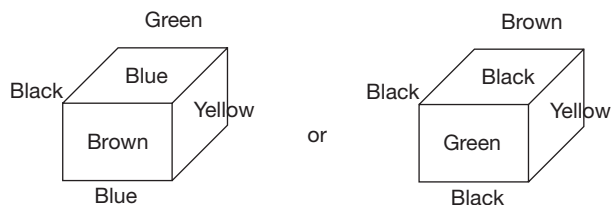
Solutions for questions 20 to 22: Let us draw the diagrams of cube P and Q.

Cube P:

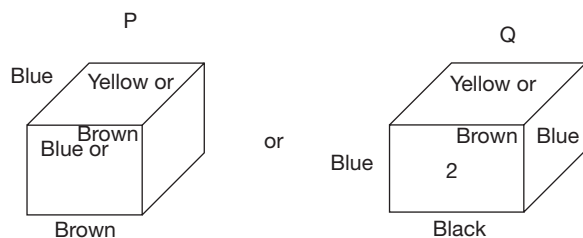


Two opposite faces of blue can be replaced by two opposite reds and vice-versa.

Cube Q:

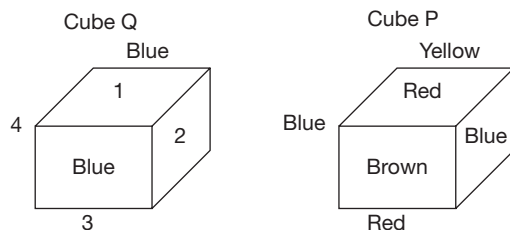


20.



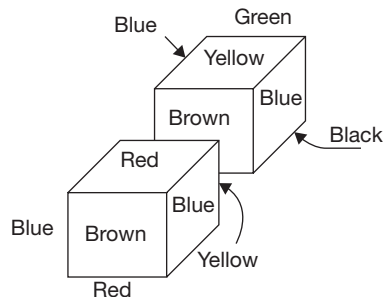
The faces marked with number 2 of cube Q can be of any colour among yellow, brown, black and green. But as far as the front face of the cube is concerned, it has to be of red colour, as the two faces of cubes P and Q which are touching each other are of the same colour even if they interchange their positions. So, those two faces must be of blue colour.

21. Cube Q is placed above P.
Cube Q



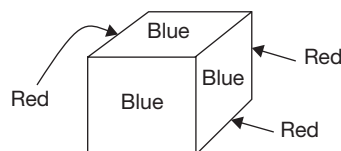
Now in cube Q the faces 1 and 3 can be of brown and green and vice-versa or they can be of black and yellow and vice-versa. On the other hand, faces 2 and 4 can also be of black and yellow and vice-versa or they can be of brown and green or vice-versa. Choice (A), (B) and (C) may or may not be true. Choice (D) is definitely false. When Q is above P, then Q's bottom face and P's top face will touch each other and these two faces will have definitely red and any one of the colours, such as black, brown, green and yellow.

22. In all the possible arrangements, one thing is common, i.e., the front face will have brown colour.



If observed carefully, we find that the top faces do not have the same colours and only the two side faces have the same colour on them.

Solutions for questions 23 to 25:



23. It is possible in exactly one way. (Example: When we can see RRR, we cannot see blue.)
24. It is possible in 3 ways.
25. This is possible in 3 ways.
26. The minimum possible number of pieces with two colours on them will be obtained when the faces of the cube to be painted with same colour are on adjacent faces. In this case, the number of pieces with exactly two faces painted in two different colours = $(12 - 3)(6 - 2) = 36$ [As there will be three edges with two faces painted but with only one colour]
The number of pieces with two colours but on three faces = $(8 - 2) = 6$ [As there will be two pieces at corner which have all the three colours]
 \therefore Total number of required pieces = $36 + 6 = 42$
27. The number of pieces with no colours on them = $4 \times 4 \times 4 = 64$.

For maximum possible number of pieces with one colour on them, the faces which are to be painted with same colour must be adjacent.

The number of pieces with only one colour on exactly one face = $6 \times (6 - 2)^2 = 96$.

The number of pieces with only one colour but on two faces = $3 \times (6 - 2) = 12$.

\therefore The total number of pieces = $64 + 96 + 12 = 172$

Solutions for questions 28 to 30: When three faces of a cube are painted, there are two possibilities, they are: (a) the three faces are continuous (in a row) or (b) the three faces meet at a corner.

Also, when the cube is cut into 216 smaller but identical cubes, we get a $6 \times 6 \times 6$ configuration.

28. Here, also we have to consider both the cases.

- (A) When the three painted faces are continuous: On the two outer painted faces, there will be $6 \times 5 (= 30)$ cubes with exactly one face painted (on two faces, there will be $2 \times 30 = 60$ such cubes) whereas, on the middle face, there will be $4 \times 6 (= 24)$ cubes with exactly one face painted. Hence, a total of 84 cubes with exactly one face painted.
- (B) When the three painted faces meet at one corner: On each of the painted faces, there will be 5×5 cubes (after we remove the cubes along the edges common with the other painted faces); since there will be 3 such edges, a total of 75 cubes.

Hence, the answer is 84 or 75 cubes.

29. Maximum number of two faces painted will be when the three painted faces are continuous in a row. Here, all the six cubes along the common edge between green face and blue face will satisfy the given condition. Hence, the answer is 6 cubes.

30. Here again, we have to consider both the cases of painting.

- (A) When the three painted faces are continuous. Here, the number of cubes that have no face painted at all is as follows:
 Middle cube – 6×6 cubes = 36
 Two end cubes – $2 \times (5 \times 6) = 60$
 A total of 96 cubes have painted face out of 216 cubes. Hence, the number of cubes that do not have any face painted at all in this case is 120.

- (B) When the three painted faces meet at a corner: Here, the number of cubes having any paint at all is as follows:

Along the three common edges together, there will be $(3 \times 5 + 1) = 16$ cubes.

On each of the faces (after the above has been deducted), there will be $(5 \times 5) = 25$ cubes. On all three faces together, there will be 75 cubes.

Hence, a total of $(75 + 16) = 91$ cubes have any paint at all out of a total of 216 cubes. So, there will be 125 cubes that do not have any face painted at all. Hence, the answer is 120 or 125.

31. Different ways of distributing three colours on the six faces of a cube are as follows:

0-0-6; 0-1-5; 0-2-4; 0-3-3;
 1-1-4; 1-2-3; 2-2-2

0-0-6 combination:

Here, all face single colour. Hence, totally, 3 ways.

0-1-5 combination:

1 way \times 3 for selection of colours out of the three available colours \Rightarrow 2 for distribution of these colours between 1 and 5 = 6 ways.

0-2-4 combination:

Two faces having one colour can be adjacent or opposite 2 ways. For each of these ways, two colours can be arranged in $3!$ ways. Hence, $2 \times 6 =$ 12 ways.

0-3-3 combination:

Three faces of same colour on one corner or continuous \Rightarrow 2 ways. For each of these, two colours can be arranged in 3 ways. Hence, $2 \times 3 =$ 6 ways.

1-1-4 combination:

2 single faces adjacent or 2 single face opposite \Rightarrow 2 ways. For each of these, three colours can be arranged in 3 ways. Hence, $2 \times 3 =$ 6 ways.

1-2-3 combination:

3 faces of same colour can be in 2 ways, (A) continuous (B) at a corner.

1. Continuous - Under this, the 2 faces with same colour can be adjacent or opposite \Rightarrow 2. For each of these, the three colours can be arranged in $3!$ or 6 ways.

Hence, $2 \times 6 =$ 12 ways.

2. At a corner - This gives one arrangement. The three colours can be arranged in $3!$ ways. Hence, $3! \times 1 =$ 6 ways.

2-2-2 combination:

Different possibilities are

(I) 2 opp - 2 opp - 2 opp - 1 way

(II) 2 opp - 2 adj - 2 adj - 1 way. The three colours can be arranged in $3!$ ways. Hence, 3 ways.

(III) 2 adj - 2 adj - 2 adj - 1 way

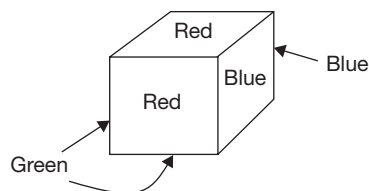
We get the total number of ways in which the cube can be painted by adding all the above values, which is 56.

32. For each of the combinations worked out, blue can come as $1 + 2 + 8 + 4 + 2 + 8 + 4 + 5 = 34$.

33. For the relevant combinations discussed above, the number of ways is $6 + 12 + 6 + 5 = 29$.

34. The only way that the cube can be painted such that no two adjacent faces have the same colour is where opposite faces have the same colour so that the three pairs of opposite faces can have three different colours. Hence, the answer is one way.

Solutions for questions 35 to 37: The following diagram shows the colours of the faces.



In total, there are eight possible ways of seeing three faces. They are: GGR, GGB, RRG, RRB, BBR, BBG, BGR and BGR.

Note: BGR can be seen in two ways.

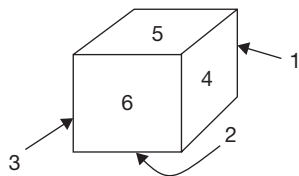
B = Blue

G = Green

R = Red

35. Red and blue both are not visible in the following cases: GGR, GGB, RRG and BBG. Both of them are visible in the other four ways.
The total number of ways is 4.
36. It is possible in two ways.
37. It is already explained above and the required number is 7 [BGR is possible in two ways].

Solutions for questions 38 to 40:



The dice is shown in the following diagram.
The possible ways of views are:

- 6, 4 and 5 [sum = 15]
6, 5 and 3 [sum = 14]
6, 4 and 2 [sum = 12]
6, 3 and 2 [sum = 11]
5, 4 and 1 [sum = 10]
5, 3 and 1 [sum = 9]
4, 2 and 1 [sum = 7]
3, 2 and 1 [sum = 6]

38. This sum can be obtained in the following ways.

$$6 + 14 = 20$$

$$14 + 6 = 20$$

$$9 + 11 = 20$$

$$11 + 9 = 20$$

$$10 + 10 = 20$$

Total number of possible ways = 5.

39. Let us take D_1 and D_2 – two dice.

Assume that it is 10 on D_1 and not 10 on D_2 .

There are seven possible ways to have this.

Assume that it is 10 on D_2 and not 10 on D_1 .

There are another 7 ways.

Assume that it is 10 on both the die.

There is exactly one way for this.

Total number of ways is $7 + 7 + 1 = 15$.

40. Any specified number appears in exactly sixteen ways.

EXERCISE-3

Solutions for questions 1 to 3: When three faces of a cube are painted, there are two possibilities.

- One pair of opposite faces is painted. The third painted face will be adjacent to these two faces.
- The three painted faces are mutually adjacent to each other. Thus, every painted face is opposite to an unpainted face.

- By considering the painted cubes in case (i), the number of painted faces = $(5 \times 5) + 2(5 \times 4) = 40 + 25 = 65$.
Hence, the total number of cubes which are unpainted = $125 - 65 = 60$.
- By considering the case (i), there are two edges common and on each of the two edges, there are 5 cubes that have exactly two faces painted.
Hence, total required cubes = 10
By considering the case (ii):
There are three common edges and along each edge, four cubes have exactly two faces painted = $3 \times 4 = 12$.
- By considering the case (i), on the two opposite faces painted we have $2 \times 5 \times 4 = 40$ cubes which have exactly one face painted and in the other faces, we have $5 \times 3 = 15$.
Hence, total required cubes = 55.

By considering the case (ii), except the cubes at the edges and the corner remaining 4×4 cubes on each painted face have only = $3 \times 16 = 48$.

Solutions for questions 4 to 6: Given that 4, 5 and 6 cuts are made in three different directions.

We can visualize the 42 pieces on one pair of opposite faces, 35 on second pair of opposite faces and 30 on the third pair of opposite faces.

- To get the maximum number of smaller pieces which have only back on them, the faces which have 42, 42, 35 and 35 pieces have to be painted in black.
Hence, the pieces which are painted only in black = $30 + 30 + 15 + 15 = 90$.
- To get the maximum number of smaller pieces with black and yellow on them, the opposite faces which consists of 42 cuboids each are painted with black, the other pair of opposite faces which consists of 35 cuboids each are painted with yellow and the out of the remaining pair of opposite faces, one face is to be painted with black or yellow and the other has to be painted red.
Colours on faces: Opposite faces $7 \times 6 =$ black/yellow.
Opposite face $7 \times 5 =$ yellow/black.

One face of $5 \times 6 =$ yellow/black (not black/yellow).

Other face of $5 \times 6 =$ red.

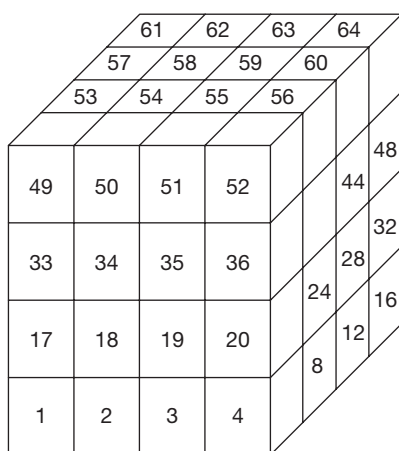
There are six cuboids including corners (excluding those corners which have red paint) on 4 edges and 4 cuboids on 2 edges each which have only black and yellow on them.

Hence, the required number of cuboids

$$= 4 \times 6 + 2 \times 4 = 32.$$

6. By painting the three pairs of opposite faces of the larger cuboid with the three different colours, we have 8 corner pieces with three different colours on them.

Solutions for questions from 7 to 10:



7. The numbers on the referred cubes are 1, 2, 3 and 4, whose sum is 10.
8. The required numbers are 1, 17, 33 and 49. These are in AP with a common difference of 16, whose sum is 100.
9. The required numbers are 13, 29, 45 and 61. These numbers are in AP with a common difference of 16, whose sum is 148.

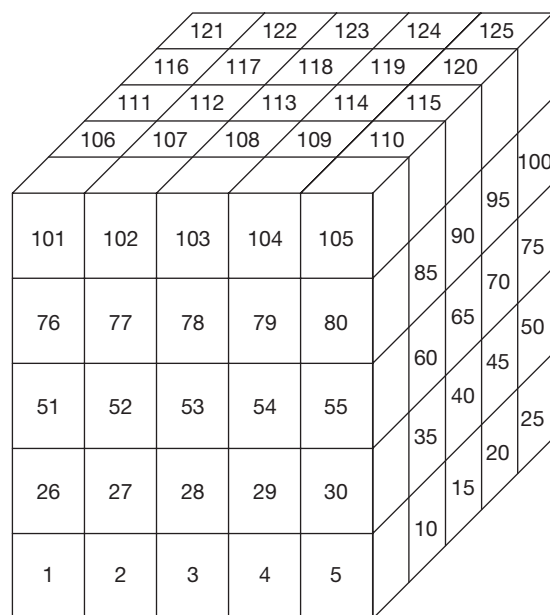
Alternate Solution:

This scenario can be viewed in relation to that in previous question. Each required cube, now, is 12 cubes away from each required cube of previous questions (from bottom to top).

Therefore, sum = $100 + 12 \times 4 = 148$.

10. The required numbers are 53, 54, 55 and 56, whose sum is 218.

Solutions for questions from 11 to 14:



11. The required numbers are 7, 32, 57, 82 and 107. These numbers are in AP with a common difference of 25, whose sum is 285.
12. The required numbers are 101, 107, 113, 119 and 125. These numbers are in AP with a common difference of 6, whose sum is 565.
13. The required numbers are 1, 32, 63, 94 and 125. These numbers are in AP with a common difference of 31, whose sum is 315.
14. The required numbers are 5, 34, 63, 92 and 121. These numbers are in AP with a common difference of 29, whose sum is 315.

Solutions for questions 15 to 18:

Total number of identical wooden pieces

$$= 455 = 5 \times 7 \times 13 \text{ (All prime factors of 455)}$$

Let the dimensions of the large wooden cube be $455 \text{ cm} \times 455 \text{ cm} \times 455 \text{ cm}$.

Then the dimensions of each identical piece would be $5 \text{ cm} \times 7 \text{ cm} \times 13 \text{ cm}$.

$$\text{Cubes thrown away} = 11 \times 5 \times 3 = 165.$$

$$\text{Cubes left with} = 455 - 165 = 290.$$

15. Total number of cuts made = $12 + 6 + 4 = 22$

Solutions for questions 19 to 22: The arrangement of the large cube is as follows:

						186	192	198	204	210	216	
						185	191	197	203	209	215	
						184	190	196	202	208	214	
						183	189	195	201	207	213	
						182	188	194	200	206	212	
181	187	193	199	205	211					177		
										176		
145	151	157	163	169	175					141		
										140		
109	115	121	127	133	139					105		
										104		
73	79	85	91	97	103					69		
										68		
37	43	49	55	61	67					33		
										32		
1	7	13	19	25	31							

19. Four corners of the top layer have three sides painted.
 $181 + 211 + 186 + 216 = 794$
20. The following diagram shows the bottom layer (with shaded region representing cubes with at least one side painted).

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

$$\begin{aligned} \text{Sum of all cubes (bottom layer)} &= \frac{36}{2} \times (36 + 1) = 37 \\ &\times 18 = 666 \end{aligned}$$

$$\begin{aligned} \text{Sum of cubes of shaded region} &= \frac{5}{2} \times ((1+5) + (6+30) + (36+32) + (31+7)) \\ &= \frac{5}{2} \times (6+36+38+66) = \frac{5}{2} \times (146) = 370 \end{aligned}$$

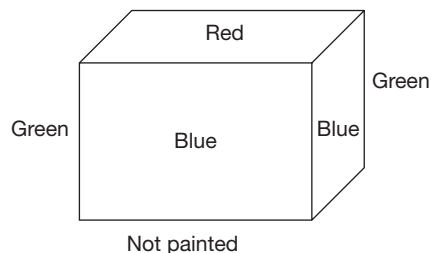
$$\text{Answer} = 666 - 370 = 296$$

- 21.** The cubes are on front row of the top layer; the numbers are in arithmetic progression.

$$\text{Sum} = 181 + 187 + 193 + 199 + 205 + 211 = 3 \times (181 + 211) = 1176$$

22. There are two such diagonals. There will be six cubes in a diagonal and the numbers will be in arithmetic progression. Sum of the numbers on any diagonal is the same though the common difference varies. The six numbers are in arithmetic progression from 211 to 186 or 181 to 216. $\text{Sum} = 3 \times (211 + 186) = 3 \times (181 + 216) = 1191$

Solutions for questions 23 to 25: The painted faces of the cube are shown below:



As the cube is cut into 512 small and identical cubes, there are 8 cubes along each edge.

- 23.** Smaller cubes having exactly one of their faces painted
 = The cubes along the edge [except corner cubes] of the not painted face + The cubes on the painted faces [except corners and edges] = $24 + 36 \times 5 = 24 + 180 = 204$.
- 24.** At most two painted faces = All cubes – Three painted faces = $512 - 4 = 508$
- 25.** Cubes having only one colour on them
 = Painted only in blue + Painted only in green + Painted only in red
 = $(36 \times 2 + 6 \times 3 + 1) + (36 \times 2 + 6 \times 3 + 1) + 36$
 = $(72 + 18 + 1) + (72 + 18 + 1) + 36$
 = $182 + 36 = 218$

9

Deductions

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Understand the correct logical interpretation of terms like 'All', 'Some', 'No', 'Some not' etc.
- Learn how to derive logical conclusions from abstract statements using various methods.

Questions based on deductions are frequently asked in competitive exams. These types of questions are generally solved by using two methods:

1. Venn diagrams
2. Rules governing syllogisms

Syllogism rules are preferred for answering those questions with two statements and do not have 'either – or' answer choice. Whereas Venn diagram method is applicable to answering questions with any number of statements and any kind of answer choices.

We are going to discuss Venn diagram method first and the syllogism concept later.

The statements given in the questions and the conclusions that are derived may not confine to generally accepted facts. None of the three statements below is a fact, but they still may be a part of a question.

Example:

1. All cats are dogs.
2. Some birds are elephants.
3. Some flowers are not mountains.

To understand and analyse these statements and to draw conclusions, we can use symbolic logic for

clear expression of our thoughts. The examinee has to understand the logical implications of the given statements and verify the truthfulness of each of the given conclusions, strictly within the preview of the given statements. Each of the given statements has to be taken as true, though they deviate from generally accepted facts and check whether the given conclusions logically follow the statements.

To achieve the above task, the given statements have to be represented in a combined format. Representation through Venn diagrams is an effective way to combine and to draw conclusions based on these hypothetical statements.

□ VENN DIAGRAMS METHOD

Venn Diagrams: These are diagrammatic/pictorial representation of sets by using geometrical figures. The Venn diagram drawn to represent all the given statements should be a combined diagram. A set of given statements can be represented in several ways using Venn diagrams. We can conclude that a conclusion definitely follows the given statements only if that conclusion is true for all possible diagrammatic representations.



Quantifiers: A quantifier describes the extent (quantity) to which one kind (or term) is similar (or dissimilar) to another kind (or term). The main quantifiers are ‘All’, ‘No’, ‘Some’ and ‘Some-not’. The following are few examples of statements/ conclusions consisting of each of the above four quantifiers.

All: All A’s are B’s, All animals are living things, All shoes are socks, etc.

No: No A is B, No boy is girl, No bat is rat, No weak is coward, etc.

Some: Some A’s are B’s, Some doctors are men, Most girls are brave, etc.

Some – not: Some A’s are not B’s, Some Cricketers are not Indians, etc.

Words like ‘a few, most, many, more’, etc., are treated as synonyms to ‘Some’, ‘Not all’ is equivalent to ‘Some-not’.

The statements, which contain the qualifiers ‘All’ and ‘Some’ are called affirmative statements and those containing the qualifiers ‘No’ and ‘Some-not’ are called negative statements.

COMPLEMENTARY PAIR

Certain combinations of conclusions, consisting of one negative and the other affirmative, negate each other. For example,

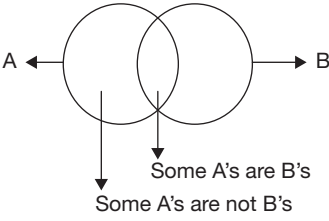
- ‘**SOME** A’s are B’s’ negates ‘**NO** A is B’.
- ‘**ALL** A’s are B’s’ negates **SOME** A’s are **NOT** B’s,

i.e., when ‘Some A’s are B’s’ is true, ‘No A is B’ cannot be true and vice versa.

Similarly, when ‘All A’s are B’s’ is true, then ‘Some A’s are not B’s’ cannot be true and vice versa.

In each of the above pairs, only one statement can be true or false at a time but both cannot be true or false at the same time.

Thus, ‘Some A’s are B’s’ and ‘Some A’s are not B’s’ does not form a complementary pair, as both can be true at the same time, as in the following figure.



Similarly, ‘All A’s are B’s’ and ‘No A is B’ does not form a complementary pair because they both are false at the same time as for the above diagrams.

Thus, the pairs of qualifiers (‘Some’ and ‘No’) and (‘Some-not’ and ‘All’), for the same terms, form complementary pairs. The existence of conclusions can be observed while reading the question itself.

The following table shows different ways of representing a statement consisting of a qualifier by using Venn diagrams.

Table – 1

Qualifier	Representations using venn diagram			
1) ALL: Example: All A’s are B’s				
2) SOME: Example: Some A’s are B’s				
3) NO: Example: No A is B				
4) SOME, NOT: Example: Some A’s are not B’s				

From the above table, it is clear that a statement can be represented diagrammatically in several ways. Similarly, a diagram may represent more than one statement.

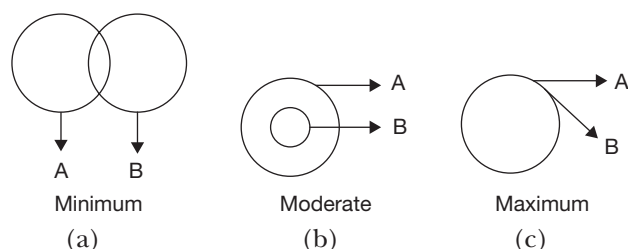
From the above table, we can draw the following possible conclusions.

Statement	Definitely true	Definitely false	May or may not be true
(1) All A's are B's	Some A's are B's Some B's are A's	No A is B No B is A	All B's are A's Some B's are not A's
(2) Some A's are B's	Some B's are A's	No A is B No B is A	All A's are B's All B's are A's Some A's are not B's Some B's are not A's
(3) No A is B	No B is A Some A's are not B's Some B's are not A's	Some A's are B's Some B's are A's All A's are B's All B's are A's	_____
(4) Some A's are not B's	_____	All A's are B's Some A's are B's Some B's are A's	Some B's are not A's No A is B No B is A All B's are A's

The diagrams are also classified as 'Basic Diagrams' (BD) and 'Alternate Diagrams' (AD), based on intersections and extent of overlap.

Basic Diagram (BD):

This is a diagram which represents the least possible situation for a given statement. To get the least possible representation, the diagram should contain minimum overlapping. The extent of overlap is of three kinds as shown below.



In Figure (a), circles (A) and (B) are overlapping with each other only to some extent, i.e., minimum for both.

In Figure (b), one circle, i.e., B is completely overlapped by A, but circle A is overlapped by B only to some extent. Here, the extent of coverage of one circle is full and the other is partial, i.e., the overlap is moderate on the whole.

In Figure (c), each of the circles is overlapped completely by the other, i.e., overlapping is the maximum.

In Table I for statement (1), Figure (i) has lesser overlapping than Figure (ii). Hence, Figure (i) forms the BD for statement (1). Similarly, Figure (i) for statement (2) has least overlapping among all possible diagrams for that statement. Hence, Figure (i) forms BD for statement (2). Similarly, Figure (ii) for statement (4) is the BD for it. For statement (3), only one diagram is possible.

Alternate Diagram (AD):

Any diagram, other than BD for the given statements is an alternate diagram. For each set of statements, several alternate diagrams are possible.

Method to draw Venn diagrams for the given statements:

Each question contains two or more statements. The Venn diagrams that we draw to represent these statements should be a combined diagram, i.e., the diagram should link all the given statements. The following examples show how a combined diagram is drawn.

Example 1:

Statements:

All A's are B's.
Some B's are C's.

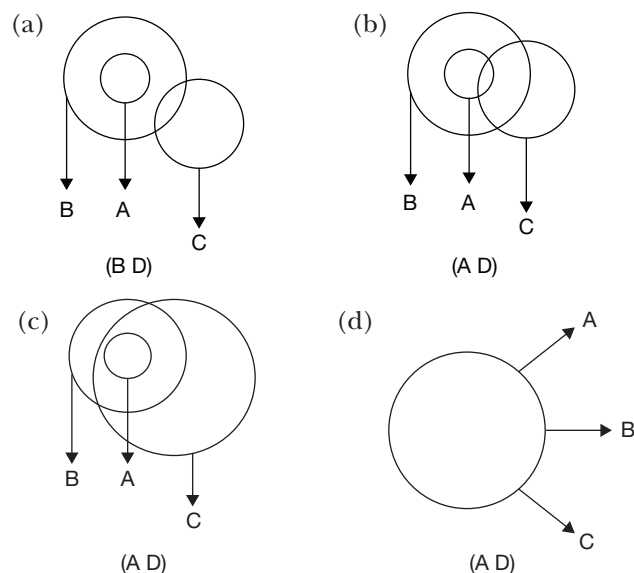




Figure (a) is the BD, as the overlapping for each of A, B and C is least in view of the given statements.

Figures (b) and (c) are the ADs because the overlap is moderate. Several other ADs are possible for the given statements. Figure (d) is the AD with the maximum overlap.

Example 2:

Statements: All A's are B's.
Some A's are not C's.

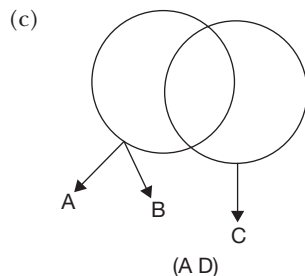
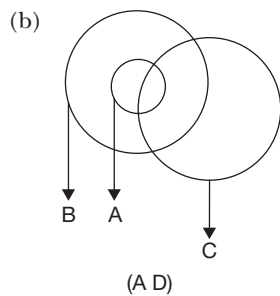
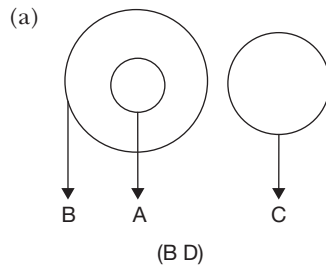


Figure (a) is the BD, as it has minimum overlapping. Figure (b) is the AD with moderate overlapping and Figure (c) is the AD with maximum overlapping.

While drawing these diagrams it has to be ensured that no diagram contradicts the given statements.

Answering the questions:

In each question, the statements are followed by three or more conclusions. The student has to verify whether the given conclusions follow the statements or not. Conclusion is said to follow the given statement, if it is true for all possible Venn diagrams for a given set of statements. We can see that in Examples (1) and (2), several diagrams are possible. Instead of drawing

all possible diagrams and verifying the truthfulness of each conclusion in each of these diagrams, it would be convenient if we can verify the truthfulness of these conclusions by using minimum number of diagrams. A student has to think logically in order to minimize the number of diagrams required to verify the truthfulness of a conclusion.

Guidelines to minimize the number of diagrams:

- We know that BD represents the least possible situation for the given set of statements. If an affirmative conclusion is true for BD, then it will be true for all ADs.
- If an affirmative conclusion or a negative conclusion is false for BD, then it can be said that the conclusion does not follow the given statements.
- If a negative conclusion is true for BD, it may or may not be true for ADs.

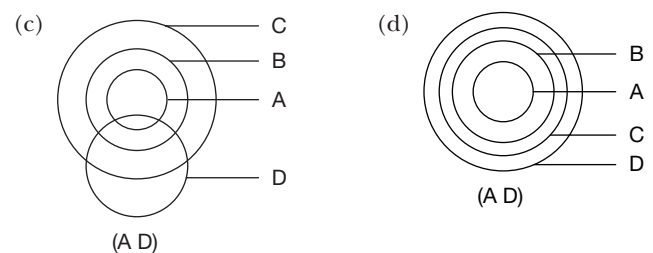
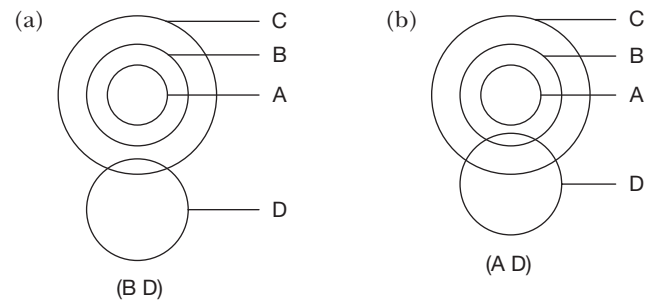
Let us understand the above with the help of the following example.

Example 1:

Statements: All A's are B's.
All B's are C's.
Some C's are D's.

Conclusions: (I) All A's are C's.
(II) Some B's are D's.
(III) No A is D.
(IV) No C is A.

The following are some of the possible diagrams for the given set of statements.



Conclusion (I), 'All A's are C's', is affirmative and is true for the basic diagram (a). This means that it will be true for all the ADs. Hence, conclusion (I) follows the given statements. Conclusion (II), 'Some B's are D's', is affirmative and is false for the BD. Therefore, it does not follow the given statements. Conclusion (III), 'No A is D' is negative and is true for BD. This means that we will have to draw some ADs to verify its truthfulness. It observed that the statement is true for the AD (b), but false for the ADs (c) and (d). Hence, it can be concluded that conclusion (III) does not follow the given statements. Conclusion (IV), 'No C is A' is negative and is false in the BD. Hence, it does not follow the given statements.

Analysis:

Since BD represents the least possible situation, for the given statements, an affirmative conclusion, which is true for the least possible situation will always be true. On the other hand, a negative conclusion, though true for the possible situation, may or may not be true for the other situations.

From the above example, it is clear that we need to draw AD only when a negative conclusion becomes true for BD.

As per the above information, the truthfulness of such negative conclusion should be checked by drawing all possible ADs. But instead of checking in so many ADs, we need to draw only one AD, in which the statement, which is complementary to this particular conclusion is true. Hence, if the 'complementary conclusion' turns out to be true, then the conclusion under consideration is false. While trying to draw such AD, it has to be ensured that no given statement is negated in the AD. If such AD can be drawn, then the negative conclusion does not follow the given statements; otherwise such a conclusion is always true.

If a complementary pair exists in the given conclusions, then either negative conclusion of that pair is true and the affirmative conclusion is false for the BD, or the negative conclusion becomes false for the BD and the affirmative conclusion becomes true. In such circumstances, we choose the answer choice in terms of 'either-or'. There may be occasions where the negative conclusions always remain true for all ADs and the affirmative statements are always false. In such a case, the 'either-or' situation does not arise.

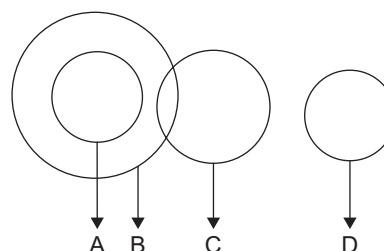
The following example will be helpful in understanding the above concept.

Example 2:

Statements: All A's are B's.
Some B's are C's.
No B is D.

Conclusion: (I) No C is D.
(II) No A is D.
(III) Some C's are not D's.

Solution:



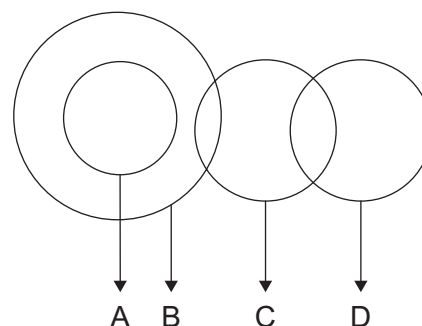
Above diagram is the BD for the given statements.

Conclusion (I) is negative and is true.

Conclusion (II) is negative and is true.

Conclusion (III) is negative and is true.

To prove conclusion (I), 'No C is D' to be false, we have to prove that its complementary conclusion, 'Some C's are D's' is true. Hence, the AD for this will be as shown below:



The above diagram does not defy any of the given statements. Conclusion (I), 'No C is D' is false for this diagram. Hence, it is not valid.

To negate conclusion (II), 'No A is D' and (III), 'Some C's are not D's', we have to prove that their respective complementary conclusions 'Some A's are D's' and 'All C's are D's' are true. This is possible, only if D encroaches into B. But this will violate statement (3). Hence, no diagram can be drawn to negate these two conclusions. Hence, only conclusion (II) and (III) follows.

Thus, we are able to answer the question with only two diagrams. From the BD, we can verify the truthfulness of each statement and accordingly decide whether a conclusion follows the given statements or not. In

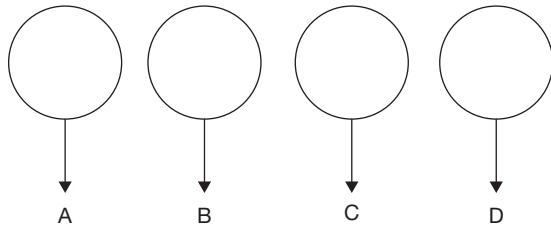


case of a negative conclusion becoming true, we go for AD to prove the negative conclusion is false. If such AD is possible, the negative statement does not follow, otherwise it follows the given statements. In certain rare cases we may have to go for a second AD, as shown in the following example.

Example 3:

Statements: Some A's are not B's.
Some B's are not C's.
Some C's are not D's.

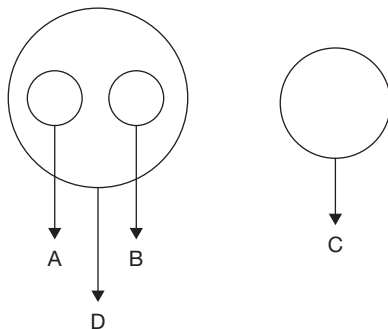
Conclusions: (I) Some A's are not D's.
(II) Some B's are not D's.
(III) Some A's are not C's.
(IV) Some C's are not A's.

Basic diagram:

Conclusion (I) is negative and is true.
Conclusion (II) is negative and is true.
Conclusion (III) is negative and is true.
Conclusion (IV) is negative and is true.

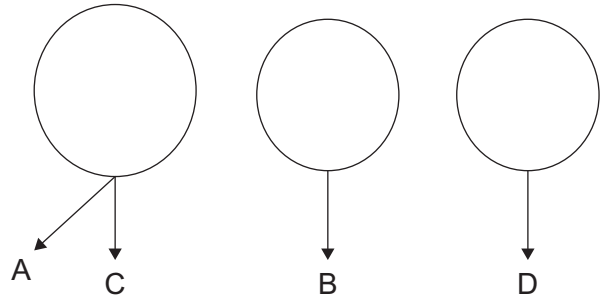
We observe that:

'All A's are D's' is complementary to conclusion (I).
'All B's are D's' is complementary to conclusion (II).
'All A's are C's' is complementary to conclusion (III).
'All C's are A's' is complementary to conclusion (IV).

Alternate diagram 1:

Conclusion (I) is false.
Conclusion (II) is false.

To negate conclusions (III) and (IV), we have to draw another alternate diagram.

Alternate diagram 2:

Conclusion (III) is false.

Conclusion (IV) is false.

Hence, none of the conclusions follows.

From the above example, it is also clear that no conclusion can be drawn when all the statements are negative.

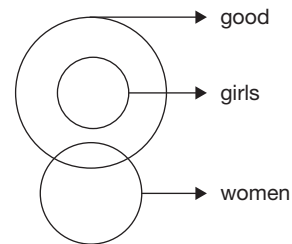
Let us take some more examples.

Example 4:

Statements: All girls are good.
Some good are women.

Conclusions: (I) Some women are girls.
(II) No woman is a girl.

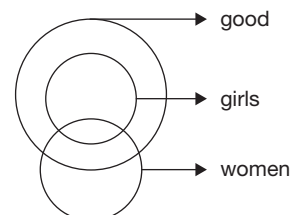
Clearly, the above two conclusions form a complementary pair.

Basic diagram:

Conclusion (I) is affirmative and is false.

Conclusion (II) is negative and is true.

Now, we should draw an AD, which would make conclusion (II) false, i.e., which proves 'Some women are girls'.

Alternate diagram:

From the above diagram, conclusion (II) is false, but conclusion (I) is true at the same time. But they

both cannot be true or false at the same time. Hence, either (I) or (II) follows.

Example 5:

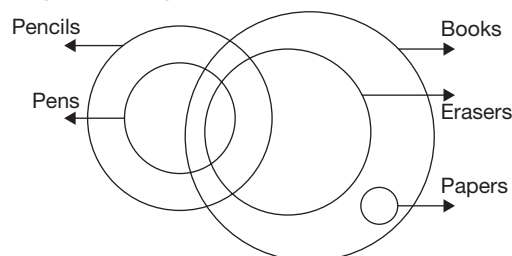
Statements: All pens are pencils.
Some pens are erasers.
All papers are books.
All erasers are books.

Conclusions: (I) Some pencils are books.
(II) Some books are pens.
(III) No paper is pen.
(IV) Some erasers are papers

- (A) Only I, II and IV (B) Only I and II
(C) Either I or II (D) Only III and IV

Solution:

The given statements can be represented in the following basic diagram.



From the above diagram, we incur the following:

Conclusion I, affirmative, follows.

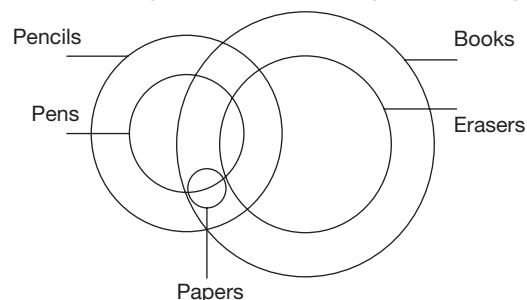
Conclusion II, affirmative, follows.

Conclusion III, negative follows.

Conclusion IV, affirmative, does not follow.

As the affirmative conclusions (I and II) are true in the basic diagram, they will always be true. The affirmative conclusion (IV) is false in the basic diagram. Even if it is true in other diagrams, it cannot be said to be true as there is a situation, where it is false.

The negative conclusion III, which is true in the basic diagram has to be checked whether it can be false in any alternate diagram. The following is such diagram.



There is a situation, where conclusion III is false. Hence, only I and II are true.

Example 6:

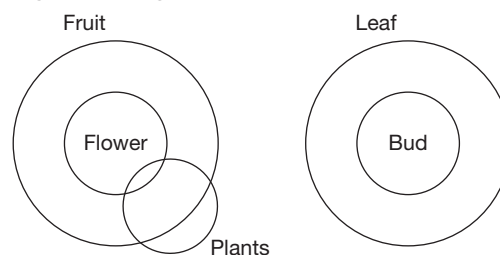
Statements: No leaves are fruits.
Flower is fruit.
Every bud is leaf.
Some plants are flowers.

Conclusions: (I) No flower is bud.
(II) Some plants are not fruits.
(III) Some plants are not leaves.
(IV) Some leaves are not buds.

- (A) Only I (B) Only II
(C) Both I and III (D) Both II and III

Solution:

The given statements can be represented in the following basic diagram.



From the above diagram, we incur the following:

Conclusion I, negative, follows.

Conclusion II, negative, does not follow.

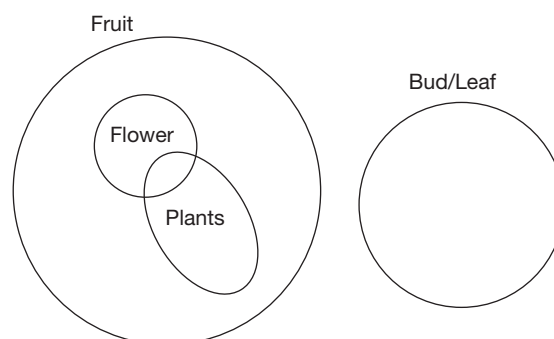
Conclusion III, negative, follows.

Conclusion IV, negative, follows.

As the negative conclusions are true for the basic diagram, let us try to negate them. As no leaf is fruit (given statement), no flower which is inside the circle fruit can ever be a bud which is inside the circle leaf. Hence, conclusion I cannot be negated. Similarly, some plants which are inside the circle flowers can never be leaves. Hence, conclusion III cannot be negated.

Conclusion IV can be negated in the following alternate diagram.

The alternate diagram is given as:



Hence, only I and III follow.

**Summary:**

1. The words 'Some', 'Some-not', 'All' and 'No' are called qualifiers.
2. Words like 'Many', 'More', 'a Few', 'Most', etc., are treated as synonyms to 'Some'. Words like 'Not-all' is treated equivalent to 'Some-not'.
3. Statements/conclusions with qualifiers 'Some' and 'All' are classified as affirmative statements/conclusions and those with qualifiers 'Some-not' and 'No' are classified as negative statements/conclusions.
4. ('Some', 'No') and ('Some-not', 'All') form complementary pairs.
5. Diagram with the least encroachment is called Basic Diagram (BD) and all other diagrams are called Alternate Diagrams (AD).
6. Truthfulness of conclusions are first tested for BD. Only when a negative conclusion is true for BD, AD is required to be drawn in such a way that this negative conclusion which was true for BD becomes false in the AD. If such AD is not possible, then the conclusion is always true.
7. Whenever there is a complementary pair of conclusions, check for 'either – or' as answer.
8. When all the statements are negative, no conclusion can be drawn. In such a case, the answer is always 'None of these'.
9. As a corollary, when all the conclusions are affirmative, BD alone is sufficient to answer the question

SYLLOGISM METHOD

Here we will look at arriving at the deduction by using some simple rules.

First, let us look at some basic terms used in the rules and understand what they mean.

The two statements given in the question are called 'premises' and the answer, the conclusion.

Example: All dogs are cats (i)
All cats are pigs (ii)

These two statements are called 'premises.'

Conclusion: All dogs are pigs.

The premises normally start with the words All, No, Some and Some - Not.

The word 'All' has its synonyms, such as Every, Any, Each, whereas the word 'Some' can also be replaced by Many, Few, A little, Most of, Much of, More, etc.

These words are referred to as qualifiers (also termed as quantifiers).

A premise consists of a subject and a predicate wherein the first term [For example: 'dogs' in statement (i)] is the subject and the second term [For example: 'cats' in statement (i)] is the predicate. Similarly, in statement (ii), 'cats' is called the subject and 'pigs' is the predicate.

The word that occurs in both the premises is known as the 'middle term' ('cat' in the example, given above). The answer or 'conclusion' should consist of the other two words ('dogs' and 'pigs' in the above example) and the middle term should not appear in the answer.

The premises can be divided into:

1. Universal statements
2. Particular statements

This classification of the premises into the above categories is dependent on the qualifier used in the premise. For example, the statements where 'All' is used are called universal statements and the statements where 'Some' is used are called particular statements.

Premises can also be divided into:

1. Positive (affirmative) statements
2. Negative statements

If there is a negative term like 'not' or 'no' in the statement, it is called a negative premise. Otherwise it is called a positive premise or an affirmative statement.

The combination of the two different categories of classifications leads to four different premises as given in Table 2 below.

Table – 1

	Affirmative	Negative
Universal	All A	No E
Particular	some; many I	some not; many not O

The subject or the predicate can be either distributed or not distributed in the given premise.

The subject and the predicate are either distributed (✓) or not distributed (✗) depending upon the type of statement given (particular, affirmative, etc.). The following table shows the distribution pattern of the subject and the predicate.

Table – 2

	Subject	Predicate
Universal affirmative	✓	✗
Universal negative	✓	✓
Particular affirmative	✗	✗
Particular negative	✗	✓

Note: ✓ indicates distributed
✗ indicates undistributed

□ RULES FOR DEDUCTIONS

1. Every deduction should contain three and only three distinct terms.
2. If both the premises are particular, no conclusion can be drawn.
3. If both the premises are negative, no conclusion can be drawn.
4. The middle term must be distributed at least once in the premises.
5. If one premise is particular, then the conclusion must be particular.
6. If one premise is negative, then the conclusion must be negative.
7. No term can be distributed in the conclusion, if it is not distributed in the premises.

We take examples of each type and look at them in detail.

Example 1:

- All dogs are cats. (i)
All cats are pigs. (ii)

As the first statement is a universal affirmative statement, the subject (dogs) has to be distributed (✓) and the predicate (cats) is not distributed (✗). As the second statement is also universal affirmative, the subject cat is distributed (✓) and the predicate pigs is not distributed (✗). The above answer/logic is arrived at on the basis of Table II.

The middle term ('cats' is the middle term as it occurs in both the premises) is distributed once in the premises. Hence, it satisfies Rule 2. As 'dogs' is distributed in the premise and 'pigs' is undistributed in the deduction also, they should appear accordingly. The type of statement that satisfies both of them is universal affirmative statement, i.e., a statement with 'All'. Hence, the answer will be 'All dogs are pigs'.

The answer cannot be 'All pigs are dogs', because Rule 7 states that no term can be distributed in the

conclusion if it is not distributed in the premises. As 'pigs' is not distributed in the premise, it cannot be distributed in the conclusion (because if we take 'All pigs are dogs', then the subject 'pigs' will be distributed). Hence, the conclusion 'All pigs are dogs' is wrong.

Example 2:

- All cats are dogs. (i)
All cats are pigs. (ii)

Statement (i) is universal affirmative and hence, the subject 'cats' is distributed and the predicate 'dogs' is not distributed as per Table II.

Statement (ii) is also universal affirmative and hence, the subject 'cats' is distributed and the predicate 'pigs' is not distributed as per Table II.

Here, the middle term 'cats' ('cats' is the middle term as it is occurring in both the premises) is distributed. Hence, we can draw a conclusion.

The answer should contain the terms 'dogs' and 'pigs' and both the terms are not distributed. Referring to Table II, we find that this is possible only in particular affirmative [the conclusion cannot start with the qualifier 'All' as the subject in 'All' should be distributed]. According to Rule 7, a term cannot be distributed in the conclusion if it is not distributed in the premises. So, the answer will be as follows.

Some dogs are pigs.
or
Some pigs are dogs.

Example 3:

- All dogs are cats. (i)
All pigs are cats. (ii)

Statement (i) is universal affirmative and hence, the subject 'dogs' is distributed and the predicate 'cats' is not distributed. In statement (ii), which is also a universal affirmative, the subject 'pigs' is distributed and the predicate 'cats' is not distributed. This is arrived at on the basis of Table II.

The middle term 'cats' ['cats' is the middle term as it occurs in both the statements] is not distributed in either of the two statements. From Rule 2, which states that the middle term should be distributed at least once in the premises for drawing a conclusion, we cannot draw any conclusion in this case.

Example 4:

- All cats are dogs. (i)
Some cats are pigs. (ii)

The first statement is a universal affirmative premise and hence, the subject 'cats' is distributed and the



predicate 'dogs' is not distributed (\times). The second statement is particular affirmative and hence, both the subject 'cats' and the predicate 'pigs' are not distributed (\times) as per Table II. As we have a particular premise, the conclusion should also be a particular one as per Rule 4. The middle term is distributed and we can draw a conclusion. So, the answer will be as follows.

Some dogs are pigs.
or
Some pigs are dogs.

Example 5:

- All dogs are cats. (i)
No cats are pigs. (ii)

As the first premise is a universal affirmative, the subject (dogs) is distributed and the predicate (cats) is not distributed. In the second premise, which is a universal negative, the first term (cats) and the second term (pigs) are both distributed (as per Table II). As the middle term is distributed at least once in the premises, Rule 2 is satisfied and hence, we can draw a conclusion.

From Rule 3, which states that if one of the premises is negative the conclusion should be negative, the conclusion should be negative and as both the terms 'dogs' and 'pigs' are distributed, the conclusion should be a universal negative statement. Hence, the answer will be as follows.

No dogs are pigs.
or
No pigs are dogs.

Example 6:

- All dogs are cats. (i)
Some cats are pigs. (ii)

Since the first statement is a universal affirmative, 'dogs' is distributed and 'cats' is not distributed. Since the second statement is a particular affirmative, 'cats' is not distributed and 'pigs' is also not distributed (as per Table II).

In the above given example, no conclusion can be drawn, as Rule 2 states that the middle term ('cats' in

the above example as it occurs in both the premises) should be distributed at least once in the premises, which is not satisfied.

Example 7:

- All dogs are cats. (i)
Some cats are not pigs. (ii)

The first statement is a universal affirmative and hence, the subject (dogs) is distributed and the predicate (cats) is not distributed.

The second statement is a particular negative and hence, the subject (cats) is not distributed and the predicate (pigs) is distributed (Table II).

But as the middle term (cats) is not distributed at least once in the premises, Rule 2 is not satisfied and hence we cannot draw any conclusion.

Example – 8

- All cats are dogs. (i)
Some cats are not pigs. (ii)

The first statement is a universal affirmative and hence, 'cats' is distributed and 'dogs' is not distributed. The second statement is a particular negative and hence, 'cats' is not distributed and 'pigs' is distributed (as per Table II).

Here, the middle term (cats) is distributed and hence, we can draw a conclusion.

The conclusion should be particular negative as Rule 3 states that if a premise is negative, the conclusion should also be negative. Also Rule 4 states that if a premise is particular, the conclusion should also be particular. Hence, the conclusion should be a particular negative.

In particular negative, we know that the subject is not distributed and the predicate is distributed.

The terms 'dogs' and 'pigs' should come in the conclusion. Also, since 'dogs' is not distributed in the premise, it cannot be distributed in the conclusion, as per Rule 7.

As per the above reasoning, only 'pigs' can be the predicate in the conclusion and hence, 'dogs' will be the subject.

Thus, the answer will be 'Some dogs are not pigs'.

EXERCISE-1

Directions for questions 1 to 15: Select the alternative that logically follows from the two given statements, but not from one statement alone.

1. All cooks are drivers.
All drivers are dancers.
(A) All dancers are drivers.
(B) All cooks are dancers.
(C) No cook is dancer.
(D) Both (A) and (B)
2. All sane are men.
Some sane are insane.
(A) Some men are insane.
(B) No men are insane.
(C) All men are insane.
(D) None of the above
3. No plane is ship.
No ship is bus.
(A) No bus is plane.
(B) No plane is bus.
(C) Both (A) and (B)
(D) None follows
4. All cats are dogs.
No dogs are rats.
(A) All cats are rats.
(B) Some cats are rats.
(C) No cat is rat.
(D) None of the above
5. Some books are brooks.
Some brooks are not cooks.
(A) Some books are cooks.
(B) Some books are not cooks.
(C) Both (A) and (B)
(D) None follows
6. Some waters are rivers.
All rivers are oceans.
(A) Some waters are not oceans.
(B) Some oceans are not waters.
(C) Some waters are oceans.
(D) Both (A) and (C)
7. All papers are books.
Some books are not diaries.
(A) No paper is a diary.
(B) Some papers are not diaries.
(C) Some papers are diaries.
(D) None follows
8. No white is black.
No black is red.
(A) Some white is red.
(B) Some white is not red.
(C) No white is red.
(D) None follows
9. Some shirts are trousers.
Some trousers are pants.
(A) Some shirts are not pants.
(B) No shirt is pant.
(C) Some pants are not shirts.
(D) None follows
10. All Ws are Ps.
All Ws are Ks.
(A) All Ps are Ks. (B) All Ks are Ps.
(C) Some Ps are Ks. (D) Both (B) and (C)
11. All Asians are Indians.
No Asian is an African.
(A) Some Africans are not Indians.
(B) No Indian is an African.
(C) Some Indians are not African.
(D) Both (B) and (C)
12. Some animals are humans.
Some animals are not birds.
(A) Some humans are not birds.
(B) Some birds are not humans.
(C) No bird is a human.
(D) None follows
13. All mobiles are electronics.
Some mobiles are smart phones.
(A) Some electronics are smart phones.
(B) Some smart phones are electronics.
(C) Some electronics are not smart phones.
(D) Both (A) and (B) follow.
14. All roads are wide.
Some wide are not highways.
(A) Some highways are not roads.
(B) Some roads are highways.
(C) No highway is a road.
(D) None follows



15. Some vessels are bottles.
No vessel is a container.
(A) Some containers are not bottles.
(B) Some bottles are not containers.
(C) No bottle is a container.
(D) None follows

Directions for questions 16 to 20: Each of these questions consist of two statements followed by two conclusions marked I and II. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which of the given conclusion(s) logically follow(s) the statements, disregarding the commonly known facts. Mark your answer as follows:

- (A) If only I follows.
(B) If only II follows.
(C) If neither I nor II follows.
(D) If both I and II follow.
16. Statements: All seas are bees.
Some teas are bees.
Conclusions: I. All teas are seas.
II. Some seas are teas.
17. Statements: All grapes are apples.
All apples are mangoes.
Conclusions: I. All grapes are mangoes.
II. All mangoes are grapes.
18. Statements: Some doctors are lawyers.
Some lawyers are architects.
Conclusions: I. Some doctors are architects.
II. All architects are doctors.
19. Statements: All weddings are writings.
All weddings are wirings.
Conclusions: I. Some writings are wirings.
II. All writings are wirings.
20. Statements: Some queues are rows.
No row is a circular.
Conclusions: I. All circular are queues.
II. Some circulars are queues.

Directions for questions 21 to 25: The questions given below have four groups of three statements each. Read the statements in each group carefully and identify the group/groups where the third statement logically follows the first two statements in the group.

21. (a) All books are copies. All copies are papers. All books are papers.
(b) All cubes are squares. All cubes are triangles. All triangles are squares.
(c) All singers are dancers. All dancers are musicians. All musicians are singers.
(d) No cock is hen. All hens are chickens. No hen is chicken.

- (A) Only d (B) Only a
(C) Only b and c (D) Only a and d

22. (a) Some journals are magazines. Some magazines are periodic. Some journals are periodic.
(b) Some horror is ghost. All ghosts are faints. Some horror are faints.
(c) All scientists are researchers. All researchers are professors. Some professors are scientists.
(d) Many baggages are luggages. All luggages are packages. Some packages are not baggages.
(A) Only b, c and d (B) Only b and c
(C) Only a and d (D) Only b
23. (a) Many fountains are cascades. No waterfall is fountain. Some cascades are not waterfalls.
(b) No bag is pack. No pack is jack. No jack is bag.
(c) No good is bad. All bad is not good. Some good is not good.
(d) Scale is ruler. No ruler is pointer. No pointer is scale.
(A) Only a (B) Only d
(C) Only b and c (D) Only a and d
24. (a) No esthetic is an atheist. Some esthetics are monotheists. Some monotheists are not polytheists.
(b) All sentences are words. No word does not have meaning. Some which do not have meanings are not sentences.
(c) No river is sea. Some seas are oceans. Some oceans are not rivers.
(d) No MMTS is MRTS. All public transports are MRTS. No public transport is MMTS.
(A) Only b, c and d (B) Only c and d
(C) Only a and b (D) Only b and c
25. (a) No sitar is a guitar. No guitar is violin. No violin is a sitar.
(b) Ragas are songs. Some pops are not songs. Some pops are not ragas.
(c) Some costume designers are not hair designers. All designers are not hair designers. Some designers are not costume designers.
(d) AC's are not DCs. Some DCs are not BC's. Some AC's are not BC's.
(A) Only b and d (B) Only a and d
(C) Only b (D) Only a and b

Directions for questions 26 to 30: Each question below has four groups of three statements each. Read the statements in each group carefully and identify the group/groups where the third statement logically follows the first two statements in the group.

26. (a) All bohemians are transcendent. Some transcendent are vermishells. Some bohemians are vermishells.

- (b) Some milks are cheese. No cheese is butter. Some butters are not milks.
- (c) All hookahs are smokes. All smokes are pungents. Some hookahs are pungents.
- (d) No white is black. All blacks are silks. Some silks are not whites.
- (A) Only c and d (B) Only a
- (C) Only a and b (D) a, b, c and d
27. (a) Few peanuts are groundnuts. Many coconuts are peanuts. Some groundnuts are not coconuts.
- (b) Every one is loyal. All honest are one. Some loyal are honest.
- (c) No chings are changs. Some twangs are not changes. Some twangs are not chings.
- (d) People are hardworking. Some hardworking are successful. All successful are people.
- (A) Only c (B) Only b
- (C) Only b and d (D) Only a and c
28. (a) Tigers are kings. Kings are deers. Tigers are deers.
- (b) Palika is a very good neighbour. Palika is humble. Some humble are not very good neighbour.
- (c) Some friends are best. No best is enemy. Some friends are enemy.
- (d) All mothers are goodness. All mothers are females. All females are goodness.
- (A) Only a and b (B) Only a
- (C) Only b and c (D) Only a, c and d
29. (a) All pinks are purple. All purple are violet. All violet are pinks.
- (b) No chord is scale. Some scales are minors. No chord is minor.
- (c) Some pollutions are dusts. Some dusts are harmfuls. Some pollutions are harmfuls.
- (d) No calcium is protein. All vitamins are calcium. No vitamin is protein.
- (A) Only b (B) Only a and c
- (C) Only d (D) Only a and d
30. (a) All formidable are fearless. All warriors are fearless. All formidable are warriors.
- (b) Some pubs are casino. No casino is public. Some pubs are not public.
- (c) Some sages are ages. All fages are sages. Some ages are fages.
- (d) No wine is old. No gold is old. No wine is gold.
- (A) Only a and c (B) Only a and d
- (C) Only b (D) Only c

Directions for questions 31 to 35: In each of the following questions, three statements followed by four conclusions marked I, II and III are given. Consider the statements to be true,

even though they seem to be at variance with the commonly known facts and find out which of the given conclusion(s) logically follow(s) the statements, disregarding the commonly known facts.

31. Statements: All digits are symbols.
All symbols are letters.
Some letters are elements.
- Conclusions: I. All digits are letters.
II. Some symbols are elements.
III. All letters are digits.
- (A) Only I and II follow.
(B) Only II and III follow.
(C) Only I and III follow.
(D) Only I follows.
32. Statements: All fats are mats.
Some mats are rats.
All rats are cats.
- Conclusions: I. Some fats are cats.
II. Some mats are cats.
III. Some rats are fats.
- (A) Only I follows. (B) Only II follows.
(C) Only III follows. (D) Both I and II follow.
33. Statements: All inputs are outputs.
Some outputs are results.
No result is good.
- Conclusions: I. Some inputs are results.
II. Some goods are not outputs.
III. Some inputs are good.
- (A) Only I follows.
(B) Only II follows.
(C) Both II and III follow.
(D) None follows
34. Statements: No pen is pencil.
No pencil is paper.
No paper is board.
- Conclusions: I. No pen is paper.
II. Some pencils are not boards.
III. No board is pen.
- (A) Only I follows. (B) Only II follows.
(C) Only III follows. (D) None follows
35. Statements: No one is two.
Some two are threes.
All four are two.
- Conclusions: I. Some four are threes.
II. No one is a four.
III. Some four are not one.
- (A) Only I and II follow.
(B) Only I and III follow.
(C) Only II and III follow.
(D) Only I follows.



Directions for questions 36 to 40: Each of these questions consists of six statements followed by sets of three statements each. Find the set in which the third statement can be logically concluded from the first two statements.

- 36.** (a) No wolf is a tiger.
 (b) No deer is tiger.
 (c) Some bears are not tigers.
 (d) Some deers are not bears.
 (e) Some bears are wolves.
 (f) No deer is wolf.
 (A) aec (B) bfd
 (C) efd (D) fbd
- 37.** (a) Anything which is kind is gentle.
 (b) Everything which is gentle is not hard.
 (c) Nothing which is firm is gentle.
 (d) Something which is firm is hard.
 (e) Many things which are hard are not kind.
 (f) Nothing which is kind is firm.
 (A) acf
 (B) dfe
 (C) abe
 (D) More than one of the above
- 38.** (a) Screening is sedimentation.
 (b) Sedimentation is purification.
 (c) Purification is filtration.
 (d) Filtration is screening.
 (e) Screening is purification.
 (f) Sedimentation is filtration.
 (A) cde (B) bfc
 (C) bcf (D) aeb
- 39.** (a) No fish is bird.
 (b) Flyers are gliders.
 (c) No flyer is fish.
 (d) Some gliders are birds.
 (e) No flyer is bird.
 (f) Some flyers are birds.
 (A) dbf (B) ace
 (C) efd (D) None of these
- 40.** (a) Junk food contains more fat.
 (b) Fast food is not healthy.
 (c) Fast food does not contain more fat.
 (d) Junk foods are fast foods.
 (e) Some fast food are junk foods.
 (f) Junk food is not healthy.
 (A) ace (B) ade
 (C) bfe (D) bdf

EXERCISE-2

Directions for questions 1 to 18: Each of these questions consists of six statements followed by sets of three statements each. Find the set in which the statements are logically related.

- 1.** (a) Shed is not shelter.
 (b) Roof is protection.
 (c) Roof is shed.
 (d) Roof is shelter.
 (e) Some shelter is not protection.
 (f) Shed is protection.
 (A) cda
 (B) aef
 (C) bcf
 (D) More than one of the above
- 2.** (a) Engineers are not doctors.
 (b) Some doctors are psychologists.
 (c) Some doctors are not professors.
 (d) Some engineers are professors.
 (e) No professor is a psychologist.
 (f) Some psychologists are not engineers.
 (A) acd (B) def
 (C) bfa (D) All the above
- 3.** (a) All cricketers are footballers.
 (b) All footballers are magicians.
 (c) All magicians are cricketers.
 (d) Some cricketers are footballers.
 (e) Some footballers are magicians.
 (f) Some magicians are cricketers.
 (A) abc (B) efb
 (C) bcd (D) def
- 4.** (a) Some RCs are not DCs.
 (b) All PCs are ACs.
 (c) Some ACs are not RCs.
 (d) Some ACs are not DCs.
 (e) Many RCs are PCs.
 (f) Some PCs are not DCs.
 (A) ceb (B) fdb
 (C) afe (D) dbf
- 5.** (a) Truss is not roof.
 (b) Truss is not timber.
 (c) Post is roof.
 (d) Timber is roof.
 (e) Post is not truss.
 (f) Timber is post.

- (A) bfe
(B) cae
(C) cdf
(D) More than one of the above
6. (a) All plays are puzzles.
(b) All riddles are plays.
(c) Some games are puzzles.
(d) No puzzle is game.
(e) Some games are riddles.
(f) All riddles are puzzles.
(A) afd (B) cef
(C) fab (D) Both (B) and (C)
7. (a) Some figures are curves.
(b) Some curves are squares.
(c) Some squares are figures.
(d) Some squares are not triangles.
(e) All curves are figures.
(f) No figure is triangle.
(A) cdf (B) def
(C) acb (D) abe
8. (a) No shoe is black.
(b) Some black is leather.
(c) Some leather are shoes.
(d) All black is dark.
(e) Some shoes are black.
(f) No shoe is dark.
(A) afd (B) abd
(C) ced (D) def
9. (a) All roses are lillies.
(b) All lillies are jasmines.
(c) All jasmines are roses.
(d) Some orchids are lillies.
(e) Some orchids are roses.
(f) Some orchids are jasmines.
(A) abc (B) dea
(C) efd (D) bef
10. (a) Some directories are dictionaries.
(b) Some yellow pages are not dictionaries.
(c) All directories are information.
(d) No dictionary is directory.
(e) All directories are yellow pages.
(f) All information are yellow pages.
(A) ade (B) def
(C) bde (D) abc
11. (a) All sad are anxious.
(b) Some mood are depressed.
(c) No sad is anxious.
(d) All moods are sad.
(e) All sad are depressed.
(f) All anxious are moods.
(A) bde (B) cdf
(C) adf (D) ade
12. (a) All prayers are tantras.
(b) Some mantras are prayers.
(c) Chantings are mantras.
(d) No mantra is tantra.
(e) All tantras are chantings.
(f) Some prayers are chantings.
(A) cde (B) efa
(C) bcf (D) Both (B) and (C)
13. (a) All gliders are smoother.
(b) All gliders are shiner.
(c) Some shiner are mirror.
(d) Some smoother are shiner.
(e) All smoother are shiner.
(f) No mirror is smoother.
(A) cdf (B) abe
(C) cef (D) acd
14. (a) All seconds are minutes.
(b) All minutes are hours.
(c) All hours are days.
(d) Some hours are minutes.
(e) Some minutes are seconds.
(f) Some seconds are hours.
(A) efb (B) fda
(C) ade (D) dfe
15. (a) Some rooms are dormitories.
(b) All suites are hotels.
(c) No building is a dormitory.
(d) Some suites are not dormitories.
(e) All hotels are buildings.
(f) Some dormitories are not hotels.
(A) cbf (B) eba
(C) cfe (D) adc
16. (a) No fibre is wood.
(b) Some fibre is rubber.
(c) Some wood is not fibre.
(d) Some rubber is not wood.
(e) No stick is fibre.
(f) All sticks are wood.
(A) eaf (B) cfe
(C) adb (D) All the above
17. (a) Some doors are not locks.
(b) Some locks are not glasses.
(c) Some glasses are not keys.
(d) Some doors are not glasses.
(e) All keys are locks.
(f) No key is a door.
(A) aef (B) cbe
(C) fcd (D) None of the above



18. (a) All lions are elephants.
 (b) No pig is a tiger.
 (c) Some elephants are not pigs.
 (d) Some lions are not pigs.
 (e) Some pigs are elephants.
 (f) Some lions are tigers.
- (A) fbd (B) dca
 (C) fde (D) Both (A) and (B)

Directions for questions 19 to 23: In each of the following questions, four statements followed by four conclusions are given. Consider the statements to be true even though they appear to be at variance with the commonly known facts. Find which of the conclusion(s) logically follow(s) the given statements, disregarding the commonly known facts and choose appropriate answer choice.

19. Statements: All pedals are frames.
 All frames are roses.
 All hubs are roses.
 All keys are hubs.
- Conclusions: I. All roses are pedals.
 II. All keys are roses.
 III. Some hubs are frames.
 IV. Some frames are keys.
- (A) Only II follows.
 (B) Only II and III follow.
 (C) Only III and IV follow.
 (D) Only I, II and III follow.
20. Statements: Some baskets are caskets.
 Some caskets are trunks.
 All trunks are fans.
 All sweets are fans.
- Conclusions: I. Atleast some baskets are trunks is a possibility.
 II. Atleast some fans are caskets is a possibility.
 III. All fans are baskets is a possibility.
 IV. Atleast some sweets are not caskets is a possibility.
- (A) Only I and III follow.
 (B) Only II and IV follow.
 (C) Only I, II and III follow.
 (D) All follow
21. Statements: Some forks are spades.
 Some spades are not shovels.
 All chisels are shovels.
 No potato is a chisel.
- Conclusions: I. Some shovels are not potatoes is a possibility.
 II. Atleast one chisel is a spade is a possibility.

- III. All potatoes are shovels is a possibility.
 IV. Some forks are chisels is a possibility.

- (A) Only III and IV follows.
 (B) Only II and IV follow.
 (C) Only I, II and IV follow.
 (D) All follow.

22. Statements: All bolts are nuts.
 All chips are washers.
 Some screws are nuts.
 All nuts are washers.
- Conclusions: I. All bolts are washers.
 II. Some washers are screws.
 III. Some washers are bolts.
 IV. All chips are screws.

- (A) Only I follows.
 (B) Only I and II follow.
 (C) Only I, II and III follow.
 (D) All follow

23. Statements: Some doctors are actors.
 Some actors are teachers.
 All dancers are teachers.
 All doctors are engineers.
- Conclusions: I. Some actors are engineers.
 II. Some teachers are engineers.
 III. No engineer is a teacher.
 IV. All teachers are doctors.

- (A) Either II or III follows
 (B) Only I follows
 (C) Only I and III follow
 (D) Only I and exactly one of II or III follows

Directions for questions 24 to 30: Select the alternative that logically follows from the two given statements, but not from one statement alone.

24. Some shirts are pants.
 All pants are shorts.
- (A) No shirt is shorts.
 (B) Some shirts are shorts.
 (C) All shirts are shorts.
 (D) None of the above
25. Some gauges are cages.
 Some cages are not catches.
- (A) Some guages are not catches.
 (B) No guage is a catch.
 (C) Some guages are catches.
 (D) None of the above

26. No red is black.
All blue are black.
(A) All red are blue.
(B) Some red are blue.
(C) No red is blue.
(D) None of the above
27. Some hammers are tools.
All tools are made of iron.
(A) Some hammers are made of iron.
(B) Some hammers are not made of iron.
(C) No hammer is made of iron.
(D) None of the above
28. Some tools are not hammers.
All tools are made of iron.
(A) Some hammers are made of iron.
(B) Some hammers are not made of iron.
(C) Some tools made of iron are not hammers.
(D) None of the above
29. All cigarettes are cigars.
Some cigarettes are not good for health.
(A) Some cigars are not good for health.
(B) Some cigars are good for health.
(C) No cigar is good for health.
(D) Both (A) and (B)
30. Some MBAs are CEOs.
All CEOs are Directors.
(A) Some MBAs are not Directors.
(B) Some MBAs are Directors.
(C) Both (A) and (B)
(D) None of the above

Directions for questions 31 to 35: Each of the following questions consists of four statements followed by four conclusions. Consider the statements to be true even if they vary from the normally known facts and find out which of the conclusion(s) logically follow(s) the given statements and choose the proper alternative from the given choices.

31. Statement: Some watches are clocks.
Some clocks are times.
Some times are fast.
Life is fast.
- Conclusions:
- I. Some watches are life.
 - II. Some lifes are time.
 - III. Some clocks are fast is a possibility.
 - IV. Some watches are fast is not a possibility.
- (A) Only I and II
(B) Only III follows.
(C) Only II, III and IV
(D) All follow

32. Statements: Earth is tree.
All trees are branches.
All branches are leaves.
All branches are flowers.
- Conclusions: I. Earth is a flower.
II. All flowers are leaves is a possibility.
III. Some trees are flowers.
IV. No flower is leaf is not a possibility.
- (A) Only II and IV
(B) Only I, II and III
(C) Only I and III
(D) All follow.
33. Statements: Some boys are engineers.
All engineers are graduates.
All graduates are literate.
Some girls are literate.
- Conclusions: I. No boy is a girl.
II. Some boys are literates.
III. Some girls are engineers.
IV. All engineers are literate.
- (A) Only II and IV
(B) Only I, II and IV
(C) Only II, IV and I or III
(D) Only III and II
34. Statements: No rice is curd.
All rice is grain.
Oats are grains.
No flour is grain.
- Conclusions: I. No curd is grain.
II. No rice is oat.
III. No flour is oat.
IV. Some oats are curds.
- (A) Only I, II and III
(B) Only III
(C) Only II and III
(D) Only III and II or IV
35. Statements: Flowers are beautiful.
No beautiful is ugly.
Coal is ugly.
Beautiful is attractive.
- Conclusions: I. Flowers are attractive.
II. No flower is coal.
III. Some flowers are not ugly.
IV. Some attractive are not coal.
- (A) Only I
(B) Only I, II and III
(C) Only II, III and IV
(D) All follow



Directions for questions 36 to 40: Each of these questions consists of three/four statements and four choices. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which choice logically does not follow the given statements, disregarding the commonly known facts:

36. Statements: Some bazaar are beach.
No beach is a beauty.
All beauty is bean.

- (A) Some beaches being beans is not a possibility.
- (B) Some beauty is bean.
- (C) Some bazaar being bean is a possibility.
- (D) All bean being beauty is a possibility.

37. Statements: All chat are compete.
Some chat are cherry.
All clean are compete.

- (A) Some compete are cherry.
- (B) Some clean are compete.
- (C) Some clean are chat.
- (D) All cherry being compete is a possibility.

38. Statements: All giant are glow.
Some glow are not locks.
Some locks are music.

- (A) Some giant are glow.
- (B) Some music being glow is a possibility.
- (C) Some locks are giant.
- (D) All glows being giant is a possibility.

39. Statements: Some mute are sound.
Some sound are pink.
Some sweet are sound.

- (A) Some pink being mute is a possibility.
- (B) All mute being sound is not a possibility.
- (C) Some pink are sound.
- (D) Some mute being pink is a possibility.

40. Statements: No battle is paper.
Some paper are word.
All battle are amount.

- (A) All paper being word is a possibility.
- (B) Some amount are battle.
- (C) Some word being amount is a possibility.
- (D) Some battles are papers.

EXERCISE-3

Directions for questions 1 to 7: Each question below has four groups of three statements each. Read the statements in each group carefully and identify the group/groups where the third statement logically follows the first two statements in the group.

1. (a) A few gasoline are flammable. All flammable are ignition. Many gasoline are ignition.
(b) All suppers are breakfast. Some supper are not dinner. Some breakfast are not dinner.
(c) No electron is nucleus. All protons are electrons. Some protons are not nucleus.
(d) Some cars are not taxies. All cars are buses. Some buses are not taxies.
(A) Only b (B) Only c and d
(C) Only a and b (D) All of them
2. (a) All colours are walls. No wall is plain. No colour is plain.
(b) All sonic are cosmic. Some cosmic are superfast. All sonic are superfast.
(c) Every amount is refundable. Some amounts are retainable. Some refundable is retainable.
(d) No one is novice. Some novice is shrewd. Some shrewd are not one.

- (A) Only a and b (B) Only a, c and d
- (C) Only b and c (D) Only c and d

3. (a) All even are numbers. Some numbers are odd. Some odd are even.
(b) Some coins are rupees. No dollar is a rupee. Some coins are not dollars.
(c) All shirts are cloths. Some good are not cloths. Some shirts are not good.
(d) Some glasses are spectacles. Some fibre are not glasses. Some fibre are spectacles.
(A) Only a (B) Only b
(C) Only c (D) Only b and d
4. (a) All relations are friends. No relation is an enemy. Some friends are not enemies.
(b) No relation is an enemy. All relations are friends. Some enemies are not friends.
(c) All bikes are vehicles. All vehicles are useful. All useful are bikes.
(d) All bikes are vehicles. All useful are bikes. Some vehicles are useful.
(A) Only b and c (B) Only a and c
(C) Only a and d (D) Only b and d

5. (a) All protocols are rules. All protocols are mandatory. All rules are mandatory.
 (b) All fruits are eatable. No eatable is vegetable. No vegetable is a fruit.
 (c) No protocol is a rule. Some rules are mandatory. Some mandatory are not protocols.
 (d) Some eatable are fruits. Some vegetables are eatable. Some fruits are vegetables.
 (A) Only a and b (B) Only b and c
 (C) Only c and d (D) Only a and d
6. (a) All imports are taxable. Some exports are not taxable. Some exports are not imports.
 (b) Banks are financial institutions. Some financial institutions are not NBFC. Some NBFC are not banks.
 (c) No gold is silver. Some metals are silver. Some gold are not metals.
 (d) Some books are files. Some manuals are not books. Some manuals are not files.
 (A) Only b (B) Only d and b
 (C) Only a and c (D) Only a
7. (a) Bulbs are bright. No bright is flammable. Some bulbs are not flammable.
 (b) Some black are not pens. All blue are pens. Some black are not blue.
 (c) Some debts are NPA. All NPA are bad debts. Some debts are bad debts.
 (d) Some laptops are desktops. No tab is a desktop. Some tabs are not laptops.
 (A) Only b, c and d (B) Only b and c
 (C) Only a, b and c (D) All follow
- Directions for questions 8 to 17:** Each of these questions consists of six statements followed by several sets of three statements each. Select your answer from the given sets in which the statements are logically related.
8. (L) Every ball is round.
 (M) Some balls are rings.
 (N) All which are round are spheres.
 (P) All rings are round.
 (Q) Some rings are spheres.
 (R) Some rings are not spheres.
 (A) PML (B) NPL
 (C) PQL (D) QNP
9. (L) Some truths are lies.
 (M) No false is true.
 (N) Some false are truths.
 (P) All lies are false.
 (Q) Some lies are not false.
 (R) All false are wrong.
 (A) PQR (B) NQR
 (C) LPN (D) MQR
10. (L) Some teams are great.
 (M) No good is great.
 (N) Some teams are not good.
 (P) Some players are great.
 (Q) All players are good.
 (R) All players are teams.
 (A) PQM (B) RNQ
 (C) PRL (D) MPN
11. (L) Some women are old.
 (M) Some men are not old.
 (N) Some engineers are women.
 (P) All men are young.
 (Q) All engineers are old.
 (R) Some men are engineers.
 (A) NQL (B) PMR
 (C) LNR (D) None of these
12. (L) No cup is a saucer.
 (M) Some cups are not fly.
 (N) All cups are big.
 (P) Some saucers are flying.
 (Q) No saucer is big.
 (R) Some which fly are not cups.
 (A) LMP (B) RPL
 (C) NQL (D) Both (B) and (C)
13. (L) Some hexagons are not pentagons.
 (M) No square is a rectangle.
 (N) All rectangles are pentagons.
 (P) No pentagon is an octagon.
 (Q) Some hexagons are not rectangles.
 (R) Some quadrilaterals are not squares.
 (A) NPM (B) NQL
 (C) MNR (D) PQL
14. (L) Some cubes are prisms.
 (M) No prism is a pyramid.
 (N) No cube is a pyramid.
 (P) All prisms are pyramids.
 (Q) Some prisms are not pyramids.
 (R) All cubes are symmetrical.
 (A) NQR (B) PRN
 (C) LNP (D) LNQ
15. (L) Some chocolates are good.
 (M) Some fats are not good.
 (N) No chocolate is protein.
 (P) All proteins are good.
 (Q) No protein is a fat.
 (R) Some chocolates are proteins.
 (A) PNL (B) LPR
 (C) MPQ (D) None of these



16. (L) All grass is brass.
 (M) No brass is copper.
 (N) Some copper are metals.
 (P) All metals are gold.
 (Q) Some copper are not grass.
 (R) Some copper are gold.
 (A) LMQ (B) NPR
 (C) MNP (D) Both (A) and (B)

17. (L) No kite is a rhombus.
 (M) All rhombuses are quadrilaterals.
 (N) Some rectangles are squares.
 (P) All squares are quadrilaterals.
 (Q) No square is a rhombus.
 (R) Some quadrilaterals are not kites.
 (A) LMR (B) LNP
 (C) PQN (D) None of these

Directions for questions 18 to 22: Each of these questions consists of six statements followed by four sets of three statements each. Select your answer in the given sets in which the statements are logically related.

18. (a) A few tufts are combs.
 (b) All crests are combs.
 (c) No crest is tuft.
 (d) All crests are tufts.
 (e) A few crests are not combs.
 (f) A few tufts are not combs.
 (A) abd (B) abc
 (C) eda (D) bcf

19. (a) A few straps are not curbs.
 (b) Some curbs are not chains.
 (c) All curbs are chains.
 (d) Many straps are chains.
 (e) Many chains are curbs.
 (f) Some straps are not chains.
 (A) acf (B) abf
 (C) dae (D) afe

20. (a) Some desks are not decks.
 (b) No slope is desk.
 (c) Some slopes are desks.
 (d) No desk is a deck.
 (e) No slope is decks.
 (f) All desks are slopes.
 (A) cde (B) def
 (C) abe (D) bde

21. (a) No dogma is a belief.
 (b) Some beliefs are dogmatic.
 (c) Some dogmatics are not dogmas.
 (d) Some dogmatics are dogmas.
 (e) Many beliefs are not dogmatic.
 (f) Some beliefs are dogmas.

- (A) abd (B) ace
 (C) cba (D) bdf

22. (a) No frontier is limit.
 (b) Some margins are not frontiers.
 (c) All margins are frontiers.
 (d) Some margins are frontiers.
 (e) No margin is limit.
 (f) Some limits are margins.
 (A) eba (B) eac
 (C) adf (D) acf

Directions for questions 23 to 27: In each of the following questions, three statements followed by four conclusions marked I, II, III and IV are given. Consider the statements to be true, even though they seem to be at variance with the commonly known facts and find out which of the given conclusion(s) logically follow(s) the statements, disregarding the commonly known facts.

23. Statements: Some arguments are arrangements.
 All arrangements are agreements.
 Some agreements are achievements.
 Conclusions: I. All arguments are agreements.
 II. Some agreements are arguments.
 III. Some arguments are achievements.
 IV. Some arrangements are achievements.
 (A) Only I and III follow.
 (B) Only I, II and III follow.
 (C) Only II and IV follow.
 (D) Only II follows.

24. Statements: All even are odd.
 Some even are prime.
 All prime are digits.
 Conclusions: I. Some odd are prime.
 II. All odd are prime.
 III. All odd are even.
 IV. Some digits are even.
 (A) Only I and II follow.
 (B) Only II and III follow.
 (C) Only I and IV follow.
 (D) Only I and III follow.

25. Statements: Some shirts are trousers.
 Some trousers are not shorts.
 All shorts are costly.
 Conclusions: I. Some shirts are shorts.
 II. No shirt is costly.
 III. Some trousers are shorts.
 IV. Some costly are trousers.
 (A) Only I follows.
 (B) Only II follows.
 (C) Only I and II follow.
 (D) None follows

26. Statements: Some north are east.
No east is west.
All west are south.

Conclusions: I. No north is west.
II. Some east are west.
III. Some south are not east.
IV. All south are east.

- (A) Only I follows.
(B) Only II follows.
(C) Only III follows.
(D) Either III or IV follows.

27. Statements: No cause is effect.
All weak are effect.
Some effect are strong.

Conclusions: I. Some strong are cause.
II. No cause is a weak.
III. Some strong are not cause.
IV. Some weak are strong.

- (A) Only I follows.
(B) Only II and III follow.
(C) Only III follows.
(D) Only II, III and IV follow.

ANSWER KEYS

Exercise-1

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

Exercise-2

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

Exercise-3

- | | | | | | | |
|--------|--------|---------|---------|---------|---------|---------|
| 1. (D) | 5. (B) | 9. (C) | 13. (B) | 17. (A) | 21. (C) | 25. (D) |
| 2. (B) | 6. (D) | 10. (C) | 14. (D) | 18. (A) | 22. (B) | 26. (C) |
| 3. (B) | 7. (C) | 11. (A) | 15. (B) | 19. (A) | 23. (D) | 27. (B) |
| 4. (C) | 8. (D) | 12. (D) | 16. (D) | 20. (B) | 24. (C) | |



SOLUTIONS

EXERCISE-1

1. A. The term 'dancers' is not distributed in the premise. Hence, it should not be distributed in the conclusion. Also, the middle term 'drivers' cannot be included in the conclusion.
B. No rule is violated, hence, it is correct.
C. From two affirmative statements, we cannot get a negative conclusion, hence, it is incorrect.
2. The middle term 'sane' is distributed in the first premise and one premise is particular. Hence, the conclusion must be particular. Choice (A) is the correct option.
3. As both the premises are negative, no conclusion can be derived.
4. As one premise is negative, the conclusion should be negative. Hence, (A) and (B) are incorrect but (C) is correct.
5. As both the premises are particular, no conclusion can be derived.
6. Conclusions (A) and (B) are negative. Hence, they do not follow. Only conclusion (C) satisfies all the conditions.
7. The middle term 'books' is not distributed. Hence, no conclusion can be drawn.
8. Both the given statements are negative. Hence, no conclusion can be drawn.
9. Both statements are particular. Hence, no conclusion can be drawn.
10. Only option (C) does not negate any rule. In option (A) and (B), the term 'P' and 'K' are distributed respectively, which are not distributed in the statements.
11. In choice (A) and choice (B) 'Indian's' is distributed which was not distributed in the premises. Choice (C) satisfies all the conditions.
12. The middle term is not distributed in the premises. Hence, none follows.
13. Choice (C) is negative whereas both given premises are positive. Choice (A) and choice (B) satisfy all the conditions.
14. Middle term is not distributed in the premises. Hence, none follows.
15. In choice (A) and choice (C) 'bottle' is distributed which was not distributed in the premises. Choice (B) satisfies all the conditions.

Solutions for questions 16 to 20: Refer the rules for deductions given in the introduction.

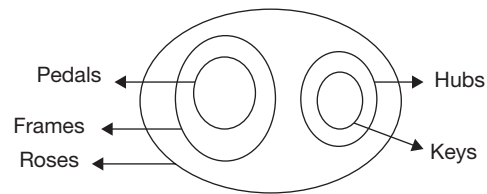
16. The middle term 'bees' is not distributed. Hence, no conclusion can be drawn.
17. The middle term 'apples' is distributed in the second premise. Hence, the conclusion that can be drawn is 'All grapes are mangoes'.
18. Both statements are particular. No conclusion can be drawn.
19. The middle term 'weddings' is distributed in both the premises. Hence, the conclusion that can be drawn is 'Some writings are wirings'.
20. The middle term 'row' is distributed in the second premise. Since one premise is particular and the other is negative, the conclusion that can be drawn must be particular negative, i.e., 'Some queues are not circular'.
21. (a) → Does not violate any rule.
(b) → Here, the term 'triangle' which is not distributed in the premise is distributed in the conclusion.
(c) → Here, the term 'musician' which is not distributed in the premise is distributed in the conclusion.
(d) → Here, the term 'chicken' which is not distributed in the premise is distributed in the conclusion.
22. (a) → Here the premises are particular, so no conclusions can be drawn.
(b) → Does not violate any rule.
(c) → Does not violate any rule.
(d) → The term 'baggages' which is distributed in the conclusion is not distributed in the premise.
23. (a) → Does not violate any rule.
(b) → All the statements are negative.
(c) → There are only two terms.
(d) → Does not violate any rule.
24. (a) → There are four terms.
(b) → Does not violate any rule.
(c) → Does not violate any rule.
(d) → Does not violate any rule.
25. (a) → Both the premises are negative, so no conclusion can be drawn.
(b) → Does not violate any rule.
(c) → Both the premises are negative.
(d) → Both the premises are negative.
26. (a) The middle term 'transcendent' is not distributed in any of the premises. Hence, no conclusion can be drawn.

- (b) The term 'milk' is distributed in the conclusion. While it is not distributed in the premise.
 (c) No rule is violated.
 (d) No rule is violated.
 Hence, both c and d.
27. (a) Both the premises are particular. Hence, no conclusion can be drawn.
 (b) No rule is violated.
 (c) Both the premises are negative. Hence, no conclusion can be drawn.
 (d) When one of the premises is particular, the conclusion cannot be universal.
28. (a) No rule is violated.
 (b) When both the premises are affirmative, the conclusion cannot be negative.
 (c) When one of the premises is negative, the conclusion cannot be affirmative.
 (d) The term 'females' is distributed in the conclusion while it is not distributed in the premise.
29. (a) The term 'Violet' is distributed in the conclusion, while it is not distributed in any of the premises.
 (b) When one of the premises is particular, the conclusion cannot be universal.
 (c) Both the premises are particular. Hence, no conclusion can be drawn.
 (d) No rule is violated.
30. (a) The middle term 'fearless' is not distributed. Hence, no conclusion can be drawn.
 (b) No rule is violated.
 (c) The middle term 'sages' is not distributed in any of the premises. Hence, no conclusion can be drawn.
 (d) Both the premises are negative. Hence, no conclusion can be drawn.
31. Using statements 1 and 2 as premises, the middle term 'Symbols' is distributed in the second statement. Hence, the conclusion is 'All digits are letters'.
 Using statements 2 and 3 as premises, the middle term 'Little' is not distributed.
 Hence, no conclusion can be drawn.
 \therefore Only conclusion I follows.
32. Using statements 1 and 2 as premises, the middle term 'mats' is not distributed. Hence, no conclusion can be drawn.
 Using statements 2 and 3 as premises, the middle term 'rats' is distributed in the third statement.
 Since the second statements is particular, the conclusion must be particular, i.e., 'Some mats are cats'.
 \therefore Only conclusion II follows.
33. Using statements 1 and 2 as premises, the middle term 'Outputs' is not distributed.
 Hence, no conclusion can be drawn.
- Using statements 2 and 3 as premises, the middle term 'results' is distributed in the third statements. Since the second statement is particular and the third statement is negative, the conclusion must be particular negative, i.e., 'Some outputs are not good'.
 \therefore None follows.
34. Using statements 1 and 2 as premises or statements 2 and 3 as premises, no conclusions can be drawn, since all the statements are negative.
 \therefore None follows.
35. Using statements 1 and 2 as premises, the middle term 'two' is distributed in the second statement since the second statement is particular and the first statements is negative the conclusion that must be drawn is particular negative, i.e., 'Some threes are not one'.
 Using statements 2 and 3 as premise, the middle term 'two' is not distributed. Hence, no conclusion can be drawn.
 Using statements 1 and 3 as premises, the middle term 'two' is distributed in the first statements. Since the first statements is negative, the conclusions drawn must be negative, i.e., 'No one is four', 'Some one are not fours' and 'Some fours are not ones'.
 \therefore Only II and III follows.
36. Choice (A) \rightarrow Does not violate any rule.
 Choice (B) \rightarrow Both the premises are negative.
 Choice (C) \rightarrow The term 'bear', which is distributed in the conclusion is not distributed in the premise.
 Choice (D) \rightarrow All the statements are negative.
37. Choice (A) \rightarrow Does not violate any rule.
 Choice (B) \rightarrow Does not violate any rule.
 Choice (C) \rightarrow The middle term 'gentle' is not distributed.
38. Choice (A) \rightarrow The term 'screening' which is distributed in the conclusion is not distributed in the premise.
 Choice (B) \rightarrow The term 'purification' which is distributed in the conclusion is not distributed in the premise.
 Choice (C) \rightarrow Does not violate any rule.
 Choice (D) \rightarrow The term 'sedimentation' which is distributed in the conclusion is not distributed in the premise.
39. Choice (A) \rightarrow The middle term 'gliders' is not distributed.
 Choice (B) \rightarrow A and C are negative.
 Choice (C) \rightarrow There are only two terms.
40. Choice (A) \rightarrow Affirmative conclusion cannot be drawn from negative statement.
 Choice (B) \rightarrow Middle term appears in the conclusion.
 Choice (C) \rightarrow No conclusion can be drawn from two negative statements.
 Choice (D) \rightarrow Does not violate any rule.



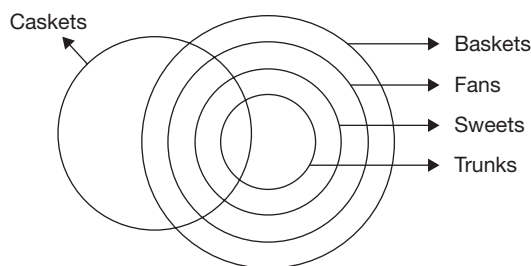
EXERCISE-2

1. Choice (A) → There is only one negative statement.
Choice (B) → Here, only (e) can be the conclusion but the term 'protection' is distributed, which is not distributed in (f).
Choice (C) → Does not violate any rule in the order cfb.
2. Choice (A) → Only (c) can be the conclusion but the term 'professor' which is distributed in the conclusion is not distributed in the premise.
Choice (B) → Only (f) can be the conclusion, but here the term 'engineer' which is distributed in the conclusion is not distributed in the premise.
Choice (C) → Does not violate any rule in the order abf.
3. Choice (A) → In any order if we take the statements, the term which is not distributed in the premise is distributed in the conclusion.
Choice (B) → There are only two terms in the statements (b) and (e).
Choice (C) → Does not violate any rule in the order bcd.
Choice (D) → All the statements are particular.
4. Choice (A) → There is only one negative statement.
Choice (B) → Does not violate any rule in the order bfd.
Choice (C) → All are particular statements.
Choice (D) → There are four terms.
5. Choice (A) → Does not violate any rule in the order efb.
Choice (B) → Does not violate any rule in the same order.
Choice (C) → Does not violate any rule in the order cfd.
6. (A) afd → There is only one negative statement.
(B) cef → Here, efc is the correct order.
(C) fab → Here, abf is a right order.
7. (A) cdf → cfd is the correct order.
(B) def → Here, 'square' and 'curve' appear only once.
(C) acb → All are particular statements.
(D) abe → The term 'curve' appears in all the three statements.
8. (A) afd → Here, fda is the correct order.
(B) abd → There is only one negative statement.
(C) ced → The term 'dark' appears only once.
(D) def → There is only one negative statement.
9. (A) abc → For every possible order the seventh rule of syllogism is violated.
(B) dea → Here, aed is the correct order.
(C) efd → All the statements are particular.
(D) bef → The term 'lilly' and 'rose' appear only once.
10. (A) ade → There is only one negative statement.
(B) def → There is only one negative statement.
(C) bde → Here, deb is the correct order.
(D) abc → There is only one negative statement.
11. (A) bde → Here, deb is the correct order.
(B) cdf → There is only one negative statement.
(C) adf → For every possible order the seventh rule of syllogism is violated. Hence, it is incorrect.
(D) ade → The term depressed appears only once.
12. (A) cde → There is only one negative statement.
(B) efa → Here, aef is the correct order.
(C) bcf → Here, cfb is the correct order.
13. (A) cdf → There is only one negative statement.
(B) abe → Here, aeb is the correct order.
(C) cef → There is only one negative statement.
(D) acd → The term 'mirror' appears only once.
14. efb – Here, bef is the correct order.
fda – The term minutes has appeared three times.
ade – The term minutes has appeared three times.
dfe – Here, all are particular statements.
15. cdf – Here, all are negative.
eba – There are more than three terms.
cfe – Here, ecf is the correct order.
adc – There are more than three terms.
16. eaf – Here, fae is the correct order.
cfe – Here, efc is the correct order.
adb – Here, abd is the correct order.
17. aef – Here, the possible order is efa, but it violates distribution rule.
cbe – It violates distribution rule.
fcd – Here, all are negative statements.
18. fbd – Here, fbd is the correct order.
dca – Here, adc is the correct order.
fde – Here, all are particular statements.
19. The basic diagram for the given statements is as follows.



From the above basic diagram, we incur the following.
Conclusion I, affirmative, does not follow.
Conclusion II, affirmative, follows.
Conclusion III, affirmative, does not follow.
Conclusion IV, affirmative, does not follow.
∴ Only II follows.

20. The possible diagram that can be drawn from the above statements is as follows.



From the above possible diagram, we incur that:

Conclusion I, follows.

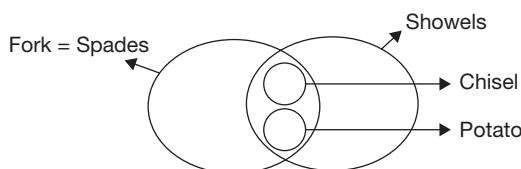
Conclusion II, follows.

Conclusion III, follows.

Conclusion IV, follows.

∴ All follow.

21. The possible diagram that can be drawn from the above statements is as follows.



From the above possible diagram, we incur that:

Conclusion I, follows.

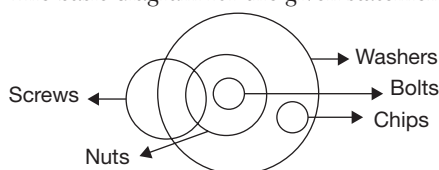
Conclusion II, follows.

Conclusion III, follows.

Conclusion IV, follows.

∴ All follow.

22. The basic diagram for the given statements is as follows.



From the above basic diagram, we incur that:

Conclusion I, affirmative, follows.

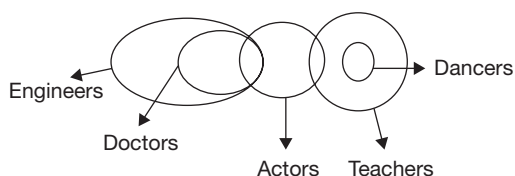
Conclusion II, affirmative, follows.

Conclusion III, affirmative, follows.

Conclusion IV, affirmative, does not follow.

∴ I, II and III follow.

23. The basic diagram for the given statements is as follows.



From the above basic diagram, we incur that:

Conclusion I, affirmative, follows.

Conclusion II, affirmative, does not follow.

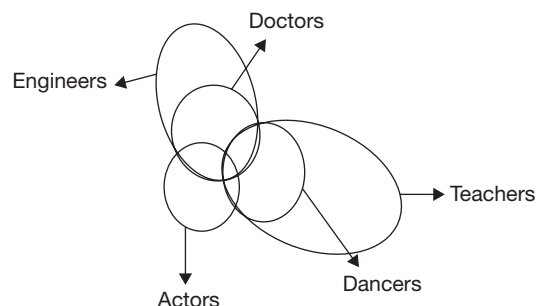
Conclusion III, negative, follows.

Conclusion IV, affirmative, does not follow.

Since conclusion III, negative, follows.

Let us try to draw an alternate diagram to negate it.

The required alternate diagram is shown below.



In the above alternate diagram, conclusion III does not follow, but II follows.

Here, conclusion II and III are contradictory to each other.

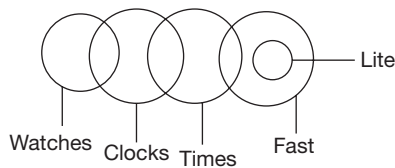
∴ Only I and either II or III follow.

Solutions for questions 24 to 30: Refer the rules for deductions given in the introduction.

24. As one premise is particular, the conclusion should be particular. (B) satisfies all the rules.
25. As both the premises are particular, no conclusion can be derived.
26. As one premise is negative, the conclusion must be negative. Therefore, (C) satisfies all the rules.
27. As both the premises are affirmative and also one premise is particular, the conclusion should be particular affirmative. Therefore, (A) satisfies all the rules.
28. All + Some not = Some not.
The middle term is distributed. Therefore, option (C) satisfies all the rules.
29. All + Some not = Some not.
The middle term is distributed. Therefore, option (A) satisfies all the rules.
30. All + Some = Some.
The middle term is distributed. As both the premises are affirmative and one of them is particular, the conclusion should be particular and affirmative. Therefore, option (B) satisfies all the rules.



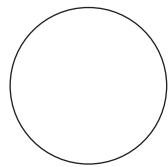
31. The basic diagram for the given statements is as follows.



From the basic diagram, we derive the conclusion as:

- I. Affirmative, does not follow.
- II. Affirmative, does not follow.

Fast = life = Time = dock = watch

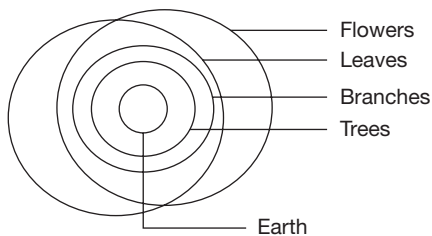


Possible diagram

From the above possible diagram, we derive that:

- Conclusion III, possibility, follows.
- Conclusion IV, possibility, does not follow.
- Hence, only III follows.

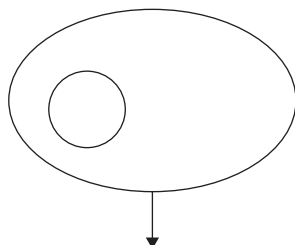
32. The basic diagram for the given statements is as follows.



In the above basic diagram, the conclusion is as follows:

- I. Affirmative, follow.
- III. Affirmative, follows.
- Conclusion II follows.

The possible diagram is as follows.



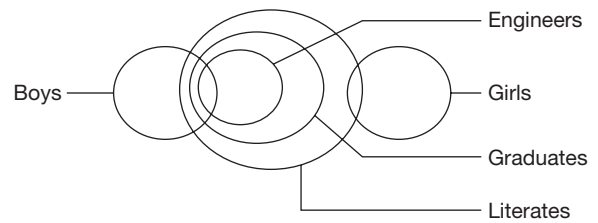
Flowers = branches

From the possible diagram:

Conclusion IV follows.

Hence, all follow.

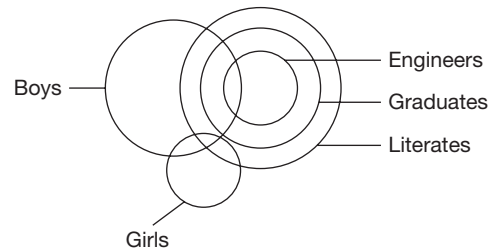
33. The basic diagram for the given statements is as follows.



In the basic diagram, the conclusion is:

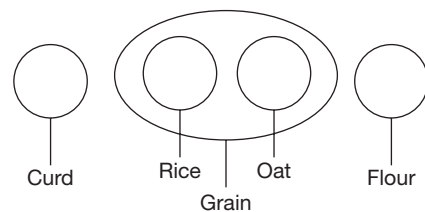
- I. Negative, follows.
- II. Affirmative, follows.
- III. Affirmative, does not follow.
- IV. affirmative, follows.

Conclusions II and IV are the definite conclusions as they are affirmative, whereas conclusion I may be false, as it is a negative conclusion. To prove that conclusion I is false, we have to prove that 'Some boys are girls'. The alternate diagram is as follows.



Hence, only II and IV follow.

34. The basic diagram for the given statements is as follows:



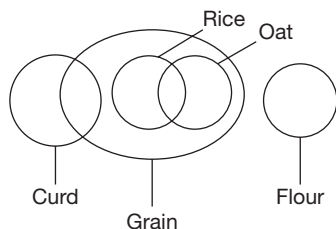
From the basic diagram, the conclusion is as follows:

- I. Negative, follows.
- II. Negative, follow.
- III. Negative, follows.
- IV. Affirmative, does not follow.

Conclusion I, II and III are true but negative. Hence, the conclusions may be false. Let us try to prove them false. So, we have to prove:

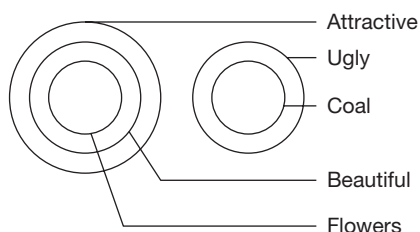
- (I) Some curds are grains.
- (II) Some rice are oats.
- (III) Some flours are oats.

The alternate diagram for the statements is as follows:



Hence, it is not possible to draw a diagram to negate III. Only III follows.

35. The basic diagram for the given statements is as follows.



In the above basic diagram, we derive the conclusion as:

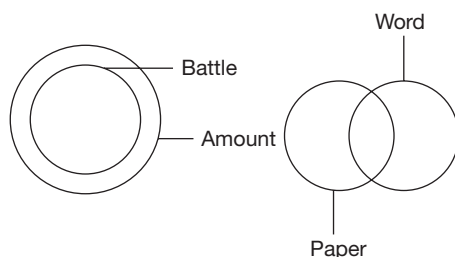
- I. Affirmative, follows.
- II. Negative, follows.
- III. Negative, follows.
- IV. Negative, follows.

To prove that conclusion II, III and IV is false, we have to prove that:

- (I) Some flowers are coal.
- (II) All flowers are ugly.
- (III) All attractives are coal.

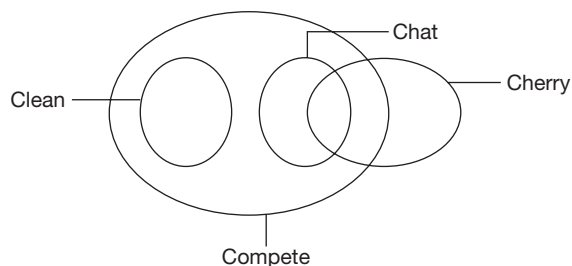
The alternate diagram for any of these three is not possible. Hence, all follow.

36. The given statements are represented in the following basic diagram.



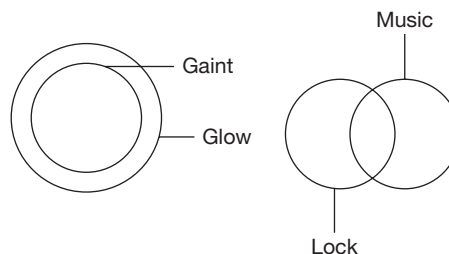
- Choice (A), possibility, does not follow.
- Choice (B), affirmative, follows.
- Choice (C), possibility, follows.
- Choice (D), possibility, follows.

37. The given statements are represented in the following basic diagram.



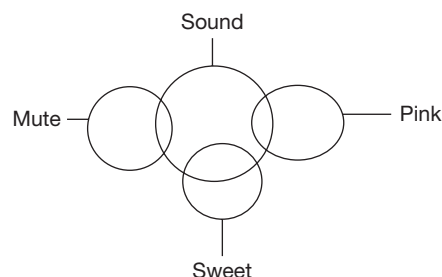
- Choice (A), affirmative, follows.
- Choice (B), affirmative, follows.
- Choice (C), affirmative, does not follow.
- Choice (D), IV, possibility, follows.

38. The given statements are represented in the following basic diagram.



- Choice (A), affirmative, follows.
- Choice (B), possibility, follows.
- Choice (C), affirmative, does not follow, since, some glow are not lock.
- Choice (D), possibility, follows.

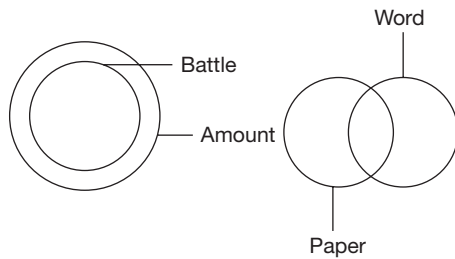
39. The given statements are represented in the following basic diagram.



- Choice (A), possibility, follows.
- Choice (B), possibility, does not follow.
- Choice (C), affirmative, follows.
- Choice (4), possibility, follows.



40. The given statements are represented in the following basic diagram:



- Choice (A), possibility, follows.
 Choice (B), affirmative, follows.
 Choice (C), possibility, follows.
 Choice (D), affirmative, does not follow.

EXERCISE-3

- No rule is violated.
 - No rule is violated.
 - No rule is violated.
 - No rule is violated.
- No rule is violated.
 - When one premise is particular, the conclusion cannot be universal.
 - No rule is violated.
 - No rule is violated.
- The middle term is not distributed. Hence, doesn't follow.
 - It satisfies all the conditions. Hence, follows.
 - The term 'good' is distributed in the conclusion which is not distributed in the premises. Hence, does not follow.
 - Here, both premises are particular. Hence, does not follow.

Hence, only (b) follows.
- It satisfies all the conditions.
 - The term 'friend's' is distributed in the conclusion which was not distributed in the premises. Hence, does not follow.
 - The term 'useful' is distributed in the conclusion which was not distributed in the premises. Hence, it does not follow.
 - It satisfies all the conditions.

∴ Only (a) and (d) follow.
- The term 'rules' is distributed in the conclusion which was not distributed in the premises. Hence, it does not follow.
 - It satisfies all the conditions.
 - It satisfies all the conditions.
 - Here, both the premises are particular. Hence, it does not follow.

∴ Only (b) and (c) follow.
- It satisfies all the conditions.
 - The middle term is not distributed. Hence, it does not follow.
 - The term 'metals' is distributed which was not distributed in the premises. Hence, it does not follow.
 - Here, both premises are particular. Hence, does not follow.

∴ Only (a) follows.
- It satisfies all the conditions.
 - It satisfies all the conditions.
 - It satisfies all the conditions.
 - The term 'laptops' is distributed in the conclusion which was not distributed in the premises.

∴ Only (a), (b) and (c) follow.
- (A) PML: By combining P and M or M and L we get a conclusion in particular.
 Now, when we combine P and L then we do not get a conclusion as the common term is not distributed.

(B) NPL: No combination would give a valid conclusion.

(C) PQL: No combination would give a valid conclusion.

(D) QNP: By combining N and P, we get 'all rings are spheres'. Hence, 'some rings are spheres' is correct.
 Hence, the correct combination is NPQ.
- PQR: Here no combination would give a conclusion.
 - NQR: No combination gives a valid conclusion.
 - LPN: By combining, L and P, the conclusion obtained is 'some false are truths'.
 - MQR: There are more than 3 terms, hence, it is wrong.
- PQM: No combination would give a valid conclusion.
 - RNQ: No combination would give a valid conclusion.
 - PRL: When P and R are combined, we get the conclusion 'some teams are great'.
 - MPN: No combination would give a valid conclusion.

11. (A) NQL: By combining N and Q we get the conclusion 'some women are old'.
Hence, choice (A) is logically related.
(B) PMR: No combination would give a valid conclusion.
(C) LNR: No combination would give a valid conclusion.
12. (A) LMP: No combination is logically related.
(B) RPL: No rule is violated; hence, it is logically related.
(C) NQL: No rule is violated; hence, it is logically related.
13. (A) NPM: No combination is logically related.
(B) NQL: No rule is violated hence it is logically related.
(C) MNR: No combination is logically related.
(D) PQL: No combination is logically related.
14. (A) NQR: No combination is logically related.
(B) PRN: No combination is logically related.
(C) LNP: No combination is logically related.
(D) LNQ: No rule is violated; hence, it is logically related.
15. (A) PNL: No combination is logically related.
(B) LPR: No rule is violated; hence, it is logically related.
(C) MPQ: No combination is logically related.
16. (A) LMQ: No rule is violated; hence, it is logically related.
(B) NPR: No rule is violated; hence, it is logically related.
(C) MNP: No combination is logically related.
17. (A) LMR: No rule is violated; hence, it is logically related.
(B) LNP: No combination is logically related.
(C) PQN: No combination is logically related.
18. From the choices:
A. From b and d, we can conclude that, 'few tufts are combs', which is A.
B. It is not a valid group as exactly one statement is negative.
C. It is not a valid group as exactly one statement is negative.
D. Among b, c, f, b cannot be the conclusion of the other two as it is affirmative. As the term 'comb' is not distributed, f cannot be the conclusion. As 'tuft' is not distributed, c cannot be the conclusion.
19. From the choices:
A. From c and f, it can be concluded that, 'few straps are not curbs', which is a.
B. It is not a valid group as all the three statements are particular. For the same reason as above, (C) and (D) are also not possible.
20. From the choices:
A. Among c, d, e, as c is particular neither d nor e can be the conclusion. As both d and e are negative, C cannot be the conclusion.
B. From f and e, it can be concluded that, 'no desk is a deck', which is d.
C. It is not a valid group as all the three statements are negative.
D. It is not a valid group as all the three statements are negative.
21. From the choices:
A. It is not a valid group as exactly one statement is negative.
B. It is not a valid group as all the three statements are negative.
C. From a and b, we can conclude that, 'some dogmatics are not dogmas', which is C.
D. It is not a valid group as all the three statements are particular.
22. From the choices:
A. It is not a valid group as all the three statements are negative.
B. From c and a, we can conclude that, 'no margin is limit', which is e.
C. It is not a valid group as exactly one statement is negative.
D. It is not a valid group as exactly one statement is negative.
23. Using statements 1 and 2 as premises, the middle term 'arrangements' is distributed in the second statements. Since the first statements is particular the conclusions drawn must be particular, i.e., 'Some arguments are agreements'.
Using statements 2 and 3 as premises, the middle term 'agreements' is not distributed, hence, no conclusion can be drawn.
Using statements 1 and 3 as premises, both statements are particular, hence, no conclusion can be drawn.
∴ Only II follows.
24. Using statements 1 and 2 premises, the middle term 'even' is distributed in the first statement. Since the second statement is particular, the conclusion drawn, must be particular, i.e., 'Some odd are prime'.
Using statements 2 and 3 as premises, the middle term 'Prime' is distributed in the third statement. Since the second statement is particular, the conclusion drawn must be particular, i.e., 'Some even are digits'.
∴ Only I and IV follows.
25. Using statements 1 and 2 as premises, since both statements are particular, no conclusion can be drawn.
Using statements 2 and 3 as premises, the middle term 'Shorts' is distributed in both the premises. Since the second statement is particular and negative, the conclusion that can be drawn must be particular negative. But such a conclusion is not possible since the two terms 'Trousers' and 'Costly' are not distributed in the statements and hence, cannot be distributed in conclusion.
∴ None follows.



26. Using statements 1 and 2 as premises, the middle term 'Cast' is distributed in the second statement. Since the first statement is particular and the second statement is negative, the conclusion drawn should be particular negative, i.e., 'Some north are not west'.

Using statements 2 and 3 as premises, the middle term 'west' is distributed in the third statement. Since the second statement is negative, the conclusions drawn must be negative, i.e., 'No east is south', 'Some east is not South' and 'Some south is not east'.

∴ Only III follows.

27. Using statements 1 and 2 as premises, the middle term 'Effect' is distributed in the first statements, which is neg-

ative. Hence, the conclusions drawn must be negative, i.e., 'No cause is weak', 'Some cause are not weak' and 'Some weak are not cause'.

Using statements 2 and 3 as premises, the middle term 'effect' is not distributed. Hence, no conclusion can be drawn.

Using statements 1 and 3 as premises, the middle term 'effect' is distributed in the first statements. The first statement is negative. Hence the conclusion drawn, must be negative, i.e., 'No cause' and 'Some cause are not strong'.

∴ Only II and III follows.

10

Connectives

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Understand the correct logical interpretation of various conditional statements.
- Understand the conclusions that can be drawn from conditional statements.

There are few questions that are frequently asked in entrance exams, which are based on logical statements and logical connectives. A proper understanding of some basics in 'Logic' will eliminate the difficulty in answering such questions. These questions can be answered easily and very quickly with a clear understanding of the basics that we shall look at in the following sections. The concepts discussed in this chapter, not only help in answering these questions, but also have lot of application value. The logical interpretations discussed can be applied, whenever we (irrespective of the test area) come across these kinds of statements.

In Logic, we deal with statements that are essentially sentences in the English language. However, in Logic we are not interested in or worried about the factual correctness of the sentence. We are interested only in the Logical 'truthfulness' of the statements.

For example, consider the following statement:

'If the sun rises in the west, then the moon rises in the north'.

Here, we are not concerned with whether the sun rises in the east or west or with the direction in which

the moon rises. We will only look at whether the moon will rise in the north or not depending on whether the part of the statement 'The sun rises in the west' is true or not. If we are given that the sun rises in the west (which, incidentally, is factually incorrect), we can then conclude that the moon rises in the north (which again does not concern with the direction in which the moon actually rises).

We can represent statements in Logic using symbols, like p , q , etc., the way we represent variables/unknowns in Algebra using symbols like x , y , z , etc.

Statements like 'I will go for a movie', 'It is a sunny day', etc., are called simple statements. When two or more such simple statements are connected together to form a single statement, then such statement is called a compound statement.

The simple statements are combined using logical connectives to form compound statements. We should know some of the important logical operators/connectives to be able to effectively tackle questions that involve compound statements and logical operations on compound statements.



□ NEGATION 'NOT'

Any statement can be negated by using the words 'not' or 'no'. In layman's language, negation is like the opposite of a statement.

For example, the negation of the statement 'It is raining' is 'It is 'NOT' raining'. The negation of the statement 'He will pass the exam' is 'He will not pass the exam'. This is equivalent to saying 'He will fail in the exam'. So, when you are looking at negating the given statement, you should keep in mind the English equivalents of the statements also.

Having defined simple statements, we shall now study about a few common operators (also called connectives) that can be used to combine (or operate upon) two or more simple statements and arrive at more complicated or compound statements.

□ LOGICAL CONNECTIVE 'OR'

Two or more statements can be connected using the connective 'OR'. The following is an example using 'OR'.

It is raining or I will go to my friend's house.

The same statement can also be written as:

Either it is raining or I will go to my friend's house.

Both the statements above mean the same. The additional word 'either' does not change the meaning of the statement.

When two (or more) statements are connected using 'OR', at least one of them is true.

Suppose we have a statement 'Either p or q ', since at least one of the two statements p , q must be true, we have p alone is true or q alone is true or both are true.

This is the interpretation to be given to an 'OR' statement (irrespective of the meaning of the sentence as per English language).

For example, the statement 'Either I will go for a movie or I will go to my friend's house' means:

I will go for a movie

or

I will go to a friend's house

or

I will go both for a movie and to a friend's house.

Let us take the statement 'Either he is dead or he is alive'. This statement means:

He is alive

or

He is dead

or

He is both alive and dead.

In this case, the possibility 'He is both alive and dead' does not make sense if we look at the meaning in English language because a person cannot be dead and alive at the same time. However, as discussed earlier, we will not be concerned about the meaning of the statements.

Hence, we will always interpret the statement '(Either) p or q ' as ' p alone is true or q alone is true or both are true' (unless otherwise explicitly stated that both are not true at the same time). In other words, in a statement ' p or q ', we can say that at least one of the two statements is true.

Given ' p or q ', we get four different possibilities that follow:

1. Given ' p or q ', we are then told ' p is true':

Since we need at least one of the two statements p or q to be true and here we already know that p is true, we cannot conclude anything about q , i.e., we cannot conclude whether q is true or false but both possibilities exist.

2. Given ' p or q ', we are then told ' q is true':

Since we need at least one of the two statements p or q to be true and here we already know that q is true, we cannot conclude anything about p , i.e., we cannot conclude whether p is true or false but both possibilities exist.

3. Given ' p or q ', we are then told ' p is 'NOT' true':

Since we need at least one of the two statements p or q to be true and here we already know that p is not true, q **has** to be true so that at least one of the two statements will then be true. So, here we **can** conclude that q is true.

4. Given ' p or q ', we are then told ' q is 'NOT' true':

Since we need at least one of the two statements p or q to be true and here we already know that q is not true, p **has** to be true so that at least one of the two statements will then be true. So, here we **can** conclude that p is true.

There is one particular category of questions that has appeared in CAT for three years in a row. These questions are based on the concepts that we looked at in the previous section. We will take two or three examples to understand these questions.

The directions of the questions asked were as follows:

‘Each question has a main statement followed by four statements labelled A, B, C and D. Choose the ordered pair of statements where the first statement implies the second, and the two statements are logically consistent with the main statement’.

10.1: Either the elephant is big or the lion is cruel.

- (a) The elephant is big.
 - (b) The elephant is not big.
 - (c) The lion is cruel.
 - (d) The lion is not cruel.
- (A) ac (B) db
(C) bc (D) ad

Sol: The main statement has two simple statements. ‘The elephant is big’ and ‘The lion is cruel’ connected by ‘OR’. Let us call these two statements p and q , respectively for the purpose of our discussion. Then the main statement can be represented as ‘ p OR q ’.

First, let us look at each choice and understand the logic discussed above. Once we do that, we will also see how to answer such questions in a much shorter time.

At least one of these two statements have to be true in any ordered pair we look at. As per the discussion we had above, from among the choices, if we have an ordered pair where the first part of the ordered pair from the two statements in the choice is true, then we cannot conclude anything about the second part of the ordered pair. However, if the first part of the ordered pair in the choice is not true, then the second part should contain the second statement as given in the main statement (i.e., the second statement has to be ‘true’).

Take choice (A) for the above question. The first statement is A which says ‘The elephant is big’. This is p (as we denoted above) which is given in the main statement. Since p is true, we cannot conclude whether q is true or not, i.e., q may be true or it may be false. So, we cannot have any statement following A which can be concluded from A and is consistent with the main statement. Hence, this cannot be the answer choice.

Take choice (B). The first statement is D which says ‘The lion is not cruel’. This is the

negation of statement q , that is to say, ‘Not q ’ is the first of the two statements in the choice. Since q is negated, p must be true (for at least one of the two statements to be true). But the second statement in this choice is ‘The elephant is not big’ which is ‘Negation p ’. Hence, this is not the correct choice.

Take choice (C). The first statement is B which is ‘The elephant is not big’, i.e., Negation p . Since p is negated, q must be true (for at least one of the two statements to be true). The second statement in the choice is C which is ‘The lion is cruel’, i.e., q . Thus, in this choice, we have Negation p followed by q . So, this is the correct answer choice.

Let us also take a look at choice (D). The first statement in this choice is A, which is ‘The lion is big’, i.e., p is true. Since the first statement is true, we cannot conclude anything about statement q .

□ APPROACH IN THE EXAM

In an exam, for these types of questions, we do not need to go from the answer choices and check each and every one of them. We can directly identify the correct combinations of statements that will satisfy the directions given.

We know that if the first statement out of the two statements in the choice is either p or q (that is one of the two statements given in the question), then we cannot draw any conclusion.

We also know that if p or q is negated, then the other statement should definitely be true. So, ‘Negation p ’ is followed by q and ‘Negation q ’ is followed by p will be the correct combination of statements. Hence, we directly check out for ‘NOT’ $p \rightarrow q$ or ‘NOT’ $q \rightarrow p$ in the answer choices.

In the above example not $p \rightarrow q$, is represented by bc and not $q \rightarrow p$, is represented by da . We should check which among bc and da is/are given in the answer choices.

□ LOGICAL CONNECTIVE ‘AND’

Two or more statements can be connected using the connective ‘AND’. The following is an example using ‘AND’.

It is raining **and** I will go to my friend’s house.

The two statements connected by **and** have to be true for the compound statement to be true. In



general, if we have a statement ' p and q ', then we can conclude that p should be true as well as q , i.e., both the statements should be true. Even if one of the two statements is false, the compound statement is false.

Negation of compound statements formed with 'OR', 'AND'

A compound statement formed with 'OR' or 'AND' can be negated in the following manner:

'Negation (p 'OR' q)' is the same as 'Negation p 'AND' Negation q '.

'Negation (p 'AND' q)' is the same as 'Negation p 'OR' Negation q '.

As can be seen in the above example, when a compound statement consisting of two simple statements (connected with 'OR' or 'AND') is negated, the result will consist of each of the individual statements negated. In addition to that, the following will also have to be observed:

'OR' will become 'AND'

'AND' will become 'OR'

□ LOGICAL CONNECTIVE 'IF-THEN'

This is a very important connective. This is represented by $p \rightarrow q$ (and is read as ' p implies q '). This means that if we know that p has occurred, q has to occur or must have occurred. For example, the statement 'If it is raining, then I wear a raincoat' means that if we know that it is raining, we can conclude that I must be wearing a raincoat.

The statement ' p implies q ' is called an implication statement. The term on the left hand side in $p \rightarrow q$ is called the 'antecedent' and the term q is called the 'consequent'.

Let us look at the following cases when we are given that $p \rightarrow q$.

1. Given that $p \rightarrow q$, we are then told that q has occurred. Can we conclude that p must have occurred?

We cannot conclude that p must have occurred. This is because while whenever p occurs, q will definitely occur, q may occur even otherwise, i.e., even without the occurrence of p . So, both p and Negation p are possible and hence, we cannot conclude anything when we know that q has occurred.

2. Given that $p \rightarrow q$, we are then told that p has not occurred. Can we conclude that q will also not occur?

We cannot conclude that q will not occur. This is because while whenever p occurs, q will definitely occur, q may occur even when p does not occur (as discussed above). So, both q and Negation q are possible, and hence, we cannot conclude anything when we know that p has not occurred.

3. Given that $p \rightarrow q$, we are then told that q has not occurred. Can we conclude that p must not have occurred?

We can conclude that p must not have occurred. This is because had p occurred, q would have occurred. But we know that q has not occurred, so p must not have occurred. So, we can conclude that 'Negation p ' follows 'Negation q '.

So, if we are given that $p \rightarrow q$, then 'Negation $q \rightarrow$ Negation p '. This is a very important relationship. We can express it in words as:

'In an implication statement, negation of the right hand side will always imply the negation of the left hand side'.

We can summarize the above three points as follows:

$p \rightarrow q$	Given
$q \rightarrow p$	Cannot be concluded
$q \rightarrow$ Negation p	Cannot be concluded
Negation $p \rightarrow$ Negation q	Cannot be concluded
Negation $p \rightarrow q$	Cannot be concluded
Negation $q \rightarrow$ Negation p	Is always true

In certain CAT papers, there were questions on 'if—then' concepts discussed above and the questions similar to those on 'either—or' that we looked at above. Let us take an example and understand these questions. The directions are the same as that we looked at above:

'Each question has a main statement followed by four statements labelled as A, B, C and D. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement'.

10.2: If the elephant is big, then the lion is cruel.

- (a) The elephant is big.
- (b) The elephant is not big.
- (c) The lion is cruel.
- (d) The lion is not cruel.

- (A) ca (B) bd
(C) bc (D) db

Sol: The main statement has two simple statements 'The elephant is big' and 'The lion is cruel' connected by 'IF—THEN'. Let us call these two statements p and q , respectively for the purpose of our discussion. Then the main statement can be represented as ' p implies q ' or ' $p \rightarrow q$ '.

First, let us look at each choice and understand the logic discussed above. Once we do that, we will also see how to answer such questions in a much shorter time.

Take choice (A). In terms of p and q , this can be represented as $q \rightarrow p$. As per the table above, we know that this cannot be concluded, given $p \rightarrow q$. Hence, this is not the correct answer.

Take choice (B). In terms of p and q , this can be represented as 'Negation $p \rightarrow$ Negation q '. Again, as per the table above, we know that this cannot be concluded, given $p \rightarrow q$. Hence, this is not the correct answer.

Take choice (C). In terms of p and q , this can be represented as 'Negation $p \rightarrow q$ ', as per the table above, we know that this cannot be concluded, given $p \rightarrow q$. Hence, this is not the correct answer.

Since we eliminated three answer choices, the fourth has to be the correct answer. Let us take

choice (D) and look at it. In terms of p and q , it can be represented as 'Negation $q \rightarrow$ Negation p '. As per the table above, we know that this can definitely be concluded. Hence, this is the correct answer choice.

□ APPROACH IN THE EXAM

In an exam, for these types of questions, we do not need to go from the answer choices and check each and every one of them. We can directly identify the combinations of statements that will satisfy the directions given.

Given that $p \rightarrow q$, we know that 'Negation $q \rightarrow$ Negation p '. Hence, the two correct combinations are $p \rightarrow q$ (because this is the given statement itself) and 'Negation $q \rightarrow$ Negation p '.

So, in the above example, we should look for ac or db. Hence, the correct answer is choice (D).

□ OTHER FORMS OF 'IF-THEN'

There are different types of statements which can be reduced to or represented as $p \rightarrow q$. Let us look at these statements in descriptive form and the representation by using ' \rightarrow ' sign.

S. No.	Statement	Representation using \rightarrow	Also equivalent to	Remarks
1.	If p , then q	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Already discussed above
2.	q , if p	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Identical to 1 above
3.	When p , then q Whenever p , then q	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Identical to "if p , then q "
4.	q , when p q , whenever p	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Same as 3 above
5.	Everytime p , q	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Same as "If p , then q "
6.	q , everytime p	$p \rightarrow q$	Neg. $q \rightarrow$ Neg. p	Same as 5 above
7.	q , only if p	$q \rightarrow p$	Neg. $p \rightarrow$ Neg. q	
8.	Unless p , q	Negation $p \rightarrow q$	Neg. $q \rightarrow p$	
9.	q , unless p	Negation $p \rightarrow q$	Neg. $q \rightarrow p$	Same as 8 above
10.	p , otherwise q	Negation $p \rightarrow q$	Neg. $q \rightarrow p$	Same as "Unless p , q "



□ ANOTHER MODEL OF QUESTIONS

There is one particular model of question that appeared in the XAT exam in the recent past. These questions are based on the logic that has been discussed above. We will take an example and see how to solve such questions.

Directions: Each question below consists of a main statement followed by four statements. From the choices, select the one that is logically consistent with the main statement.

(Please note that the directions, instead of asking you to find out the choice that is 'logically consistent with the main statement', may ask you to find out the choice that is 'logically equivalent to the main statement' or 'Which of the following statements is true?')

10.3: If it is raining, then I will go for a movie or I will visit my friend's house.

- (A) It is not raining, means that I will not go for a movie or I will not visit my friend's house.
- (B) It is not raining, means that I will not go for a movie and I will not visit my friend's house.
- (C) I will not go for a movie or I will not visit my friend's house, means that it is not raining.
- (D) I will not go for a movie and I will not visit my friend's house, means that it is not raining.

Sol: Solving this question involves the application of simple concepts/rules about IF—THEN, 'OR', 'AND' and NEGATION which we have already looked at.

EXERCISE-1

Directions for questions 1 to 20: Each question below consists of a main statement followed by four answer choices. From the answer choices, select the one that logically follows the main statement.

1. If movie is a superhit, then I watch it.
 - (A) I watched a movie means it is a superhit.
 - (B) The movie is a superhit. Hence, I do not watch it.
 - (C) I did not watch a movie, though it was a superhit.
 - (D) I did not watch a movie implies that the movie was not a superhit.
2. Whenever it is cold, I wear a jacket.
 - (A) It is cold implies I am wearing a jacket.
 - (B) I did not wear a jacket implies it was not cold.
 - (C) It is cold but I did not wear the jacket.
 - (D) Both (A) and (B)
3. Either Shaheen cooks or Salim brings the food parcel.
 - (A) Shaheen cooks means Salim will not bring the food parcel.
 - (B) Salim did not bring the food parcel. Hence, Shaheen cooked.
 - (C) Shaheen is cooking. Hence, Salim has brought the food parcel.
 - (D) Salim did not bring food parcel implies that Shaheen did not cook.
4. Only if Raj does not come, then Geetika will come to the party.
 - (A) Raj came, hence, Geetika will also come to the party.
 - (B) Geetika will not come to the party. Hence, Raj will come.
 - (C) Geetika has come to the party means Raj is not coming.
 - (D) Raj has not come. Hence, Geetika has come to the party.
5. Unless I have money, I cannot enjoy my weekend.
 - (A) I have money, so I can enjoy my weekend.
 - (B) I can enjoy my weekend means I have money.
 - (C) I do not have money implies I cannot enjoy my weekend.
 - (D) Both (B) and (C)
6. If I can swim, then I can clear the exam.
 - (A) I can swim. Hence, I can clear the exam.
 - (B) I cannot clear the exam implies I cannot swim.
 - (C) I can swim. Hence, I cannot clear the exam.
 - (D) Both (A) and (B)
7. India will talk, only if the terrorists are handed over.
 - (A) The terrorists are handed over; hence, India will talk.
 - (B) India will not talk implies that the terrorists have not been handed over.
 - (C) India will talk though the terrorists are not handed over.
 - (D) India will talk implies the terrorists are handed over.
8. Whenever there is demand, there will be supply.
 - (A) There is supply, hence, there is demand.
 - (B) There is demand, hence, there will be supply.
 - (C) There is no supply implies that there is no demand.
 - (D) Both (B) and (C)
9. Suhasita purchases either a cooler or a refrigerator.
 - (A) Suhasita is not purchasing a cooler implies that she is purchasing a refrigerator.
 - (B) Suhasita is not purchasing a refrigerator implies that she is purchasing a cooler.
 - (C) Suhasita is purchasing neither a cooler nor a refrigerator.
 - (D) Both (A) and (B)
10. I will not have enemies, unless I fight.
 - (A) I fight implies that I will have enemies.
 - (B) I do not fight implies that I will not have enemies.
 - (C) I have enemies implies that I fight.
 - (D) Both (B) and (C)
11. If you are good, then everyone loves you.
 - (A) You are good, hence, everyone does not love you.
 - (B) Everyone loves you means you are good.
 - (C) You are not good; hence, everyone does not love you.
 - (D) Everyone does not love you means you are not good.
12. Unless Pratik comes home, his son does not eat.
 - (A) Pratik did not come home so his son does not eat.
 - (B) Pratik came home, hence, his son eats.
 - (C) Pratik's son eats means Pratik came home.
 - (D) Both (A) and (C)
13. Only if you are qualified in written test, you get a call for interview.
 - (A) You did not qualify in written test means you do not get a call for an interview.
 - (B) You do not get a call for an interview means you did not qualify in written test.
 - (C) You are qualified in written test, hence, you get a call for an interview.
 - (D) Both (A) and (C)



14. If Raju plays well, then the team can win the match.
 (A) Raju did not play well, implies that the team did not win the match.
 (B) The team won the match implies that Raju played well.
 (C) The team did not win the match implies that Raju did not play well.
 (D) More than one of the above.
15. Either he plays cricket or eats biscuit.
 (A) He is playing cricket implies that he is not eating biscuit.
 (B) He is not eating biscuit implies that he is playing cricket.
 (C) He is eating biscuit implies that he is not playing cricket.
 (D) All the above
16. Unless the inflation is low, economic growth will not be high.
 (A) The economic growth is low means that inflation is high.
 (B) The inflation is not low implies that the economic growth will not be high.
 (C) The economic growth is high; hence, the inflation is low.
 (D) Both (B) and (C)
17. Only if the train does not leave late, he can attend the interview.
 (A) He attended the interview implies that the train left on time.
 (B) He could not attend the interview implies that the train left late.
 (C) The train left late implies that he could not attend the interview.
 (D) More than one of the above
18. Whenever I go to church, I pray to god.
 (A) I prayed to god means I did not go to church.
 (B) I did not pray to god implies that I did not go to church.
 (C) I did not go to church implies that I did not pray to god.
 (D) Both (B) and (C)
19. If you deposit money, then you will get interest.
 (A) You did not get interest means you did not deposit money.
 (B) You deposited money. Hence, you will get interest.
 (C) You deposited money but did not get interest.
 (D) More than one of the above.

20. Unless Kiran finds a soulmate, he will not marry.
 (A) Kiran did not find a soulmate, hence, he will not marry.
 (B) Kiran found a soulmate, hence, he will marry.
 (C) Kiran found a soulmate, but he will not marry.
 (D) Both (A) and (B)

Directions for questions 21 to 35: In each question, there is a main statement followed by four statements a, b, c and d. From the choices, choose the pair in which the first statement implies the second statement and the two are logically consistent with the main statement.

21. Teachers can teach, only if students are well mannered.
 (a) Teachers can teach.
 (b) Students are not well mannered.
 (c) Teachers cannot teach.
 (d) Students are well mannered.
 (A) ab (B) bc
 (C) da (D) cd
22. Prajakta is healthy, whenever she is happy.
 (a) Prajakta is not happy.
 (b) Prajakta is happy.
 (c) Prajakta is healthy.
 (d) Prajakta is not healthy.
 (A) cb (B) bc
 (C) da (D) bc and da
23. Rohit is suffering either from malaria or from typhoid.
 (a) Rohit is not suffering from typhoid.
 (b) Rohit is suffering from malaria.
 (c) Rohit is not suffering from malaria.
 (d) Rohit is suffering from typhoid.
 (A) ab (B) ac
 (C) bc (D) dc
24. Manjula works, unless she is married.
 (a) Manjula is not married.
 (b) Manjula is married.
 (c) Manjula works.
 (d) Manjula does not work.
 (A) ca (B) bd
 (C) bd and ac (D) ac and db
25. If tea is sweet, then Samarth cannot drink it.
 (a) Samarth can drink tea.
 (b) Tea is not sweet.
 (c) Samarth cannot drink tea.
 (d) Tea is sweet.
 (A) cb (B) ab
 (C) ab and bc (D) ab and dc
26. Nisha will do an MBA only if she gets admission into a good college.

- (a) Nisha will not do MBA.
 (b) Nisha got admission into a good college.
 (c) Nisha did not get admission into a good college.
 (d) Nisha will do MBA.
 (A) bd (B) db
 (C) ac (D) cd
27. Rajesh is wealthy, only if he is healthy.
 (a) Rajesh is not wealthy.
 (b) Rajesh is healthy.
 (c) Rajesh is not healthy.
 (d) Rajesh is wealthy.
 (A) ab (B) db
 (C) bc (D) ac
28. Madhuri is not a philosopher, unless she completes her Ph.D.
 (a) Madhuri is a philosopher.
 (b) Madhuri is not a philosopher.
 (c) Madhuri completed her Ph.D.
 (d) Madhuri did not complete her Ph.D.
 (A) ca (B) db
 (C) ad (D) Both (A) and (B)
29. Happiness is real, whenever it is shared.
 (a) Happiness is not shared.
 (b) Happiness is not real.
 (c) Happiness is shared.
 (d) Happiness is real.
 (A) cd (B) ba
 (C) bd (D) Both (A) and (B)
30. Ramu wants to be either a Manager or a Director.
 (a) Ramu did not become a Director.
 (b) Ramu becomes a Manager.
 (c) Ramu becomes a Director.
 (d) Ramu did not become a Manager.
 (A) bd (B) da
 (C) bc (D) ab
31. If I have money, I will buy a book.
 (a) I do not have money.
 (b) I will not buy a book.
 (c) I will buy a book.
 (d) I have money.
 (A) ca (B) ab
 (C) dc (D) bd
32. Swati would be selected in the first company, if she has an excellent academic record.
 (a) Swati is selected in the first company.
 (b) Swati is not selected in the first company.
 (c) Swati has an excellent academic career.
 (d) Swati does not have an excellent academic record.
 (A) ac (B) bd
 (C) dc (D) ad
33. Only if Abhijeet has good knowledge in classical music, he would be elected as Musical Idol.
 (a) Abhijeet does not have good knowledge in classical music.
 (b) Abhijeet is elected as Musical Idol.
 (c) Abhijeet is not elected as Musical Idol.
 (d) Abhijeet has good knowledge in classical music.
 (A) ca (B) db
 (C) bd (D) ba
34. Unless the Indian government seals the borders illegal migration in India will not stop.
 (a) Indian government sealed the border.
 (b) Illegal migration in India stopped.
 (c) Indian government had not sealed the borders.
 (d) Illegal migration in India will not stop.
 (A) cd (B) ab
 (C) cb (D) ad
35. Whenever Sandeep receives a message from Sangeeta, he seems to be on cloud nine.
 (a) Sandeep did not receive a message from Sangeeta.
 (b) Sandeep is on cloud nine.
 (c) Sandeep is not on cloud nine.
 (d) Sandeep received a message from Sangeeta.
 (A) ba (B) bd
 (C) cd (D) ca
- Directions for questions 36 to 40:** Select the correct alternative from the given choices.
36. If Ali has good knowledge of JAVA, he will be selected in Satyam Computers. Unless Ali is not selected in Satyam Computers, he will not be selected in CTS. Ali is selected in CTS implies that
 (A) Ali has good knowledge in JAVA.
 (B) Ali is selected in Satyam Computers.
 (C) Ali does not have good knowledge of JAVA.
 (D) None of these
37. The HR manager of TCS will come, if the strike does not affect the flight timings. Only if the HR manager of TCS comes, TCS will recruit people. TCS is recruiting people implies that
 (A) The strike affects the flight timings.
 (B) The strike does not affect the flight timings.
 (C) The HR manager of TCS does not come.
 (D) None of these
38. Unless the coding is not tested, the company can implement it. If the company can implement the coding, the network system will work properly. The network is not working properly, it implies that
 (A) The coding is tested.
 (B) The coding is not tested.



- (C) The company implements the coding
(D) None of these
39. When the Infosys team's performance is excellent, then Infosys will become the top IT company. Either Infosys does not become the top IT company or TCS remains in the top rank.
The Infosys team's performance is excellent, means that
(A) TCS remains in the top rank.
(B) TCS will not remain in the top rank.
(C) Infosys will be in the top rank.
(D) None of these
40. If a person follows the conventional methods, he cannot be successful. Unless a person is successful, he cannot be a part of successful company.
Mr Prasad has become a part of P & G, a successful company. Hence, it can be concluded that
(A) Mr. Prasad is not successful.
(B) Mr Prasad follows conventional methods.
(C) Mr Prasad does not follow conventional methods.
(D) None of these

EXERCISE-2

Directions for questions 1 to 18: Each question given below is a statement followed by four different statements. Choose the one which is the correct negation of the given statement.

- Either Anand marries Vandana or Madhavi marries Kollol.
(A) Anand does not marry Vandana, so Madhavi marries Kollol.
(B) Neither Anand marries Vandana nor Madhavi marries Kollol.
(C) Madhavi does not marry Kollol but Anand marries Vandana.
(D) None of these
- Whenever Bhiru and Basanti go for a long drive, Joy follows them.
(A) Joy follows Bhiru and Basanti but they are not going for a long drive.
(B) Bhiru and Basanti are going for a long drive and Joy follows them.
(C) Joy does not follow Bhiru and Basanti even when they go for a long drive.
(D) None of these
- Pratap Rana will attend the class, only if his father allows him to go by bike.
(A) Pratap Rana is not attending the classes even his father allows him to come by bike.
(B) Pratap Rana's father did not allow him to go by bike but he was attending the class.
(C) Pratap Rana is not attending the classes because his father did not allow him to go on bike.
(D) None of these
- Unless Aiswariya plays the role of Paro, Madhuri will not play the role of Chandramukhi.
(A) Madhuri is not playing the role of Chandramukhi, but Aiswariya is playing the role of Paro.
(B) Aiswariya is playing the role of Paro, Madhuri is playing the role of Chandramukhi.
(C) Madhuri is playing the role of Chandramukhi but Aiswariya is not playing the role of 'Paro'.
(D) None of these
- Unless the change happens, the problem will not be solved.
(A) The problem is solved and the change did not happen.
(B) The change happened but the problem is not solved.
(C) The change happened and the problem is solved.
(D) The problem is solved implies that the change happened.
- The presentation was lengthy but simple.
(A) The presentation was not lengthy and not simple.
(B) The presentation was lengthy but not simple.
(C) The presentation was not lengthy or not simple.
(D) The presentation was simple but not lengthy.
- Unless Tarun learns the basics, he cannot solve connectives.
(A) Tarun learned the basics but he could not solve connectives.
(B) Tarun did not learn the basics, but he could solve connectives.
(C) Tarun learned basics and solved connectives.
(D) Tarun did not learn basics and he did not solve connectives.
- He either goes to US or he will join in a job.
(A) He went to US and did not join in a job.
(B) He went to US but joined in a job.
(C) He did not go to US and joined in a job.
(D) He did not go to US and did not join in a job.

9. If you share your sorrow with your friends, you will be happy.
 (A) You did not share your sorrow with your friends and you are happy.
 (B) You shared your sorrow with your friends but you are not happy.
 (C) You did not share your sorrow with your friends and you are not happy.
 (D) You shared your sorrow with your friends so you are happy.
10. Every mind works at its best, only if it is open.
 (A) Mind worked at its best when it is open.
 (B) Mind did not work at its best because it is not open.
 (C) Mind worked at its best even though it is not open.
 (D) Mind did not work at its best even when it is open.
11. If it is the post of a manager, then Shastri will join the firm.
 (A) It is the post of a manager, but Shastri did not join the firm.
 (B) The post is not of a manager, but Shastri joined the firm.
 (C) Shastri did not join the firm as the post is not of a manager.
 (D) Shastri joined the firm as the post is that of a manager.
12. I cannot make tomato soup, unless I have some onions.
 (A) I have onions but I cannot make tomato soup.
 (B) I do not have onions; hence, I cannot make tomato soup.
 (C) I made tomato soup though I do not have onions.
 (D) I have onions; hence, I can make tomato soup.
13. Only if Tara is happy, then she does not go to work.
 (A) Tara is not happy and she does not go to work.
 (B) Tara is happy and she goes to work.
 (C) Tara is not happy and she goes to work.
 (D) Tara is happy and she does not go to work.
14. Paul is popular either as a lead guitarist or as a base guitarist.
 (A) Paul is popular as a lead guitarist but not as a base guitarist.
 (B) Paul is famous neither as a lead guitarist nor as a base guitarist.
 (C) Paul is not popular as base guitarist but popular as a lead guitarist.
 (D) Paul is popular as both a lead guitarist and as a base guitarist.
15. Kohli cannot score a hundred, unless Jhonson bowls.
 (A) Kohli scored a hundred though Jhonson did not bowl.
 (B) Jhonson did not bowl hence Kohli did not score a hundred.
 (C) Jhonson bowled but Kohli did not score a hundred.
 (D) Jhonson bowled but Kohli scored a hundred.
16. Either he wears shoes or a tie.
 (A) Neither he wore shoes nor he wore a tie.
 (B) He wore a tie but not shoes.
 (C) He wore shoes but did not wear a tie.
 (D) All of the above
17. If it is a holiday, I will sleep throughout the day.
 (A) I slept throughout the day even though it is not a holiday.
 (B) I did not sleep throughout the day even though it is a holiday.
 (C) I slept throughout the day even though it is a holiday.
 (D) Both (A) and (C)
18. Rajesh goes to college and attends classes.
 (A) Rajesh either goes to college or attends classes.
 (B) Rajesh will not go to college but attends college.
 (C) Rajesh neither goes to college nor attends classes.
 (D) None of these
- Directions for questions 19 to 33:** Each question below consists of a main statement followed by four answer choice. From the answer choices, select the one that logically follows the main statement.
19. If Ankita eats pastry, then it is a black forest or a pineapple.
 (A) Ankita eats pastry but it is not a pineapple, means it is a black forest.
 (B) Ankita eats pastry but it is not a black forest, means it is a pineapple.
 (C) The pastry is neither a pineapple nor a black forest, means Ankita does not eat the pastry.
 (D) All the above.
20. If you want to stay fit, then you must eat nutritious food and exercise.
 (A) You did not eat nutritious food; hence, you cannot stay fit.
 (B) You did not exercise which implies you cannot stay fit.
 (C) You ate nutritious food and exercised which implies you have stayed fit.
 (D) Both (A) and (B)
21. Yaseem plays cricket, only if he wears blue or white.
 (A) Yaseem plays cricket which implies he wears blue and white.
 (B) Yaseem plays cricket but he does not wear blue, hence, he wears white.



- (C) Yaseem wears neither blue nor white implies that he may play cricket.
(D) None of these
- 22.** Sunil cannot meet his friends or his family, unless he has a job.
(A) Sunil met his friend and his family implies he has a job.
(B) Sunil does not have a job and cannot meet his family; hence, he cannot meet his friends.
(C) Sunil does not have a job but he met his family implies that he cannot meet his friends.
(D) Both (A) and (C)
- 23.** Only if there is a sale, I will buy clothes or cosmetics.
(A) I have bought clothes and cosmetics means there is a sale.
(B) I have bought cosmetics, hence, there is a sale.
(C) I have bought clothes, hence, there is a sale.
(D) All the above.
- 24.** Unless you take medicines, you will not recover and will not be able to walk.
(A) You recovered means you have taken medicines.
(B) You are not able to walk means you have not taken medicines.
(C) You have not taken medicines; hence, you will not recover but you will be able to walk.
(D) You did not recover means you have not taken medicines.
- 25.** If Ganshyam goes to the U.S.A., his mother or his brother will accompany him.
(A) Ganshyam is going to the U.S.A. but his brother is not accompanying him implies his mother will accompany him.
(B) Neither Ganshyam's mother nor his brother is accompanying him means Ganshyam is not going to the U.S.A.
(C) Ganshyam is not going to the U.S.A, hence neither his mother nor his brother is accompanying him.
(D) Both (A) and (B)
- 26.** Whenever Preeti watches TV, then she watches movies and sports.
(A) Preeti is not watching sports implies that she is watching TV.
(B) Preeti is not watching movies implies she is not watching TV.
(C) Preeti is neither watching movies nor sports, hence, she must be watching something else on TV.
(D) Preeti is watching TV, but not movies, implies that she is watching sports.
- 27.** Sagar will marry Sheela, only if she is a graduate and a good cook.
(A) Sheela is a good cook but not a graduate, hence, Sagar will not marry Sheela.
(B) Sagar will marry Sheela since she is a good cook though she is not a graduate.
(C) Sheela is a graduate and a good cook implies that Sagar will marry Sheela.
(D) Sagar did not marry Sheela implies that she is neither a graduate not a good cook.
- 28.** The electricity supply will not be restored and we will not be able to watch TV unless you pay the bill.
(A) The electricity supply is restored and we are able to watch TV implies that you have paid the bill.
(B) We are able to watch TV but electricity supply is not restored implies that you have paid the bill.
(C) We are unable to watch TV but electricity supply is restored implies that you have paid the bill.
(D) All the above
- 29.** If you try hard, then you can win or gain.
(A) You tried hard but did not win means you gained.
(B) You tried hard but did not gain, means you won.
(C) You neither won nor gained means you did not try hard.
(D) All the above
- 30.** Rajesh cooks, only if it is Sunday or Saturday.
(A) Rajesh cooked implies that it is Sunday and Saturday.
(B) Rajesh cooked but it is not Sunday, hence, it is Saturday.
(C) Rajesh cooked but it is neither Sunday nor Saturday.
(D) None of these
- 31.** Ravi does not meet Pranith or Mani, unless he goes to New York.
(A) Ravi met Pranith and Mani implies he went to New York.
(B) Ravi did not go to New York and did not meet Pranith, hence, he did not meet Mani.
(C) Ravi did not go to New York but he met Mani implies that he did not meet Pranith.
(D) Both (A) and (C)
- 32.** Whenever David goes to church, he donates money and clothes.
(A) David did not donate clothes implies that he went to church.
(B) David did not donate money implies that he did not go to church.
(C) David donated neither money nor clothes, hence, he must have gone to church.
(D) David went to church but did not donate money implies that he donated clothes.

33. If Prashanth buys a book, he gives it to his brother or his friend.
- Prashanth bought a book, but he did not give it to his friend implies that he gives it to his brother.
 - Prashanth gave the book to neither his brother nor his friend means he did not buy a book.
 - Prashanth did not buy a book, hence, he gave the book neither to his brother nor to his friend.
 - Both (A) and (B)
34. If I am not paid, I will not work and I will not take leave.
- If I have worked and I took leave, then I am paid.
 - If I have worked and I have not taken leave, then I was paid.
 - If I have worked or I have taken leave, then I was paid.
 - More than one of the above.
35. If Rama leaves Ayodhya, then he will go to forest or to Sri Lanka.
- Rama did not go to forest and did not go to Sri Lanka, implies that he did not leave Ayodhya.
 - Rama did not leave Ayodhya, implies that he will not go to forest or will not go to Sri Lanka.
 - Rama went to forest or to Sri Lanka, implies that he did not leave Ayodhya.
 - Rama did not leave Ayodhya, implies that he will not go to forest and will not go to Sri Lanka.
36. Unless the party gets a majority, the house will be dissolved and the President's rule will be imposed.
- The party got a majority, it means that either the house will not be dissolved or the President's rule will not be imposed.
 - The house is not dissolved or the President's rule is not imposed, means that the party got a majority.
 - The house is not dissolved and the President's rule is not imposed means that the party got a majority.
 - Both (B) and (C).
37. If you plant trees, then there will be no pollution and you get fruits.
- If there is no pollution and you did not get fruits, then you planted trees.
 - If there is pollution and you did not get fruits, then you did not plant trees.
 - If there is pollution or you did not get fruits, then you did not plant trees.
 - Both (B) and (C)

38. If there is no traffic, then I will not drive slow but I will go on a long drive.
- If there is traffic, then I will drive slow but I will not go on a long drive.
 - If there is traffic, then I will not drive slow but I will not go on a long drive.
 - If I drive slow or I do not go on a long drive, it means that there is traffic.
 - If I did not drive slow and I went on a long drive, it means that there is traffic.

Directions for questions 29 and 30: Each question consists of a set of statements in alphabetical order. Assume that each one of these statements is individually true. Each of the four choices consists of a subset of these statements. Choose the subset as your answer where the statements therein are logically consistent among themselves.

39. (a) Only if the water level in the coastal areas rises, then the people change their life style.
 (b) People change their life style only if they are rewarded.
 (c) If people are rewarded, then they will not change their life style.
 (d) If the temperatures rise, then the water level in the coastal areas rises.
 (e) Whenever the water level in the coastal areas rises, then the temperature rises.
 (f) Unless the people change their lifestyle, temperature rises.
 (g) People are rewarded.
 (h) Water level in the coastal area does not rise.
- | | |
|----------------------|----------------------|
| (A) c, d, f, g and h | (B) g, f, d, b and h |
| (C) a, c, d, g and h | (D) e, f, g, h and b |
40. (a) If Gulam sings, then audience sleep.
 (b) If Gulam sings, then audience dance.
 (c) Unless audience do not dance, the concert will be successful.
 (d) Only if audience dance, the concert will be successful.
 (e) If Vani dances, then Gulam sings.
 (f) Gulam sings, only if Vani dances.
 (g) Vani dances.
 (h) The concert is successful.
- | | |
|----------------------|----------------------|
| (A) c, f, g, b and h | (B) a, c, f, g and h |
| (C) e, c, g, b and h | (D) d, f, g, h and b |



EXERCISE-3

Directions for questions 1 to 10: Each question below consists of a main statement followed by some numbered statements. From the numbered statements, select the one that logically follows the main statement.

1. If it is a holiday, then I will go for a picnic or I will visit my uncle's house.
 - (A) I will not go for a picnic or I will not visit my uncle's house implies that it is not a holiday.
 - (B) If it is not a holiday, then I will not go for a picnic and I will not visit my uncle's house.
 - (C) I will not go for a picnic and I will not visit my uncle's house implies that it is not a holiday.
 - (D) If it is not a holiday, then I will not go for a picnic or I will not visit my uncle's house.
2. Whenever my mom scolds me, I either hide behind my dad or complain to my grandma.
 - (A) If I complain to my grandma or I hide behind to my dad, then my mom must have scolded me.
 - (B) If I did not complain to my grandma and I did not hide behind my dad, then my mom must not have scolded me.
 - (C) If my mom does not scold me, I will neither hide behind my dad nor complain to my grandma.
 - (D) Both (A) and (B)
3. Whenever it rains, I will either carry an umbrella or wear a raincoat.
 - (A) It is not raining means that I will neither carry an umbrella nor wear a raincoat.
 - (B) I am carrying an umbrella or I am wearing a raincoat, implies that it is raining.
 - (C) I am not carrying an umbrella or I am not wearing a raincoat means that it is not raining.
 - (D) If it is raining but I am not wearing a raincoat means that I must be carrying an umbrella.
4. If it is very hot outside, then I will carry an onion with me and I will return home by lunch time.
 - (A) I will not carry an onion with me or I will not return home by lunch time means that it is not very hot outside.
 - (B) It is not very hot outside means that I will not carry an onion with me and I will not return home by lunch time.
 - (C) I will not carry an onion with me and I will return home by lunch time means that it is very hot outside.
 - (D) I will carry an onion with me and I will return home by lunch time means that it is very hot outside.
5. Whenever Arpita's father is in town, she abstains from college and goes to her uncle's house.
 - (A) If Arpita has not abstained from college or she has not gone to her uncle's house means that her father is not in town.
 - (B) If Arpita has not abstained from college but her father is in town, then she will definitely go to her uncle's house.
 - (C) If Arpita has abstained from college but she has not gone to her uncle's house, it means that her father is not in town.
 - (D) Both (A) and (C) above.
6. If the tea is not hot, then I will not go to school and will not have dinner.
 - (A) If I have gone to school or I have not had dinner, then the tea is not hot.
 - (B) If I have gone to school and I had dinner, then the tea is hot.
 - (C) If I have gone to school and I have not had dinner, then the tea is hot.
 - (D) If I have gone to school or I have had dinner, then the tea is hot.
7. If Ramesh leaves his job, then he will join for an MBA course or for an MCA course.
 - (A) Ramesh has neither joined an MBA course nor an MCA course implies that he has not left his job.
 - (B) Ramesh has not left his job implies that he will not join an MBA course or he will not join an MCA course.
 - (C) Ramesh has joined an MBA course or an MCA course implies that he has not left his job.
 - (D) Ramesh has not left his job implies that he will not join an MBA course and he will not join an MCA course.
8. Unless we win the Assembly elections, we will lose the Rajya Sabha elections and the Presidential elections.
 - (A) We have won the Assembly elections, it means that we will not lose either the Rajya Sabha elections or the Presidential elections.
 - (B) We have not lost the Rajya Sabha elections or we have not lost the Presidential elections means that we have won the Assembly elections.
 - (C) We have not lost the Rajya Sabha elections and not lost the Presidential elections means that we have won the Assembly elections.
 - (D) Both (B) and (C).

9. If it is a Sunday, then on that day there is no college and I go to Church.
 (A) If there is no college and I do not go to Church, then that day is a Sunday.
 (B) If there is college and I do not go to Church, then that day is not a Sunday.
 (C) If there is college or I do not go to Church, then that day is not a Sunday.
 (D) Both (B) and (C).
10. If it is not raining, then I will not go for a movie but I will visit my friend's house.
 (A) If it is raining, then I will go for a movie but I will not visit my friend's house.
 (B) If it is raining, then I will not go for a movie but I will not visit my friend's house.
 (C) If I go for a movie or I do not visit my friend's house, it means that it is raining.
 (D) If I will not go for a movie and I will visit my friend's house, it means that it is raining.

Directions for questions 11 to 13: Each question below consists of a main statement followed by four numbered statements. From the numbered statements, select the one that logically follows the main statement.

11. Harish will get through the interview, if he is thorough with the basics.
 (A) Harish got through the interview, hence, he was thorough with the basics.
 (B) Harish is not thorough with the basics; hence, he will not get through the interview.
 (C) Harish did not get through the interview means he was not thorough with the basics.
 (D) Although he was not thorough with the basics, still Harish managed to get through the interview.
12. Either Pakistan or China will attack India, only if India supports Russia and the USA.
 (A) Pakistan and China attacked India means India supported Russia and the USA.
 (B) India neither supported Russia nor supported the USA means that only Pakistan attacked India.
 (C) India supported the USA but not Russia, means that only China attacked India.
 (D) All of the above
13. I will neither talk to you nor play with you, unless you apologize to me.
 (A) I talked with you or played with you means that you apologized to me.
 (B) I did not apologize to you means that you neither talked with me nor played with me.

- (C) You apologized to me means that you neither talked nor played with me.
 (D) Both (A) and (B)

Directions for questions 14 and 15: Each question has a main statement followed by four statements labelled as a, b, c and d. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement.

14. Either Rajeev is a genius or he cheated in the exam.
 (a) Rajeev cheated in the exam.
 (b) Rajeev is a genius.
 (c) Rajeev is not a genius.
 (d) Rajeev did not cheat in the exam.
 (A) Only ca (B) Only bd
 (C) cd and ba (D) db and ca
15. Unless the politician took money, he is not good enough.
 (a) The politician is not good enough.
 (b) The politician took money.
 (c) The politician is good enough.
 (d) The politician did not take money.
 (A) Only bc (B) Only da
 (C) Only ab (D) cb and da

Directions for questions 16 to 20: Each question below consists of a statement followed by some numbered statements. From the numbered statements, select the one that logically negates the main statement.

16. Sravan will go to the movie, if his parents are not with him.
 (A) Sravan did not go to the movie and his parents are with him.
 (B) Sravan's parents are with him and he went to the movie.
 (C) Sravan did not go to the movie and his parents are not with him.
 (D) Sravan went to the movie and his parents are not with him.
17. Ramesh works very hard whenever there is an exam.
 (A) Ramesh worked very hard and there is no exam.
 (B) Ramesh did not work hard and there is no exam.
 (C) Ramesh did not work hard and there is an exam.
 (D) Both (B) and (C)
18. Either it is a flying saucer or the person is not telling the truth.
 (A) It is not a flying saucer and the person is not telling the truth.
 (B) The person is telling the truth and it is not a flying saucer.
 (C) It is a flying saucer and the person is telling the truth.
 (D) The person is not telling the truth and it is a flying saucer.



19. Sachin scores a century, unless he is paired with the Captain.
- (A) Sachin is paired with the Captain and he did not score a century.
- (B) Sachin scored a century and he is not paired with the Captain.
- (C) Sachin is paired with the Captain and he scored a century.
- (D) Sachin did not score a century and he is not paired with the Captain.
20. Bond will buy the car only if it is the costliest and fastest.
- (A) Bond did not buy the car and it is neither the fastest nor the costliest.
- (B) Bond bought the car and it is not the costliest or it is not the fastest.
- (C) The car is the fastest and costliest, and Bond did not buy it.
- (D) Bond bought the car and it is the fastest and costliest.

Directions for questions 21 to 23: Each question has a main statement followed by four statements labelled as a, b, c and d. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement.

21. If the price of a good increases, then its consumption decreases.
- (a) The price of a good increased.
- (b) The price of a good did not increase.
- (c) The consumption of the good decreased.
- (d) The consumption of the good did not decrease.
- (A) cb (B) ad
- (C) ca (D) db
22. The exam's difficulty level increases only if the number of applicants increases.
- (a) The exam's difficulty level increased.
- (b) The exam's difficulty level did not increase.

- (c) The number of applicants have increased.
- (d) The number of applicants have not increased.
- (A) ca (B) db
- (C) ac (D) both (B) and (C)
23. Whenever the hero needs money, he acts in a new movie.
- (a) The hero needed money.
- (b) The hero did not need money.
- (c) The hero acted in a new movie.
- (d) The hero did not act in a new movie.
- (A) ac (B) ad
- (C) ca (D) bd

Directions for questions 24 and 25: Each question below consists of a main statement followed by four numbered statements. From the numbered statements, select the one that logically follows the main statement.

24. The chief guest will come on time, if the fog does not affect the flight timings. Only if the chief guest comes, then the meeting will be started.
- The meeting started implies that
- (A) The fog did not affect flight timings.
- (B) The fog affected the flight timings.
- (C) The chief guest did not come.
- (D) None of these
25. Unless coding is done, the software project cannot be completed. If the company does not meet the project completion deadline, then the team working on it will be fired.
- The team working in the project, is not fired implies
- (A) The coding is done.
- (B) The software project was not completed.
- (C) The company did not meet the project completion deadline.
- (D) None of these

ANSWER KEYS

Exercise-1

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

Exercise-2

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

Exercise-3

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

SOLUTIONS

EXERCISE-1

1. If $\boxed{\text{movie is a superhit}}$ then $\boxed{\text{i watch it}}$ The statement is of the form, 'If p , then q '.
The implications are (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (D) is according to (ii).

2. Whenever $\boxed{\text{it is cold}}$, $\boxed{\text{I wear a jacket}}$. The statement is of the form 'whenever p then q '.
The implications are: (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$.
Choice (A) is according to (i) and Choice (B) is according to (ii).

3. Either or
The statement is of the form 'either p or q '.
The implications are:
(A) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (B) is according to (ii).

4. Only if $\boxed{\text{Raj is not coming}}$, then $\boxed{\text{Geetika will come to the party}}$
The statement is of the form 'only if p , then q '.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Choice (C) is according to (i).

5. Unless $\boxed{\text{I have money}}$, $\boxed{\text{I cannot enjoy my weekend}}$
The statement is of the form 'unless p then q '.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (B) is according to (ii) and Choice (C) is according to (i).



6. If $\boxed{\text{I can swim}}$, then $\boxed{\text{I can clear the exam}}$
- The statement is of the form, 'If p then q '.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (A) is according to (i) and Choice (B) is according to (ii).

7. $\boxed{\text{India will talk}}$ Only if $\boxed{\text{the terrorists are handed over.}}$
- The statement is of the form 'only if p then q '.
The implications are:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Choice (D) is according to (i).

8. Whenever $\boxed{\text{there is demand}}$ $\boxed{\text{there will be supply}}$
- The statement is of the form 'whenever p then q '.
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (C) is according to (ii) and Choice (B) is according to (i).

9. Suhasita purchases either $\boxed{\text{a cooler}}$ or $\boxed{\text{a refrigerator}}$
- The statement is of the form 'either p or q '.
The implications are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) is according to (i).
Choice (B) is according to (ii).

10. $\boxed{\text{I will not have enemies}}$ Unless $\boxed{\text{I fight}}$
- The statement is of the form 'unless p then q '.
The implications are:
(A) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (B) is according to (i).
Choice (C) is according to (ii).
11. If $\boxed{\text{you are good.}}$ then $\boxed{\text{everyone loves you.}}$
- The statement is of the form, 'if p , then q '.
The implications are: (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (D) is according to (ii).

12. Unless $\boxed{\text{Pratik comes,}}$ $\boxed{\text{his son does not eat}}$
- The statement is of the form, 'unless p , q '.
The implications are: (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) is according to (i) and Choice (C) is according to (ii).

13. Only if $\boxed{\text{you are qualified in written test}}$
 $\boxed{\text{you get a call for an interview}}$

The statement is of the form 'only if p , then q '.

The implications are:

- (i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$

Choice (A) is according to (ii).

14. The given statement is of the form
If $\boxed{\text{Raju plays well}}$ then $\boxed{\text{the team can win the match.}}$

The implications are $p \Rightarrow q$ and $\sim q \Rightarrow \sim p$.
(C) logically follows the main statement.

15. The given statement is of the form
Either $\boxed{\text{He plays cricket}}$ or $\boxed{\text{eats biscuit.}}$

The implications are $\sim p \Rightarrow q$ and $\sim q \Rightarrow p$.
(B) logically follows the main statement.

16. The given statement is of the form
Unless $\boxed{\text{the inflation is low}}$

The implications are $\sim p \Rightarrow q$ and $\sim q \Rightarrow p$
 \therefore Both (B) and (C) logically follow the main statement.

17. The given statement is of the form.
Only if:
 $\boxed{\text{the train does not leave late}}$ then

The implications are $q \Rightarrow p$ and $\sim p \Rightarrow \sim q$.
(C) logically follows from the main statement.

18. The given statement is of the form:
Whenever $\boxed{\text{I go to church}}$ then $\boxed{\text{I pray to god}}$
- The implications are: $p \Rightarrow q$ and $\sim q \Rightarrow \sim p$
Choice (B) logically follows the main statement.

19. If $\boxed{\text{you deposit money,}}$ $\boxed{\text{you will get interest.}}$
- The statement is of the form 'if p , then q '.
The implications are: (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Choice (A) follows (ii) and Choice (B) follows (i).

20. Unless $\boxed{\text{Kiran finds a soul mate,}}$ $\boxed{\text{he will not marry}}$
- The statements of the form 'unless p , q '.
The implications are: (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
Choice (A) follows (i).

21. $\begin{matrix} q & p \\ \boxed{\text{Teachers can teach.}} & \text{only if } \boxed{\text{students are well mannered}} \end{matrix}$
 The statement is of the form 'only if p then q '. The implications are: (i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
 (a) $\Rightarrow q$ (b) $\Rightarrow \sim p$
 (c) $\Rightarrow \sim q$ (d) $\Rightarrow p$
 Here, 'ad' and 'bc' are proper pairs.

22. $\begin{matrix} q & p \\ \boxed{\text{Prajakta is healthy}} & \text{whenever } \boxed{\text{she is happy}} \end{matrix}$
 The statement is of the form 'whenever p then q '. The implications are:
 (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
 (a) $\Rightarrow \sim p$ (b) $\Rightarrow p$
 (c) $\Rightarrow q$ (d) $\Rightarrow \sim q$
 Here, 'bc' and 'da' are proper pairs.

23. Rohit is suffering either
 $\begin{matrix} p & q \\ \boxed{\text{from malaria}} & \text{or } \boxed{\text{from typhoid.}} \end{matrix}$
 The statement is of the form 'either p or q '. The implications are:
 (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
 (a) $\Rightarrow \sim q$ (b) $\Rightarrow p$
 (c) $\Rightarrow \sim p$ (d) $\Rightarrow q$
 Here, 'ab' and 'cd' are the proper pairs.

24. $\begin{matrix} q & p \\ \boxed{\text{Manjula works}} & \text{unless } \boxed{\text{she is married.}} \end{matrix}$
 The statement is of the form 'unless p then q '. The implications are:
 (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
 (a) $\Rightarrow \sim p$ (b) $\Rightarrow p$
 (c) $\Rightarrow q$ (d) $\Rightarrow \sim q$
 Here, 'ac' and 'db' are the proper pairs.

25. If $\begin{matrix} p & q \\ \boxed{\text{tea is sweet}} & \text{then } \boxed{\text{Samarth cannot drink it.}} \end{matrix}$
 The statement is of the form 'if p then q '. The implications are:
 (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
 (a) $\Rightarrow \sim q$ (b) $\Rightarrow \sim p$
 (c) $\Rightarrow q$ (d) $\Rightarrow p$
 Here, 'dc' and 'ab' are the proper pairs.

26. $\begin{matrix} q & p \\ \boxed{\text{Nisha will do an MBA}} & \text{only if } \boxed{\text{she gets admission into a good college.}} \end{matrix}$

The statement is of the form 'only if p then q '. The implications are:

- (i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
 (a) $\Rightarrow \sim q$ (b) $\Rightarrow p$
 (c) $\Rightarrow \sim p$ (d) $\Rightarrow q$

Here, 'db' and 'ca' are the proper pairs.

27. $\begin{matrix} q & p \\ \boxed{\text{Rajesh is wealthy}} & \text{only if } \boxed{\text{he is healthy}} \end{matrix}$
 The statements of the form 'only if p , then q '. The implications are:
 (i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
 (a) $\sim q$ (b) p
 (c) $\sim p$ (d) q
 Here, 'db' and 'ca' are proper pairs.

28. $\begin{matrix} q & p \\ \boxed{\text{Madhuri is not a philosopher,}} & \text{unless } \boxed{\text{she completes her Ph.D.}} \end{matrix}$
 The statement is of the form 'unless p , q '. The implications are:
 (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
 (a) $\sim q$ (b) q
 (c) p (d) $\sim p$
 Here, 'db' and 'ac' are proper pairs.

29. $\begin{matrix} q & p \\ \boxed{\text{Happiness is real,}} & \text{whenever } \boxed{\text{it is shared}} \end{matrix}$
 The statement is of the form 'whenever p , then q '. The implications are:
 (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
 (a) $\sim p$ (b) $\sim q$
 (c) p (d) q
 Here, 'cd' and 'ba' are proper pairs.

30. Ramu wants to be either
 $\begin{matrix} p & q \\ \boxed{\text{a Manager}} & \text{or } \boxed{\text{a Director}} \end{matrix}$
 The statement is of the form 'either p or q '. The implications are:
 (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
 (a) $\sim q$ (b) p
 (c) q (d) $\sim p$
 Here, 'dc' and 'ab' are proper pairs.

31. If $\begin{matrix} p & q \\ \boxed{\text{I have money,}} & \boxed{\text{I will buy a book}} \end{matrix}$
 The statement is of the form 'if p , then q '. The implications are:
 (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

- (a) $\sim p$ (b) $\sim q$
 (c) q (d) p
 Here, 'dc' and 'ba' are proper pairs.

 q

32. Swati would be selected in the first company,

 p

if she has an excellent academic record.

The implications of the statement are:

- (i) $p \Rightarrow q$ and (ii) $\sim q \Rightarrow \sim p$
 \therefore It can be ca or bd.

 p

33. Only if Abhijeet has good knowledge is classical music,

 q

he would be elected as Musical Idol.

The implications of the above statement are:

- (i) $q \Rightarrow p$ and (ii) $\sim p \Rightarrow \sim q$
 It can be bd or ac.

 p

34. Unless The Indian government seals the borders,

 q

illegal migration wil not stop.

The implications of the above statement are:

- (i) $\sim p \Rightarrow q$ and (2) $\sim q \Rightarrow p$
 It can be cd or ba.

 p

35. Whenever Sandeep receives a message from Sangeeta

 q

he seems to be on cloud nine.

The implications of the above statement are:

- (1) $p \Rightarrow q$ and (2) $\sim q \Rightarrow \sim p$
 It can be db or ca.

 p

36. If Ali has good knowledge of JAVA,

 q

he will selected in Satyam Computers,

The implications for the above statement are:

- (i) $p \Rightarrow q$ and (ii) $\sim q \Rightarrow \sim p$

Unless

 $\sim q$

Ali is not selected in Satyam Computers

 r

he will not be selected in CTS.

The implications for the above statement are:

- (iii) $q \Rightarrow r$ and (iv) $\sim r \Rightarrow \sim q$

The given statement:

Ali is selected in CTS [$\sim r$]

From (iv) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow \sim p$

$\therefore \sim r \Rightarrow \sim p$, i.e., Ali does not have good knowledge of JAVA.

 q

37. The HR manager of TCS will come,

 p

if the strike does not effect the flight timings.

The implications of the above statement are:

- (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

 q

Only if The HR manager of TCS comes,

 r

TCS will recruit people.

The implications of the above statement are:

- (iii) $r \Rightarrow q$ and (iv) $\sim q \Rightarrow \sim r$

The given statement is TCS is recruiting people [r].

From (iii), $r \Rightarrow q$.

But there is no implication for q .

So, the answer will be none of these.

 p

38. Unless the coding is not tested,

 q

the company can implement it.

The implications of the above statement are:

- (i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$

 q

If the company can implement the coding

 r

the network system will work properly.

The implications of the above statement are:

- (iii) $q \Rightarrow r$ and (iv) $\sim r \Rightarrow \sim q$

The given statement, 'The network is not working properly' ($\sim r$).

From (iv) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow p$

$\therefore \sim r \Rightarrow p$ (The coding is not tested).

 p

39. Whenever the Infosys team's performance is excellent,

 q

they become the top IT company

The implications of the above statement are:

- (i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

Either $\sim q$
 Infosys does not become the top IT company
 r

or TCS remains in the top rank.

The implications for the above statement are:

(iii) $q \Rightarrow r$ (iv) $\sim r \Rightarrow \sim q$

The given statement, 'The Infosys team's performance is excellent' (p).

From (i) $p \Rightarrow q$ and from (iii) $q \Rightarrow r$

$\therefore p \Rightarrow r$ [TCS remains in the top rank].

40. If p
 a person follows conventional methods,
 q
 He cannot be successful.

The statement is of the form, if p then q .

The implications are:

(i) $p \Rightarrow q$; (ii) $\sim q \Rightarrow \sim p$

$\sim q$
 Unless a person is successful,

r
 he cannot be a part of successful company.

The statement is of the form unless ($\sim q$), r .

The implications are:

(i) $q \Rightarrow r$ (ii) $\sim r \Rightarrow \sim q$

The given statement, Mr Prasad has become a part of P & G, a successful company ($\sim r$).

From (ii) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow \sim p$

Now,

$\sim r \Rightarrow \sim q \Rightarrow \sim p$ (Mr Prasad does not follow conventional methods).

EXERCISE-2

1. Either p
 Anand will marry Vandana or
 q
 Madhavi will marry Kollol.
 The negation of the above statement is $\sim p$ and $\sim q$.

2. Whenever p
 Bhiru and Basanti go for long drive,
 q
 Joy followed them.
 The negation of the above statement is p and $\sim q$.

3. q
 Pratap Rana will attend the class,
 p
 only if his father allows has to go by bike
 The negation of the above statement is $\sim p$ and q .

4. Unless p
 Aiswariya plays the role of 'Paro',
 q
 Madhuri will not play the role of 'Chandramukhi'.
 The negation of the above statement is $\sim p$ and $\sim q$.

5. Unless p
 The change happens,
 q
 The problems will not be solved.

The statement is of the form:

Unless p , q .

Negation for the above statement is $\sim p$ and $\sim q$.

6. The statement is of the form:
 p and q
 The negation is $\sim p$ or $\sim q$.
7. The statements is of the form:
 Unless p , q .
 The negation is $\sim p$ and $\sim q$.
8. The statement is of the form:
 Either p or q .
 The negation is $\sim p$ and $\sim q$.
9. The statement is of the form:
 If p , then q .
 The negation is p and $\sim q$.
10. The statement is of the form, p , only if q .
 The negation is p and $\sim q$.

11. If p
 it is the post of a manager, then
 q
 Shastri wil join the firm.

The statement is of the form 'if p then q '.

The negation is ' p and $\sim q$ '.



12. $\begin{matrix} q & & p \\ \text{I cannot make tomato soup,} & \text{unless} & \text{I have some onions.} \end{matrix}$

The statement is of the form 'unless p then q '.
The negation is $\sim p$ and $\sim q$.

13. $\begin{matrix} p & & q \\ \text{Only if Tara is happy,} & \text{then} & \text{she does not go to work} \end{matrix}$

The statement is of the form 'only if p then q '.
The negation is $\sim p$ and q .

14. Paul is popular $\begin{matrix} q \\ \text{either as a lead guitarist} \end{matrix}$ or

$\begin{matrix} q \\ \text{as a base guitarist.} \end{matrix}$

The statement is of the form 'either p or q '.
The negation is $\sim p$ and $\sim q$.

15. $\begin{matrix} q & & p \\ \text{Kohli cannot score a hundred,} & \text{unless} & \text{Jhonson bowls.} \end{matrix}$

The statement is of the form 'unless p , q '.
The negation is $\sim p$ and $\sim q$.

16. The given statement is of the form

$\begin{matrix} p & & q \\ \text{He either wears shoes} & \text{or} & \text{a tie} \end{matrix}$

The negations are: $\sim p$ & $\sim q$ and $\sim q$ & $\sim p$.
Choice (A) is the correct negation of the given statement.

17. The given statement is of the form

If $\begin{matrix} p & & q \\ \text{It is a holiday} & \text{then} & \text{I sleep throughout the day} \end{matrix}$

The negations are p & $\sim q$ and $\sim q$ & $\sim p$.
Choice (B) is the correct negation of the given statement.

18. The given statement is of the form

Rajesh $\begin{matrix} p & & q \\ \text{goes to college} & \text{and} & \text{attends classes.} \end{matrix}$

The negations are $\sim p$ or $\sim q$ and $\sim q$ or $\sim p$.

19. The statement is of the form, 'If p , then q or r '.

$\begin{matrix} p & & q \\ \text{If Ankita eats pastry} & \text{then} & \text{It is a black forest} \end{matrix}$

$\begin{matrix} r \\ \text{or a pineapple.} \end{matrix}$

The implications are:

- (i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Choice (A) is according to (iv).
Choice (B) is according to (iii).
Choice (C) is according to (ii).

20. The statement is of the form 'if p then q and r '.

$\begin{matrix} p & & q \\ \text{If you want to stay fit,} & \text{then} & \text{you must eat healthy food} \end{matrix}$

$\begin{matrix} r \\ \text{and exercise.} \end{matrix}$

The implications are:

- (i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
(iii) $\sim q \Rightarrow \sim p$ (iv) $\sim r \Rightarrow \sim p$
(v) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (A) is according to (iii) and Choice (B) is according to (iv).

21. The statement is of the form 'only if q or r then p '.

$\begin{matrix} p & & q \\ \text{Yaseem plays cricket} & \text{only if} & \text{he wears blue} \end{matrix}$

$\begin{matrix} r \\ \text{or white} \end{matrix}$

The implications are:

- (i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
(iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Choice (B) is according to (iii).

22. The statement is of the form 'unless p then q or r '.

$\begin{matrix} q & & r \\ \text{Sunil cannot meet his friends} & \text{or} & \text{his family} \end{matrix}$ unless

$\begin{matrix} p \\ \text{he has a job.} \end{matrix}$

The implications are:

- (i) $\sim p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow p$
(iii) $\sim p$ and $\sim q \Rightarrow r$ (iv) $\sim p$ and $\sim r \Rightarrow q$

Choice (A) is according to (ii).

Choice (C) is according to (iv).

23. The statement is of the form 'only if p then q or r '.

$\begin{matrix} p & & q \\ \text{Only if there is a sale,} & & \text{I will buy clothes} \end{matrix}$

$\begin{matrix} r \\ \text{or cosmetics.} \end{matrix}$

The implications are:

- (i) q or $r \Rightarrow p$ (ii) $q \Rightarrow p$
(iii) $r \Rightarrow p$ (iv) q and $r \Rightarrow p$
(v) $\sim p \Rightarrow \sim q$ and $\sim r$

Choice (A) is according to (iv).
Choice (B) is according to (iii).
Choice (C) is according to (ii).



The implications are:

- (i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
 (iii) $\sim q \Rightarrow \sim p$ (iv) $\sim r \Rightarrow \sim p$
 (v) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (B) is according to (iii).

33. The statement is of the form 'if p , then q or r '.

p

If Prashanth buys a book,

q

then he gives it to his brother

r

or his friend.

The implications are:

- (i) $p \Rightarrow q$ or r ii) p and $\sim q \Rightarrow r$
 (iii) p and $\sim r \Rightarrow q$ (iv) $\sim q$ and $\sim r \Rightarrow \sim p$

Choice (A) is according to (iii).

Choice (B) is according to (iv).

34. If I am not paid, then I will not work and

r

I will not take leave.

Statement: If p , then q and r .

Implications:

- (i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
 (iii) q and $\sim r \Rightarrow \sim p$ (iv) $\sim q$ and $r \Rightarrow \sim p$
 (v) $\sim q$ and $\sim r \Rightarrow \sim p$

Implication (v) is represented in Choice (A), (iv) is represented in Choice (B) and (ii) is represented in the Choice (C).

35. If Rama leaves Ayodhya, then he will go to forest

r

or to Sri Lanka.

Statement: If p , then q or r .

Implications:

- (i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
 (iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

$\sim p$ is 'Rama did not leave Ayodhya', $\sim q$ is 'Rama did not go to forest' and $\sim r$ is 'Rama did not go to Sri Lanka'.

Implication (i) is represented in the Choice (A).

36. Unless the party gets majority,

q

the house will be dissolved

r

and the President's rule will be imposed.

Statement: Unless p , then q and r .

Conclusions:

- (i) $\sim p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow p$
 (iii) $\sim q$ & $r \Rightarrow p$ (iv) q & $\sim r \Rightarrow p$
 (v) $\sim q$ & $\sim r \Rightarrow p$

Conclusions:

- (i) The party did not get a majority, implies that the house will be dissolved and the President's rule will be imposed.
 (ii) The house is not dissolved or the President's rule is not imposed means that the party got a majority, Choice (B).
 (iii) The house is not dissolved but the President's rule is imposed means that the party got the majority.
 (iv) The house is dissolved and the President's rule is not imposed means that the party got a majority.
 (v) The house is not dissolved and the President's rule is not imposed implies that the party got a majority, Choice (C).

37. If you plant trees, then there will be no pollution

r

and you get fruits.

Statement: If p , then q and r .

Implications:

- (i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
 (iii) $\sim q$ and $r \Rightarrow \sim p$ (iv) q and $\sim r \Rightarrow \sim p$
 (v) $\sim q$ and $\sim r \Rightarrow \sim p$

$\sim p$ is 'You did not plant trees', $\sim q$ is 'There will be pollution' and $\sim r$ is 'You do not get fruits'.

Implication (v) is represented in the Choice (B) and (ii) is represented in Choice (C).

38. If there is no traffic, then I will not drive slow

r

but I will go on a long drive.

Statement: If p , then q and r .

Implications:

- (i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
 (iii) $\sim q$ and $r \Rightarrow \sim p$ (iv) q and $\sim r \Rightarrow \sim p$
 (v) $\sim q$ and $\sim r \Rightarrow \sim p$

Implication (ii) is represented in Choice (C).

39. (a) Only if the water level in the coastal areas rises,

q

then the people change their life style

The implications are:

- (i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$

(b) , only if

q

People change their life style, only if

r

they are rewarded.

The implication are:

(iii) $q \Rightarrow r$ (iv) $\sim r \Rightarrow \sim q$

(c) If people are rewarded

$\sim q$

then they will not change their life style.

The implications are:

(v) $r \Rightarrow \sim q$ (vi) $q \Rightarrow \sim r$

(d) If the temperature rises,

p

then the water level in the coastal areas rises.

The implications are:

(vii) $s \Rightarrow p$ (viii) $\sim p \Rightarrow \sim s$

(e)

p

Whenever the water level in the coastal areas rises,

s

then the temperature rises.

The implications are:

(ix) $p \Rightarrow s$ (x) $\sim s \Rightarrow \sim p$

(f) Unless the people change their life style,

s

temperature rises.

The implications are:

(xi) $\sim q \Rightarrow s$ (xii) $\sim s \Rightarrow q$

(g) People are rewarded $\Rightarrow r$

(h) Water level in the coastal area does not rise.
 $\Rightarrow \sim p$

Choice (A) $\Rightarrow h \rightarrow$ (viii) \rightarrow (xii) \rightarrow (vi) $\rightarrow \sim r$

\therefore Hence, the statements are inconsistent.

or $G \rightarrow$ (v) \rightarrow (xi) \rightarrow (vii) $\rightarrow p$

\therefore Hence, the statements are inconsistent.

Choice (B) $\Rightarrow h \rightarrow$ (viii) \rightarrow (xii) \rightarrow (iii) $\rightarrow r$, i.e., G.

\therefore Hence, the statements are consistent.

Choice (C) \Rightarrow Here s is mentioned only in statement (d).

\therefore No consistency or inconsistency can be established.

Choice (D) \Rightarrow There is no relation with either g or h for any of the other statements. So, no consistency can be established.

40. (a) then

p q

If Gulam sings, then audience will sleep.

The implications are:

(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$

(b) then

p r

If Gulam sings, then audience dance.

The implications are:

(iii) $p \Rightarrow r$ (iv) $\sim r \Rightarrow \sim p$

(c)

$\sim r$

Unless audience do not dance,

s

the concert will be successful.

The implications are:

(v) $r \Rightarrow s$ (vi) $\sim s \Rightarrow \sim r$

(d)

r

only if the audience dance,

s

the concert will be successful.

The implications are:

(vii) $s \Rightarrow r$ (viii) $\sim r \Rightarrow \sim s$

(e)

p t

Gulam sings, only if Vani dances.

The implications are:

(ix) $t \Rightarrow p$ (x) $\sim p \Rightarrow \sim t$

(f) only if

p t

Gulam sings, only if Vani dances.

The implications are:

(xi) $p \Rightarrow t$ (xii) $\sim t \Rightarrow \sim p$

(g) Vani dances $\Rightarrow t$

(h) The concert is successful $\Rightarrow s$

Choice (A) \Rightarrow There is no implication for either s or t .

\therefore Consistency cannot be established.

Choice (B) \Rightarrow The term q is mentioned only in statement a.

\therefore Consistency cannot be established.

Choice (C) $\Rightarrow g \rightarrow$ (ix) \rightarrow (iii) \rightarrow (v) $\rightarrow s \rightarrow h$.

\therefore The statements are consistent.

Choice (D) \Rightarrow We can only relate g to (vii).

\therefore Consistency cannot be established.



EXERCISE-3

1. If $\overset{p}{\boxed{\text{it is a holiday,}}}$ then $\overset{q}{\boxed{\text{I will go for a picnic}}}$

r

or $\boxed{\text{I will visit my Uncle's house.}}$

Statement:

If p , then q or r .

Conclusions:

- (i) $p \Rightarrow q$ or r (ii) $\sim q$ and $\sim r \Rightarrow \sim p$
 (iii) p and $\sim q \Rightarrow r$ (iv) p and $\sim r \Rightarrow q$

Conclusions:

- (i) It is a holiday means that I will go for a picnic or I will visit my uncle's house.
 (ii) I did not go for a picnic and I did not visit my uncle's house means that it was not a holiday.
 (iii) It was a holiday but I did not go for a picnic means that I visited my uncle's house.
 (iv) It is a holiday but I did not visit my uncle's house means that I went for picnic.

But only statement (ii) is represented in Choice (C).

2. Whenever $\overset{p}{\boxed{\text{my mom scolds me,}}}$ I either

q

$\boxed{\text{hide behind my dad}}$ or

r

$\boxed{\text{complain to my grandma.}}$

Statement:

Whenever p , then q or r is same as if p , then q or r .

Conclusions:

- (i) $p \Rightarrow q$ or r (ii) $\sim q$ & $\sim r \Rightarrow \sim p$
 (iii) p & $\sim q \Rightarrow r$ (iv) p & $\sim r \Rightarrow q$

Conclusions:

- (i) My mom scolded me, so I hid behind my dad or I complained to my grandma.
 (ii) I did not hide behind my dad and I did not complain to my grandma means that my mom did not scold me.
 (iii) My mom scolded me but I still did not hide behind my dad means that I complained to my grandma.
 (iv) My mom scolded me but I did not complain to my grandma means that I hid behind my dad.

Questions numbered 3 and 7: These questions can be solved in the same way as questions numbered 1 and 2 are solved.

4. If $\overset{p}{\boxed{\text{it is very hot outside,}}}$ then $\overset{q}{\boxed{\text{I will carry on onion with me}}}$

r

and $\boxed{\text{I will return home by lunch time.}}$

Statement:

If p , then q and r .

Conclusions:

- (i) $p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow \sim p$
 (iii) $\sim q$ & $r \Rightarrow \sim p$ (iv) q & $\sim r \Rightarrow \sim p$
 (v) $\sim q$ & $\sim r \Rightarrow \sim p$

Conclusions:

- (i) It is very hot outside means that I will carry an onion with me and I will return home by lunch time.
 (ii) I will not carry an onion with me or I will not return home by lunch time means that it is not very hot outside.
 (iii) I will not carry an onion with me but I will return home by lunch time means it is very hot outside.
 (iv) I will carry an onion with me but I will not return home by lunch time means that it is not very hot outside.
 (v) I will not carry an onion with me and I will not return home by lunch time means that it is not very hot outside.

Question 5: This can be solved in the same way as question 4 is solved.

6. If $\overset{p}{\boxed{\text{tea is not hot,}}}$ then $\overset{q}{\boxed{\text{I will not go to school}}}$

r

nor $\boxed{\text{will I have dinner.}}$

Statement:

If p , then q and r .

Note: Here, 'nor' is same as 'and' so, Questions 7 is similar to question 1.

8. Unless $\overset{p}{\boxed{\text{we win the Assembly elections,}}}$ $\overset{q}{\boxed{\text{we will lose the Rajya Sabha elections}}}$ and $\overset{r}{\boxed{\text{the presidential elections.}}}$

Statements:

Unless p , q and r .

Conclusions:

- (i) $\sim p \Rightarrow q$ and r (ii) $\sim q$ or $\sim r \Rightarrow p$
 (iii) $\sim q$ & $r \Rightarrow p$ (iv) q & $\sim r \Rightarrow p$
 (v) $\sim q$ & $\sim r \Rightarrow p$

Conclusions:

- (i) We did not win the Assembly elections means that we lost the Rajya Sabha elections and the Presidential elections.
- (ii) We did not lose the Rajya Sabha elections or we did not lose the Presidential elections means that we won the Assembly elections.
- (iii) We did not lose the Rajya Sabha elections but lost the Presidential elections means that we won the Assembly elections.
- (iv) We lost the Rajya Sabha elections but did not lose the Presidential elections means that we won the Assembly elections.
- (v) We did not lose the Rajya Sabha elections and did not lose the Presidential elections means that we won the Assembly elections.

Questions 9 and 10: These questions can be solved in the same way as question 8 is solved.

11. $\boxed{\text{Harish will get through the only interview}}$ if

p
 $\boxed{\text{he is through with the basics.}}$

Implications:

- (i) $p \Rightarrow q$
 - (ii) $\sim q \Rightarrow \sim p$
- Choice (C) follows (ii).

12. $\boxed{\text{Either Pak or China attacks India,}}$ only if

p
 $\boxed{\text{India supports Russia and USA.}}$

Implications:

- (i) $q \Rightarrow p$
- (ii) $\sim p \Rightarrow \sim q$

The first choice follows the first implication.

13. $\boxed{\text{I will neither talk to you nor play with you,}}$

p
 $\boxed{\text{you apologize to me.}}$

Implications:

- (i) $\sim p \Rightarrow q$
- (ii) $\sim q \Rightarrow p$

Choice (A) follows (ii).

14. The given statement is of the form, p or q , i.e.,

either $\boxed{\text{Rajeev is a genius}}$ or

p
 $\boxed{\text{he cheated in the exam.}}$

q

The possible implications are:

- (i) $\sim p \Rightarrow q$
- (ii) $\sim q \Rightarrow p$

Therefore, the answer is ca or db.

15. The given statement is of the form, unless p , then q , i.e.,

unless $\boxed{\text{the politician took money}}$
 p
 $\boxed{\text{he is not good enough.}}$
 q

The possible implications are:

- (i) $\sim p \Rightarrow q$
- (ii) $\sim q = p$

Therefore, the answer is cb and da.

16. $\boxed{\text{Sravan will go to the movie,}}$ if

p
 $\boxed{\text{his parents are not with him}}$

Statement: q , if p

Negation: p and $\sim q$

Sravan's parents are not with him and he did not go to the movie.

17. $\boxed{\text{Ramesh works very hard}}$ whenever

p
 $\boxed{\text{there is an exam}}$

Statement: q , whenever p

Negation: p and $\sim q$

There is an exam and Ramesh did not work hard.

18. Either $\boxed{\text{it is a Flying Saucer}}$ or

p
 $\boxed{\text{the person is not telling the truth}}$

Statement: Either p or q

Negation: $\sim p$ and $\sim q$

It is not a flying saucer and the person is telling the truth.

19. $\boxed{\text{Sachin scores a century,}}$ unless

p
 $\boxed{\text{he is paired with the Captain}}$

Statement: p unless q

Negation: $\sim p$ and $\sim q$

Sachin did not score a century and he is not paired with the Captain.

20. $\boxed{\text{Bond will buy the car}}$ only if $\boxed{\text{it is the costliest}}$

r
 $\boxed{\text{fastest}}$

Statement: p only if (q and r), i.e., $p \Rightarrow q$ and r

Negation: p and $\sim(q$ and $r) \Rightarrow p$ and $(\sim q$ or $\sim r)$

Therefore, Bond bought the car and it is not the costliest or it is not the fastest.



21. The statement is in the form of if p , then q .
The implications are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Therefore, it can be ac or db.
22. The statement is in the form of q , only if p .
Implications:
(i) $q \Rightarrow p$ (ii) $\sim p \Rightarrow \sim q$
Therefore, it can be ac or db.
23. Statement: whenever p , then q .
Implications:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Therefore, the answer can be ac or db.
24. The chief guest will come on time = q
if
the fog does not affect the flight timings = p .
The implications of above statements are:
(i) $p \Rightarrow q$ (ii) $\sim q \Rightarrow \sim p$
Only if
the chief guest comes = q

then the meeting be started = r .

The implications of above statements are:

- (i) $r \Rightarrow q$ (ii) $\sim q \Rightarrow \sim r$

Therefore, implications with respect to q is not possible here.

25. Unless
the coding is done = p
the software project cannot be completed = q .
The implications of above statements are:
(i) $\sim p \Rightarrow q$ (ii) $\sim q \Rightarrow p$
If
the company does not meet the project completion dead line = q ,
the team working on it employees will be fired = r .
The implications of above statements are:
(iii) $q \Rightarrow r$ (iv) $\sim r \Rightarrow \sim q$
The given statement is 'the team working on the project are not fired' $\Rightarrow \sim r$.
From (iv) $\sim r \Rightarrow \sim q$ and from (ii) $\sim q \Rightarrow p$
Therefore, $\sim r \Rightarrow p$ 'the coding is done'.

11

Quant Based Reasoning

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn how to deal with questions which involve concepts of both logical reasoning and quantitative aptitude
- Learn how to interpret the given data and get the final outcome out of it.

□ INTRODUCTION

In this section we deal with questions which are a mixture of both quantitative as well as reasoning section. Such, questions are important from the exam point

of view as the CAT generally gives questions based on combination of multiple topics.

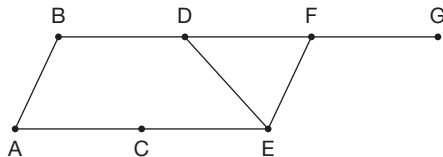
EXERCISE-1

Directions for questions 1 to 10: Select the correct alternative from the given choices.

1. The maximum possible number of squares that can be formed using 12 straight lines is _____.
(A) 45 (B) 55
(C) 60 (D) 65
2. Two candles of different lengths burn at different rates. Each candle burns exactly for one hour. Which of the following time intervals can we measure by burning these candles?
(A) 20 minutes (B) 15 minutes
(C) 10 minutes (D) 24 minutes
3. A group of three friends Rose, Jasmine and Tulip were watching butterflies. All three of them saw one butterfly in common. Any two of them saw two butterflies in common and each one of them saw one butterfly which is not common with others. Among the butterflies seen by Tulip, four have polka dots on them. Among the butterflies seen by Jasmine, three have polka dots on them and among the butterflies seen by Rose, two have polka dots on them. What is the minimum possible number of butterflies that do not have polka dots on them?
(A) 0 (B) 1
(C) 2 (D) 3
4. Mr Bhatnagar is an exporter of Champagne. While crossing the borders he bribes the guards by giving them a bottle of Champagne per box of Champagne to cross every border. Each box can contain a maximum of 15 bottles of Champagne. If he has to cross 10 borders to supply 50 bottles of Champagne, then what is the minimum possible number of bottles of Champagne he should start with?



- (A) 110 (B) 99
(C) 105 (D) 107
5. When I asked my friend about her age, she said that she has two siblings and the product of the ages of the three is 15 and the sum of their ages is an odd number, then what is the age of my friend if she is the eldest?
(A) 1 (B) 3
(C) 5 (D) Cannot be determined
6. A pile has 34 coins. Two friends, Neeta and Leena are playing a game in which each of them draws 2 or 3 coins from a pile of 34 coins. The person to draw the last coin is the loser. How many coins should Neeta draw to ensure her win if she is the first one to draw?
(A) 2
(B) 3
(C) Either (A) or (B)
(D) Neeta cannot win
7. Using a 4 litre vessel and 6 litre vessel which of the following quantities of water cannot be measured? (Assume there is infinite supply of water)
(A) 2 litre
(B) 3 litre
(C) 8 litre
(D) More than one of the above
8. Each of A, B and C is a different digit among 1 to 9. How many different values of the sum of A, B and C are possible, if $ABA \times AA = ACCA$?
(A) 1 (B) 3
(C) 7 (D) 8
9. In the following diagram, A is the reserve station from which a lorry can take 100 units of liquid at a time to be supplied to B, C, D, E, F and G, whose requirements per day are 78, 61, 26, 42, 34 and 59 units, respectively. Every day a lorry starts at A and supplies the requirements. In this process it moves back and forth from A to the other places and the location of all places is as shown in the diagram given below:



In a day, how many times does the lorry start from A and what is the unused capacity of the lorry per day?

- (A) 4 times and 100 units.
(B) 5 times and 200 units.
(C) 3 times and zero units.
(D) 5 times and zero units.

10. The following sets of weighing stones are available to measure weights.

Number of stones in the range	Weights in the range (in grams)	Interval between two successive weights
9	1.001, 1.002, ...1.009	0.001 g
49	1.01, 1.02, 1.49	0.01 g
19	0.5, 1.0, 1.5, ...9.5	0.5 g
9	10, 20, 30, ...90	10 g

What is the minimum number of stones required to weigh an item which weighs 68.892 g?

- (A) 6 (B) 5
(C) 3 (D) 4

Directions for questions 11 to 13: These questions are based on the following letter multiplication in which each letter represents a unique non-zero digit.

$$\begin{array}{r} A B C \\ B A C \\ \hline C A D E F C \end{array}$$

Also, it is known that $E = 3B$, $F = A + B$ and $3A = 2D$

11. What is the value of C?
(A) 1 (B) 3
(C) 5 (D) 2
12. What is the value of A?
(A) 2 (B) 4
(C) 5 (D) 6
13. What is the value of F?
(A) 3 (B) 6
(C) 9 (D) 7

Directions for questions 14 and 15: These questions are based on the following letter multiplication in which each letter represents a unique non-zero digit.

$$\begin{array}{r} A B \\ C D \\ \hline F E B D \end{array}$$

Also, it is known that $D = E + A$, $B = 2E$ and $2B = 3F$.

14. What is the value of D?
(A) 4 (B) 1
(C) 8 (D) 5

15. What is the value of C?

- (A) 3 (B) 7
(C) 9 (D) 6

Directions for questions 16 and 17: These questions are based on the following letter multiplication in which each letter represents a unique non-zero digit.

A B
C D

CCEB

Also, it is known that $B = 2C$, $5D = 6E$ and $A = B + E$.

16. What is the value of A?

- (A) 7 (B) 9
(C) 5 (D) 3

17. What is the value of C?

- (A) 4 (B) 2
(C) 1 (D) 6

Directions for questions 18 to 21: These questions are based on the following information.

A computer helps in finding out a 4-digit code number in the following way.

If we select a number, the computer gives the number of digits present in the selected number. These numbers are also present at the same positions in the code number as shown in the column 'R' in the table given below. The computer also gives the number of digits present in the selected number. These numbers are not present in the code number, which is shown in the column W in the table.

To construct a code number only digits from 1 to 6 are used.

The following 3 numbers are selected to find out the code.

S. No.	Selected number	R	W
1	3425	2	2
2	3625	1	2
3	3426	2	1

18. If 6 is the first digit from the left in the code number then which of the following is the second digit from right?

- (A) 1 (B) 2
(C) 3 (D) 4

19. If 6 is the second digit from the right, then which of the following is the first from the left in the code number?

- (A) 1 (B) 2
(C) 3 (D) 4

20. Which of the following digits is not in the code number?

- (A) 2 (B) 3
(C) 5 (D) 4

21. Which of the following cannot be the code number?

- I. 6421 II. 3461
III. 3416
(A) Only I (B) Only III
(C) Only II (D) Both I and III

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

A group of five people, namely Govind, Mathew, Naveen, Jagdish and Preet travelled for a different time duration among 1 hour, 2 hour, 3 hour, 4 hour and 5 hour and at a different speed among 15 kmph, 20 kmph, 30 kmph 40 kmph and 60 kmph, not necessarily in the same order. The total distance travelled by each of them is also different. The following is the information known about them.

- (i) Naveen travelled the maximum distance but he neither travelled at the maximum speed nor for the maximum duration.
(ii) Govind travelled more distance than Preet but less distance than Mathew.
(iii) Jagdeesh travelled a distance of 120 km.
(iv) None of them travelled a distance of 60 km and one of them travelled a distance of 30 km.

22. Who travelled at a speed of 15 kmph?

- (A) Jagdish (B) Mathew
(C) Govind (D) Cannot be determined

23. For what time duration did Govind travel?

- (A) 1 hour (B) 2 hour
(C) 3 hour (D) 5 hour

24. Who travelled for the least time duration?

- (A) Jagdish (B) Govind
(C) Mathew (D) Preet

25. If everyone reached the picnic spot at the same time then who among them started earlier than anyone else?

- (A) Jadish (B) Govind
(C) Mathew (D) Preet

Directions for questions 26 to 29: These questions are based on the following information.

A group of six teams from A to F participated in a football tournament. Each team played exactly one match against each of the other teams in the tournament. The tournament was planned in three weeks such that equal number of matches are played in each week and each team played at least one match but not more than two matches in a week. The following table gives week-wise performance of the teams.



Teams	Result at the end of the 1st week		Result at the end of the 2nd week		Result at the end of the 3rd week	
	Goals for	Goals against	Goals for	Goals against	Goals for	Goals against
A	6	3	9	5	14	8
B	1	3	1	9	7	13
C	4	6	10	8	11	8
D	1	3	6	7	8	11
E	5	4	7	7	10	12
F	6	4	10	7	12	10

- (i) No match ended in a draw.
- (ii) No team scored more than 3 goals in a match.
- (iii) No match was played between A and E in the second week.

26. Who won the maximum number of matches?

- (A) C
- (B) F
- (C) A
- (D) B

27. Against whom did B play in the third week?

- (A) Both A and F
- (B) Both D and F
- (C) Only D
- (D) Both D and E

28. In the first week, D play (s) the match against

- (A) A only
- (B) E only
- (C) Both A and E
- (D) Both A and C

29. In how many matches was there a goal difference of more than 1?

- (A) 3
- (B) 4
- (C) 5
- (D) 6

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

Narayan, Michael and Russell participated in a car race. All three of them could drive the car for distinct time periods (because their fuel tanks got empty) and at different speeds (in km/hr). The person who drove the car for the maximum time period had driven at a minimum speed compared to the other two but covered the maximum distance. The person who drove at the maximum speed covered the minimum distance of 360 km, but he was not Michael, who drove at 150 km/hr. Russell drove the car for a time period, which was the same as the sum total of the time periods taken by the other two contestants. The total distance covered by all the three contestants is 1620 km. The speeds and the time taken by the contestants in their respective units (km/hr and hr) are integral numbers.

30. What is the distance covered by Russell?

- (A) 360 km
- (B) 600 km
- (C) 810 km
- (D) 660 km

31. What is the time taken by Michael?

- (A) 2 hours
- (B) 3 hours
- (C) 4 hours
- (D) 5 hours

32. Which of the following statements may be true?

- (A) Russell drove at a speed of 110 km/hr.
- (B) Narayan drove the car for 2 hours.
- (C) Russell drove at a speed of 132 km/hr.
- (D) More than one of the above

33. If no contestant drove the car at a speed beyond 200 km/hr, then what was the speed of Narayan?

- (A) 110 km/hr
- (B) 132 km/hr
- (C) 180 km/hr
- (D) 150 km/hr

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

In a tournament, each of the six teams played every other team. In a match between two teams, the winner got two points, the loser got zero points and if it was a draw, then each team got one point. Scores of A, B, C, D, E and F were 9, 8, 7, 3, 2 and 1 point, respectively. There were exactly two draws.

34. D had a tie with which of the following teams?

- (A) A
- (B) C
- (C) F
- (D) Cannot be determined

35. A had a tie with which of the following teams?

- (A) D
- (B) C
- (C) F
- (D) B

36. Which of the following lost the maximum number of matches?

- (A) D
- (B) E
- (C) F
- (D) Both E and F

37. Out of the following teams, A did not win against

- (A) B
- (B) C
- (C) D
- (D) F

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

Ravi, a retail dealer of Air-Tel prepaid cards, asked his brother Gopi to buy cards of denominations ₹200, ₹700, ₹1000, ₹1500 and ₹2000. He asked Gopi to buy five cards each of exactly three of the above denominations and six cards each of the remaining denominations. However, Gopi forgot which denominations he was supposed to buy five and which he had to buy six of each. However, the wholesale dealer could figure out how many cards of each denomination were required as Ravi had sent an amount of ₹30,000, which was the exact amount required to buy the cards of Ravi's choice.

38. What is the ratio of the total number of cards of denominations ₹200 and ₹2000 to those of all other cards purchased by Gopi?
- (A) 10 : 17 (B) 16 : 11
(C) 17 : 11 (D) 11 : 16

39. What is the total value of all those cards of which five each were bought?

(A) 14,400 (B) 12,000
(C) 18,000 (D) 16,000

40. If Gopi had told the shopkeeper that he required 6 cards each of the 3 denominations that his brother asked him to get 5 each and 5 cards each of the other denominations that his brother asked him to get 6 each, then what is the amount that Gopi would have left with him or fall short of from the total amount of ₹30,000 his brother had given him?

(A) He was left with ₹600.
(B) He fall short of ₹400.
(C) He fall short of ₹600.
(D) He was left with ₹400.

EXERCISE-2

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

There are 8 containers and each container has K number of balls. Each of the balls in seven containers weighs 2 kg, whereas each of the balls in the remaining container weighs 1 kg. A spring balance is used to weigh these balls and n is the number of minimum weighing required to find the container that contains 1 kg balls.

1. If $K = 12$, then $n = ?$
- (A) 1 (B) 2
(C) 3 (D) 4
2. If $K = 4$, then $n = ?$
- (A) 1 (B) 2
(C) 3 (D) 4
3. If $K = 3$, then $n = ?$
- (A) 1 (B) 2
(C) 3 (D) 4

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

Mr Helpinghand has ₹ x with him in the denomination of ₹1 only. Each time a beggar approaches him, he divides the money with him into four equal parts and a remainder (if any). He gives one part and the remainder (if any) to the beggar. This continues till he is left with less than ₹4, which he gives to the last beggar.

4. If Mr Helpinghand has ₹45 with him, then to how many beggars can he give money?

(A) 9 (B) 7
(C) 8 (D) 6

5. If Mr Helpinghand wants to give money to five beggars, then what is the minimum possible initial amount he has to carry with him?

(A) ₹12 (B) ₹24
(C) ₹18 (D) ₹16

6. If Mr Helpinghand wants to serve six people, then what is the maximum possible amount he might be carrying?

(A) ₹31 (B) ₹27
(C) ₹28 (D) ₹30

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

A group of five people, namely Sarvajeet, Manjeet, Paramjeet, Karamjeet and Biswajeet invested a different amount, such as ₹2000, ₹3000, ₹4000, ₹5000 and ₹6000 at a different simple rate of interest among 4, 5, 6, 7.5 and 8 per cent per year for 5 years. The following is the information known about them.

- The interest earned by each one of them was different.
- The interest earned by Sarvajeet was more than that earned by Karamjeet, which was more than that earned by each of Paramjeet and Biswajeet. Manjeet earned the least interest among the five.
- The interest earned by Biswajeet was ₹600.
- The person who invested the maximum amount did not earn the highest interest.



7. What is the investment made by Paramjeet?
(A) ₹4000 (B) ₹5000
(C) ₹3000 (D) Cannot be determined
8. What is the interest earned by Sarvajeet?
(A) ₹1800
(B) ₹1875
(C) ₹2000
(D) Cannot be determined
9. Who invested at 6% per annum rate of interest?
(A) Paramjeet (B) Karamjeet
(C) Biswajeet (D) Sarvajeet
10. What is the difference between the interest earned by Biswajeet and Karamjeet?
(A) ₹1000 (B) ₹1500
(C) ₹1275 (D) ₹1200

Directions for questions 11 to 15: These questions are based on the following information.

In a game show called 'Graded Answer' there were five contestants, namely Kamal, Ranjit, Ajay, Varun and Sashank.

In each round a question was given to all the contestants. For each question the computer has ten predetermined answers. In each round, every contestant gave one answer from these predetermined answers and no contestant is aware of the answers given by the other contestants. Each set of answers were given distinct grades by the computer. In each round, the computer awards points to the contestants based on the grade of the answer given by them. The contestant whose answer has the lowest grade among the five answers, gets one point and the points for other contestants are increased if the grade goes on increasing. In the first round the five contestants gave five different answers. The table given below shows some of the cumulative scores of the contestants at the end of different rounds.

No.	Kamal	Ranjit	Ajay	Varun	Sashank
1	5	2			4
2	6		3		
3					5
4	7	7	7		7
5		9			11
6			9		
7	13	14		15	

In any round if a group of contestants (i.e., two or more) give the same answer, then the cumulative scores at the end of that round of each contestant in the group is reduced to the least of the cumulative scores of the contestants of this

group at the end of the previous round the rest of the contestants get points starting from 1 depending on the grades as explained in earlier.

We know the following additional information about the proceedings of the game.

- (i) The cumulative scores of at least two contestants are equal at the end of the second round onwards until at the end of the sixth round (both the rounds included).
 - (ii) If two or more people give the same answer in a round, in the next round the answers given by the contestants are distinct.
 - (iii) The game ended in the seventh round, at the end of which the cumulative scores are distinct.
 - (iv) Each contestant's answer matches with that of another contestant in at least one round in the game.
 - (v) The averages of cumulative scores for the five contestants at the end of each of the round 1 and 2 are the same.
 - (vi) In the sixth question, only Kamal and Varun gave the same answers.
 - (vii) Total of cumulative scores of the contestants at the end of the fifth round was 51 and that at the end of the seventh round was 71.
 - (viii) In the fourth round, Varun gave the least graded answer.
 - (ix) The person with the highest cumulative score at the end of the game was the winner.
11. Who was the winner?
(A) Ajay (B) Varun
(C) Sashank (D) Either (A) or (B)
 12. Who gave the same answer in the second round?
(A) Varun and Sashank
(B) Ajay and Sashank
(C) Ranjit and Sashank
(D) Ranjit, Varun and Sashank
 13. What was the score of Ranjit at the end of the third round?
(A) 3 (B) 5
(C) 4 (D) Either (3) or (5)
 14. What was the score of Kamal and Varun at the end of the sixth round?
(A) 10, 10 (B) 11, 11
(C) 12, 12 (D) Either (A) or (C)
 15. Who gave the highest graded answer in the fifth round?
(A) Kamal (B) Sashank
(C) Varun (D) Ajay

Directions for questions 16 to 19: These questions are based on the following information:

In sports gambling's, fractional odds are often used. If a bookmaker is offering an odd of 10/1 on a particular team, it means that for every ₹1 that a gambler puts at stake, he earns ₹10, in addition to the original stake being returned to him. If the team loses, the gambler, of course, does not win anything and loses his stake on a particular day, when three football matches are taking place. Match I is between teams A and B, Match II is between teams C and D, Match III is between teams E and F. A bookmaker has offered the following odds on different teams:

Match	Odds	Odds
I	A – 1/4	B – 10/1
II	C – 2/5	D – 7/2
III	E – 20/1	F – 1/5

An 'upset' happens when a team beats an opposing team, which had better chance of winning. The bookmaker offers worse odds on teams that are expected to win.

For example: A team with odds 2/7 has a better chance of winning than a team with 7/2 odds.

16. Amit put ₹100 at stake in each of the three matches (one team per match). What is the maximum possible amount that he can receive, if there is only one match that results in an upset?
(A) 2365 (B) 2745
(C) 2435 (D) 2565
17. If there was no upset in any of the three matches and Bhaskar bet ₹20, ₹40 and ₹60 in each match (in any order) and he ended up earning the maximum possible amount, then what is his total earnings?
(A) 158 (B) 162
(C) 170 (D) 188
18. If Ravi bet equal amounts on all the six teams, then which results are most favourable to him if there are 2 upsets? Pick the option with the winning teams.
(A) B, C, E (B) A, D, E
(C) B, D, E (D) B, C, F
19. Suresh has a strong feeling that team F will win and he bought stake ₹50 on it. He bought a stake ₹50 in one of the teams playing Match II. What is the difference between the maximum and minimum earnings?
(A) 285 (B) 250
(C) 265 (D) 295

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

In a college, each of the 900 students participated in at least one of the six events, 50 m dash, 100 m dash, 150 m dash, 200 m dash, 250 m dash and 300 m dash. No student who participated in the 50 m dash participated in the 200 m dash or in the 250 m dash. No student who participated in the 300 m dash participated in the 100 m or 150 m dash. The same number of students participated in only 50 m dash, only 100 m dash, only 150 m dash, only 200 m dash, only 250 m dash and only 300 dash. The same number of students participated in each combination of exactly two events. An equal number of students participated in each combination of exactly three events. 20 students participated in exactly four events. The number of students who participated in only 100 m dash, in only 100 m and 50 m dash and in only 100 m, 50 m and 150 m dash are in 1 : 2 : 3 ratio.

20. How many students participated in the 50 m dash?
(A) 80 (B) 160
(C) 100 (D) 120
21. How many students participated in both the 100 m dash and the 150 m dash?
(A) 240 (B) 180
(C) 200 (D) 320
22. How many students did not participate in the 300 m dash?
(A) 160 (B) 640
(C) 580 (D) 740
23. How many students participated in at most two events?
(A) 680 (B) 520
(C) 600 (D) 440

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

P, Q and R played a game and each scored some points. The number of points is an integer. When I asked four individuals A, B, C and D about the scores of P, Q, and R, they made the following statements.

- A: Exactly two of P, Q and R together scored 10 points.
- B: Exactly two of P, Q and R together scored 11 points.
- C: Exactly two of P, Q and R together scored 12 points.
- D: Exactly two of P, Q and R together scored 13 points.

I understood that at least one of A, B, C and D was lying and later I found out the names of the people who could have lied.



24. Who was not lying?
 I. A II. B
 III. C IV. D
 (A) Only I and III
 (B) Only II and IV
 (C) Only I and IV
 (D) Only II and III
25. If the average score of P, Q and R is an integer, then who lied?
 (A) A (B) B
 (C) C (D) D
26. Which of the following is the highest score?
 (A) 6 (B) 7
 (C) 8 (D) 9
27. Which of the following is the least score?
 (A) 3 (B) 4
 (C) 5 (D) Cannot be determined

Directions for questions 28 to 31: These questions are based on the following information.

A group of four wealthy people, namely Oswald Henry, Princess Stephanie, Gennady Yuganov and Henry Ford III each bought one of four different classic watches, such as a Louis Ulysse Chopard, a Breguet Dupuis, a Piaget Sunmaster and a Rolex Mercator at the annual Sotheby's auction. The following information is available about the person, the watch purchased and their prices.

- The total amount paid for these four watches was \$8,40,000 and the costliest watch was priced \$1,20,000 more than the cheapest.
 - Oswald did not purchase the costliest watch and neither did he purchase a Piaget.
 - Gennady did not buy the costliest or the cheapest watch but had paid \$1,80,000 for his watch.
 - The Rolex Mercator is the costliest and the Chopard is the cheapest among the watches.
 - Princess Stephanie purchased the Breguet Dupuis and had paid \$40,000 more than what Gennady Yuganov had paid.
28. Which watch did Oswald Henry purchase and at what price?
 (A) Louis Ulysse Chopard at \$2,20,000.
 (B) Rolex Mercator at \$1,80,000.
 (C) Louis Ulysse Chopard at \$1,60,000.
 (D) Rolex Mercator at \$1,60,000.
29. What is the difference in the cost of the watches purchased by Henry Ford III and Gennady Yuganov?

- (A) \$80,000 (B) \$1,00,000
 (C) \$1,20,000 (D) \$1,10,000

30. Which of the following statements is true?
 (A) Princess Stephanie bought the cheapest watch.
 (B) Oswald Henry did not purchase the Louis Ulysse Chopard.
 (C) Henry Ford III bought a watch that was priced \$60,000 more than the Piaget Sunmaster.
 (D) The watches bought by Oswald Henry and Henry Ford III cost more than the watches bought by Gennady Yuganov and Princess Stephanie.
31. Which of the following watches was purchased by Gennady Yuganov?
 (A) The watch that was priced \$40,000 less than the one bought by Henry Ford III.
 (B) The watch that was the cheapest of all.
 (C) The watch that was called Piaget Sunmaster.
 (D) The watch that was called Breguet Dupuis.

Directions for questions 32 to 35: These questions are based on the following information:

These questions are based on the following information.

Six friends are comparing their expenses on a recent trip to Goa. Each of them spent a different amount. The following information is known about their expenses.

- Piyush spent ₹3783.
 - Saket spent ₹4640, which is ₹600 more than how much Uday spent.
 - The difference between the expenses of Uday and Tomar is ₹535.
 - The maximum difference between the expenses of any two of the six is ₹1135, whereas the minimum difference between the expenses of any two people is ₹167.
 - The difference between the expenses of Qureishi and Raina is ₹246.
 - Raina spent ₹4227.
32. How much did Qureishi spend?
 (A) ₹4473 (B) ₹4493
 (C) ₹3981 (D) ₹4040
33. Whose expense was the highest?
 (A) Qureishi (B) Saket
 (C) Raina (D) Tomar
34. What is the difference between the expenses of Raina and Uday?
 (A) ₹167 (B) ₹246
 (C) ₹187 (D) ₹257

35. Which of them spent the third least amount?

- (A) Tomar (B) Uday
(C) Raina (D) Qureishi

Directions for questions 36 to 40: These questions are based on the following information.

A company named XYZ Ltd. manufactures a product 'Q' and sends it to five of its outlets A, B, C, D and E. The cost of production is ₹10,000 per unit. To transport one unit of Q to A, B, C, D and E, XYZ Ltd. spends ₹1000, ₹2000, ₹3000, ₹4000 and ₹5000, not necessarily in that order. The selling price of Q is ₹20,000 at three of the outlets, ₹21,000 at one of the outlets and ₹22,000 at another. Two of the outlets sell 40 units each per month and the remaining outlets sell 30 units, 45 units and 50 units per month. Sum of the cost of production and cost of transportation is subtracted from the selling price to arrive at profit per unit. The product of profit per unit and sales in units per month is profit per month. The following additional information is available.

- I. One of the outlets earns ₹5,000 as profit per unit and it gets the least profit per month.
- II. Exactly two outlets earn the same amount of profit per unit.
- III. None of the outlets earn ₹11,000 profit per unit.
- IV. Profit of outlet E per month is ₹3,20,000.
- V. Profit per unit at outlet D is more than that at outlet E but its profit per month is less than that at outlet E.
- VI. Profit of outlet B per month is ₹10,000, which is more than that of another outlet.

VII. Profit of outlet A per month is more than that of outlet C.

VIII. There is exactly one outlet which earns more profit per month than that of outlet E.

IX. Selling prices at outlets A, D and E are distinct.

36. What is the profit per month earned by the outlet B?

- (A) ₹2,70,000 (B) ₹4,50,000
(C) ₹4,05,000 (D) ₹2,80,000

37. What is the selling price of the outlet E?

- (A) ₹20,000 (B) ₹21,000
(C) ₹22,000 (D) Cannot be determined

38. If the selling price at outlet A is more than that at outlet D, then what is the transportation cost per unit at outlet A?

- (A) ₹1000 (B) ₹2000
(C) ₹3000 (D) ₹4000

39. If the number of units sold by the outlet A is more than those sold by the outlet C, then what is the profit per month of C?

- (A) ₹2,50,000 (B) ₹2,70,000
(C) ₹2,25,000 (D) ₹2,80,000

40. What is the profit per unit at the outlet E?

- (A) 8000 (B) 9000
(C) 10,000 (D) None of these

EXERCISE-3

Directions for questions 1 to 4: These questions are based on the following information:

A chemical crusher unit has five different mills, such as P, Q, R, S and T of different capacities. The crusher unit operates 24 hours per day in three shifts 01st – 08th hour, 09th – 16th hour and 17th – 24th hours.

The time during which the mill is running is called uptime. For any mill each uptime is of exactly one-hour duration. In a period of 24 hours each mill has at least four hours of total uptime. The time period between two successive uptimes is called downtime. It is measured in hours and is always a whole number.

The downtime of a mill is directly proportional to its capacity and a constant. No two mills have the same downtime duration between successive uptimes.

During his visit in the third shift on a particular day, the new maintenance engineer observed that the mills P, Q, R, S and T were in uptime in the first five hours of the third shift, in that order. He was given a slip of paper indicating the history of functioning of the mills, observed during their uptime.

Mill	Day	Time
P	Yesterday	5th hour of the third shift
Q	Two days ago	6th hour of the third shift
R	Two days ago	3rd hour of the third shift
S	Yesterday	2nd hour of the day
T	Yesterday	Last hour of the day



The engineer kept thinking if he could determine the uptimes and downtimes of each of the mill.

- Which mill has the highest capacity?
(A) P (B) S
(C) R (D) Cannot be determined
- If different ranks from 1 to 5 were given to the mills in the descending order of their downtimes, then which mill will be ranked the second?
(A) P (B) T
(C) R (D) Cannot be determined
- If mill R has lesser downtime than P, but not the lowest amongst all, then what is the downtime of mill R?
(A) 4 hours (B) 6 hours
(C) 3 hours (D) 8 hours
- If mill R has greater downtime than mill S, which of the following is true for the mills P, Q, R, S and T to be in their uptime in the first five hours of a day respectively?
(A) This is possible at least once in a week.
(B) This is possible at most once in a week.
(C) Cannot be determined.
(D) Such a case is not possible.

Directions for questions 5 to 8: These questions are based on the following information.

A tour operator plans a one tour package each in four different circuits. Each tour starts at 7 a.m. from the office in a bus on the first day of the tour package and ends by dropping the tourists back at the office at 7 p.m. on the last day of the tour package. The four tour packages are (i) Circuit A – Seven days duration which starts every Wednesday and Thursday (ii) Circuit B – Three days duration which starts every Thursday and Friday (iii) Circuit C – Four days duration which starts every Wednesday and Saturday and (iv) Circuit D – A daily tour of 12 hour duration.

- If a person has started his tour with Circuit A, then what is the minimum number of days required for him to completely tour all the circuits?
(A) 18 days (B) 17 days
(C) 16 days (D) 15 days
- To completely tour all the four circuits in the shortest possible time, with which tour does a person shall start his touring?
(A) Circuit C on Saturday.
(B) Circuit B on Friday.
(C) Circuit C on Wednesday.
(D) Circuit B on Thursday.
- On which day of the week, will there be the least activity at the tour operator's office?
(A) Sunday (B) Friday
(C) Monday (D) Saturday

- If a person wants to complete all the circuits in the shortest possible time but with one day rest between any two tour packages, what is the best day for a person to start touring?

(A) Friday (B) Monday
(C) Sunday (D) Wednesday

Directions for questions 9 to 12: These questions are based on the following information.

A kid is promised by his father that starting the following Monday, a pocket money of five rupees per day will be given every day in the morning. The kid has school for five days in a week from Monday to Friday and wants to spend that amount for purchasing snacks during break in the school. He equally likes the chocolate (₹5), Samosa (₹10) and the pastry (₹15). He purchases not more than one item on any day. He makes a purchase if he has sufficient amount to purchase an item and he will not purchase the same item in the next two purchases.

(Assume that the kid did not have any other money and there are no holidays other than Saturdays and Sundays)

- Which of the following is true with regard to the pattern in which the kid makes his purchases?
I. More data is required to identify a pattern.
II. The pattern of the purchases is repetitive.
III. If the first purchase of the kid is known, then the pattern will be repetitive.
(A) Only I and III (B) Only II
(C) Only I (D) Either I or III
- What is the maximum possible amount available with the kid on any Monday?
(A) ₹15 (B) ₹20
(C) ₹25 (D) Cannot be determined

Additional information for questions 11 and 12: During the second week, the kid tasted a complimentary fruit worth ₹5, he decided to add to the fruit his purchase list from the following Monday, along with the other three such that the price of every next purchase increases and decreases alternately.

- Which of the following is definitely true?
(A) The kid does not purchase on a Wednesday.
(B) The kid does purchase on a Thursday.
(C) The kid does not purchase on a Friday.
(D) The kid does purchase on a Tuesday.
- What is the maximum possible amount available with the kid on any Monday (after he decided to eat the fruit)?
(A) ₹15 (B) ₹20
(C) ₹25 (D) Cannot be determined

Directions for questions 13 to 16: These questions are based on the following information.

Annie, Ben, Cain, Dan and Engel are five friends who purchased a book where each of them related to one of

the following fields, such as Architecture, Biotechnology, Criminology, Demography and Economics. Further, the following information is known.

- (a) No friends first letter of the name matches with the field to which the book purchased is related.
 - (b) Annie and Dan love to read books related to Criminology apart from the books they purchased.
 - (c) Engel hates Criminology and Biotechnology and hence, did not purchase them.
 - (d) The first letter of the field to which the book that Ben purchased pertains to, matches with the first letter of the name of the friend who purchased a book pertaining to Biotechnology.
13. After a month of reading, Annie exchanges her book with Dan and then Dan exchanges this book with Engel. The exchanges resulted in the first letter of the friends matching with the field to which the book belonged without violating conditions (b) to (d). Which of the following is true?
- (A) Engel bought the book which is related to Demographics.
 - (B) Annie bought the book which is related to Demographics.
 - (C) Dan bought the book which is related to Economics.
 - (D) Engel bought the book which is related to Architecture.
14. Which of the following is not necessarily true?
- (A) Either Annie or Ben bought a book which is related to Criminology.
 - (B) Dan bought the book which is related to either Architecture or Economics.
 - (C) Either Dan or Engel bought the book which is related to Architecture.
 - (D) Either Engel or Cain bought the book which is related to Demographics.
15. While delivering the books, the sales man interchanged the books of two friends in such a manner that the field to which the book belonged and the starting letter of only one of the friends matched. However, conditions (b) to (d) were not violated.
- Which of the following conditions lets you to completely determine the fields of the books possessed by the five friends?
- (A) Annie's and Engel's books were interchanged.
 - (B) Neither Annie nor Engel possess the book related to Economics after the sales man interchanged their books.
 - (C) Neither Dan nor Engel had books related to Biotechnology after the interchange.
 - (D) Interchange happened between the books of Annie and Dan.

16. While delivering the books, the sales man interchanged the books of two friends in such a manner that the field to which the book belonged and the starting letter of only one of the friends matched. However, conditions (b) to (d) were not violated. Then which pair of statements among (a), (b), (c) and (d) cannot be true simultaneously?
- (a) Dan did not possess books related to Economics after the interchange.
 - (b) Engel did not possess books related to Architecture after the interchange.
 - (c) Neither Dan nor Annie possess the books related to Economics after the interchange.
 - (d) Interchange took place between Annie and Dan.
- (A) (a) and (b)
 - (B) (b) and (d)
 - (C) (c) and (d)
 - (D) (a) and (c)

Directions for questions 17 to 20: These questions are based on the following information.

A test consists of two parts. Part I consists of five questions and for any question the student will score two marks for a correct answer and zero for a wrong answer. Part II consists of four questions, in which for any question, the student will score ten marks for a correct answer, five marks for a partially correct answer and zero for a wrong answer.

17. Which of the following scores is not possible for the test?
- (A) 29
 - (B) 31
 - (C) 47
 - (D) 41
18. If Virat scored 33 marks then which of the following is not necessarily true?
- (A) Virat got at least one question wrong in Part I.
 - (B) Virat answered less than six questions in all.
 - (C) Virat did not answer any question of Part II wrong.
 - (D) Virat gave wrong answer to at least one question of Part II.
19. Each of Rahul, Beena, Johan and Bijaya attempted seven questions and did not get zero in any question. No two of them scored the same marks. What is the maximum possible difference of the total marks scored by Rahul and Beena, and that of the marks scored by Bijaya and Johan?
- (A) 51
 - (B) 43
 - (C) 52
 - (D) 44
20. If both U and V attempted six questions each, the marks scored by each of them are unique and the marks received for any question is other than zero, what is the minimum possible difference between their respective scores?
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4



Directions for questions 21 to 25: These questions are based on the following information.

A library assistant has marked four racks for shelving the books each from different specializations, such as Marketing, Operations, Systems and Human Resource. Totally, there are 24 books. The librarian arranged the textbooks in such a way that each rack contained even number of textbooks and they are unique and are non-empty. The students often misplace the textbooks among any of the racks. The following information about the books in various racks on a particular day are as follows.

- (i) Half the textbooks are placed incorrectly. But each rack has the same number of textbooks as there was originally.
- (ii) The number of textbooks in Marketing rack is equal to the sum of the number of textbooks in the other three racks.
- (iii) One third of the textbooks in the Marketing rack originally belong to the Operations rack.
- (iv) All but two textbooks that are there in the Human Resource rack originally belonged to a different rack.

- (v) The number of textbooks in the Operations rack is twice that of the number of textbooks in the Systems rack.
- (vi) The textbooks from a rack are misplaced into at most one rack.

- 21. How many textbooks belonging to Operations rack are placed in Human Resource rack?
- 22. How many textbooks belonging to Systems rack is placed correctly?
- 23. How many textbooks belonging to Human Resource rack are in the Operations rack?
- 24. Which rack has all the books correctly placed?
(A) Marketing (B) Operations
(C) Systems (D) None of these
- 25. How many text books related to Operations are in the systems rack?

ANSWER KEYS

Exercise-1

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

Exercise-2

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

Exercise-3

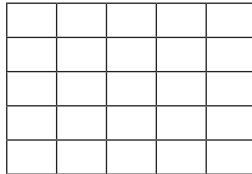
- | | | | | |
|--------|---------|---------|---------|---------|
| 1. (D) | 6. (A) | 11. (D) | 16. (C) | 21. 0 |
| 2. (A) | 7. (C) | 12. (A) | 17. (C) | 22. 2 |
| 3. (C) | 8. (D) | 13. (A) | 18. (B) | 23. 4 |
| 4. (D) | 9. (B) | 14. (D) | 19. (D) | 24. (C) |
| 5. (B) | 10. (C) | 15. (B) | 20. (A) | 25. 0 |

SOLUTIONS

EXERCISE-1

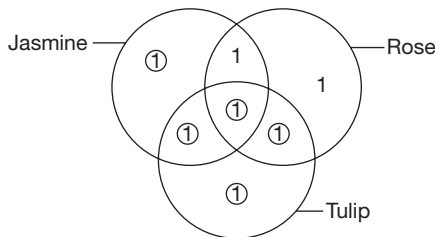
Solutions for questions 1 to 10:

- For the formation of maximum number of squares, six lines are to be horizontal and parallel to each other and the other six lines vertical are as shown below.



∴ The maximum possible number of squares
 $= 1^2 + 2^2 + 3^2 + 4^2 + 5^2 = 1 + 4 + 9 + 16 + 25 = 55$

- At first one candle is lighted from two sides and the second candle is lighted from one side.
 The first candle is burnt in 30 minutes. Immediately, the second stick is burnt from the other side.
 Now the remaining part of the second stick will be burnt in 15 minutes.
- This question can be answered by using a Venn diagram as follows.



Here, the circled number are having polka dots.

∴ There are only two butterflies which do not have polka dots.

- The details of the number of bottles while crossing the border is given below.

After crossing	Remaining number of bottles	Number of boxes	Number of bottles given as bribe
10th	$50 = 15 \times 3 + 5$	—	—
9th	$54 = 15 \times 3 + 9$	4	4
8th	$58 = 15 \times 3 + 13$	4	4
7th	$63 = 15 \times 4 + 3$	5	5
6th	$68 = 15 \times 4 + 8$	5	5
5th	$73 = 15 \times 4 + 13$	5	5
4th	$79 = 15 \times 5 + 4$	6	6

(Continued)

After crossing	Remaining number of bottles	Number of boxes	Number of bottles given as bribe
3rd	$85 = 15 \times 5 + 10$	6	6
2nd	$92 = 15 \times 6 + 2$	7	7
1st	$99 = 15 \times 6 + 9$	7	7
Initial	$107 = 15 \times 7 + 3$	8	8

∴ He should start with a minimum of 107 bottles of champagne.

- There are two possible sets of values for their ages.
 The product can be $5 \times 3 \times 1$ or $15 \times 1 \times 1$.
 ∴ The age cannot be uniquely determined.
- Neeta should draw in such a way that always $n(2 + 3) + 1$ coins remain, so that if Leena draws 3 coins Neeta should draw 2 coins and vice versa.
 So, there should be $30 + 1$ coins remaining.
 ∴ She should draw 3 coins.
 So, at the end there will be 6 coins from which Leena has to draw.
 So, in any case Neeta will win if she draws 3 coins initially.
- The process is tabulated below:

	4 litres	6 litres
Initial	0	0
1	0	6
2	4	2
3	4	0
4	0	4
5	4	4

Hence, 3 litres cannot be measured.

- From the given expression, A must be 1, the expression must be:
 $1 \text{ B } 1$
 $\times 1 \text{ 1}$

 $1 \text{ C C } 1$

 Here, B can be any value from 2 to 8.
 ∴ There will be a total of 7 different values.
- The total requirement is $78 + 61 + 26 + 42 + 34 + 59 = 300$ units.
 ⇒ The lorry starts 3 times and the unused capacity is zero units.



10. 68.892 g can be measured by using the following stones
 $1.002 + 1.39 + 6.5 + 60 = 4$ stones

Solutions for questions 11 to 13: The possible value for C is 1/5 (1 or 5).

As $E = 3B$, $B = 1/2/3$

As $3A = 2D$, $A = 2/4/6$ and $D = 3/6/9$.

If $A = 2$, then $D = 3$, $B = 1$, $C = 5$, $F = 3$

Hence, $A = 2$ is not possible as values of D and F will be same. If $A = 4$, then $D = 6$ and B cannot be 1 or 2. Therefore, B must be 3. Then $F = 7$ and $E = 9$.

If $C = 5$, $E = 9$

$$\begin{array}{r} 435 \\ \times 345 \\ \hline 150075 \end{array}$$

Hence, C cannot be 5.

If $C = 1$

$$\begin{array}{r} 431 \\ \times 341 \\ \hline 146971 \end{array}$$

Therefore, $A = 4$, $B = 3$, $C = 1$, $D = 6$, $E = 9$ and $F = 7$.

11. The value of C is 1.
 12. The value of A is 4.
 13. The value of F is 7.

Solutions for questions 14 and 15: The possible values for $B = 3/6/9$ and $F = 2/4/6$

As $B = 2E$, B must be 6.

If $B = 6$, then $E = 3$, $F = 4$, $D = 8$, and $A = 5$.

$\Rightarrow 4368 \div 56 = 78 \Rightarrow C = 7$

\therefore The values of $A = 5$, $B = 6$, $C = 7$, $D = 8$, $E = 3$ and $F = 4$.

14. The value of D is 8.
 15. The value of C is 7.

Solutions for questions 16 and 17: As $5D = 6E$, D must be 6 and E must be 5.

If $D = 6$, B must be either 2 or 4.

Case (i): $B = 2$.

$A = 7$, $C = 1 \Rightarrow 72 \times 16 = 1152$.

Hence, $B = 2$ is possible.

Case (ii): $B = 4$.

$A = 9$, $C = 2 \Rightarrow 94 \times 26 = 2444$.

Hence, $B = 4$ is not possible.

$\therefore A = 7$, $B = 2$, $C = 1$, $D = 6$ and $E = 5$.

16. The value of A is 7.
 17. The value of C is 1.

Solutions for questions 18 to 21: Assume that 2 and 5 are in the correct position. Then it must indicate 2 in column R in the 2nd selection.

\Rightarrow Both 2 and 5 are not at the correct position.

Assume that 5 is at the correct position.

\Rightarrow 3 and 2 are wrong.

\Rightarrow 4 is the 2nd digit in the code.

\Rightarrow There cannot be '2' in column 'R' in the 3rd selection.

\Rightarrow 5 is not present in the code.

Assume '2' is in the correct position.

\Rightarrow 4 is also in the correct position.

\Rightarrow 6 is present in the code but is not the 4th digit.

\Rightarrow The number is '6421'.

Assume '2' is not present in the code.

\Rightarrow 3 and 4 are in the correct position.

\Rightarrow 1 and 6 are present in the code and 6 is not the 4th digit in the code.

\Rightarrow The number is '3461'.

18. 2 is the second digit from right.

19. 3 is the first digit.

20. 5 is not present in the code number.

21. '3416' cannot be the code number.

Solutions for questions 22 to 25: Let us represent the people with the first letter of their name.

From (i) and (ii), we get the comparison of the distance travelled by them $N > M > G > P$.

From (i), it is given that the speed and the number of hour travelled by Naveen is not the maximum.

\therefore Speed cannot be 60 kmph and the number of hours travelled is not 5.

Hence, the distance travelled by N has to be less than 200 km.

As Jagdish travelled 120 km, Naveen travelled more than 120 km.

That can only be 160 km.

\therefore Naveen's Speed = 40 kmph and time = 4 hours.

Distance = 160 km

\therefore Jagdish cannot travel for 4 hours.

To get 120 km distance, there is only one possibility.

Jagdish has travelled at 60 kmph speed for 2 hrs.

Now, as one of them has travelled 30 km, that must be at 30 kmph speed for 1 hour.

The person who travelled at 20 kmph speed travelled for 5 hours, i.e., 100 km.

\therefore The person who travelled at 15 kmph speed travelled for 3 hours, i.e., 45 km.

The table of the final result is as follows.

Name	Speed	Time	Distance
Naveen	40	4	160
Jagdish	60	2	120
Mathew	20	5	100
Govind	15	3	45
Preet	30	1	30

22. Govind travelled at 15 kmph speed.

23. Govind travelled for 3 hours.

24. Preet travelled for the least time.

25. Mathew travelled for maximum time.

Solutions for questions 26 to 29: There are 6 teams, so 15 matches are played in the tournament and 5 matches in each week.

As no team scored more than 3 goals in a match. From the result of the first week it is clear that, each of A, C, E and F plays two matches. There was no match between A and E. The goals in the matches for each team in the first week can be represented as follows.

	1st week	
	For	Against
A	3 + 3	2 + 1
B	1	3
C	2 + 2	3 + 3
D	1	3
E	3 + 2	1 + 3
F	3 + 3	2 + 2

From the above table, E played one match with one of A and F and the other match with one of B and D.

C must play a match with A and the other match with F.
 \therefore The result of these two matches are A – 3, C – 2, and F – 3, C – 2.

As E scores 2 goals in the other match, then that match must be between F and E.

The result of that match is F – 3, E – 2.

\therefore B will play the match with either A or E and D will also play the match with A or E.

Similarly, for the second week after subtracting the goals of first week we will get the goals scored and conceded by a team.

The scoring pattern of the matches played by the 6 teams in the 3 weeks are tabulated below.

Teams	1st Week		2nd Week		3rd Week	
	Goals for	Goals against	Goals for	Goals against	Goals for	Goals against
A	3	1	3	2	3	2
	3	2			2	1
B	1	3	0	3	3	2
			0	3	3	2
C	2	3	3	2	1	0
	2	3	3	0		

(Continued)

Teams	1st Week		2nd Week		3rd Week	
	Goals for	Goals against	Goals for	Goals against	Goals for	Goals against
D	1	3	3	1	0	1
			2	3	2	3
E	3	1	2	3	2	3
	2	3			1	2
F	3	2	1	3	2	3
	3	2	3	0		

F played the 2nd match with D. Since A did not play with E in the 2nd week, so A's match was with D. The remaining match in 2nd week was between C and E.

Matches played in 2nd week were BC, BF, FD, AD and CE. In the 1st week C played one match with A and the other with F. Since A played with D in the 2nd week, so A's other match in the 1st week was with B. E played on match with F and the other one with D. Matches played in 1st week were CA, CF, AB, EF and ED.

In the 3rd week C's only match was with D. A played one match with E and the other with F. B played one match with D and other with E.

Matches played in 3rd week were CD, AE, AF, BD and BE. The results are as follows.

BC	B – 0	C – 3
BF	B – 0	F – 3
AD	A – 3	D – 2
EC	E – 2	C – 3
DF	D – 3	F – 1

\therefore In the first week a match cannot be between A and D. Hence, the match must be between A vs B and E vs D.

Similarly, for 3rd week, F and C play exactly one match each. In the match which C plays, it scores 1 goal and concede 0 goals.

\therefore Now the remaining matches are played in 3rd week.

The remaining matches are (A, F), (A, E), (B, D), (B, E), (C, D). By comparing the goals scored and conceded in the round, the goals scored by each team can be obtained.

The goals scored by each team will be as follows.

AE	A – 2	E – 1
AF	A – 3	F – 2
BD	B – 3	D – 2
BE	B – 3	E – 2
CD	C – 1	D – 0

26. A won the maximum number of matches.
 27. B plays against D and E in the 3rd week.
 28. In the 1st week the match was between D and E.
 29. There are 5 such matches.

Solutions for questions 30 to 33: It is clear that Russell drove the car for a maximum time period. Hence, his speed was minimum but the distance covered was maximum.

Person	Time	Speed	Distance
Narayan	t_n	S_n	$S_n t_n$
Michael	t_m	150	$150 t_m$
Russell	$(t_n + t_m)$	S_r	$(t_n + t_m) S_r$
	1620		

Let t_n, t_m be the time taken by Narayan, Michael while S_n and S_r are the respective speeds of Narayan and Russell.

$$S_r < S_n$$

$$S_r < 150$$

$$\text{Since, } S_n > 150 \Rightarrow S_r < 150 s_n$$

Since all the values in their respective units are integral numbers.

$$\Rightarrow 150 t_m \neq 360$$

$$\text{Also, } (t_n + t_m) s_r \neq 360$$

(Since, 360 km is the minimum distance)

$$\text{Hence, } s_n t_n = 360$$

$$\text{Here, } s_n > 150$$

$$\text{If } t_n = 1 \quad s_n = 360$$

$$t_n = 2 \quad s_n = 180$$

$$t_n = 3 \quad s_n = 60 \text{ (not possible)}$$

$$\text{Let } t_n = 1 \Rightarrow s_n = 360$$

Exploring possibilities, we get:

S. No.	t_n	t_m	$S_n t_n$	$(150 t_m)$	$(t_n + t_m) s_r$
1	2	1	360	300	960
2	3	1	360	450	810
3	4	1	360	600	660
4	5	1	360	750	410
5	6	1	360	900	260

Only in S. No. (3) the conditions are satisfied.

$$660 = (4 + 1) s_r$$

$$s_r = 132$$

Case I:

Person	Time (hours)	Speed (km/hr)	Distance (km)
Narayan	1	360	360
Michael	4	150	600
Russell	5	132	660

Case II:

$$\text{Let } t_n = 2, S_n = 180$$

Over here also, $t_m + t_n = (4 + 2) = 6$ hours is the only possibility.

$$\Rightarrow s_r = 660/6 = 110 \text{ km/hr}$$

Case (II):

Person	Time	Speed	Distance
Narayan	2	180	360
Michael	4	150	600
Russell	6	110	660

30. Distance covered by Russell is 660 km.
 31. Time taken by Michael is 4 hours.
 32. By observing the two possible cases, all the statements may be true.
 33. This belongs to case (II). Narayan drove at a speed of 180 km/hr.

Solutions for questions 34 to 37: As the scores of A, C, D and F are odd, they must have a draw each.

\Rightarrow B and E did not have any draw as only two draws are there in the tournament.

Now their scores are shown below:

Name	Won	Dram	Lost	Score
A	4	1	0	9
B	4	0	1	8
C	3	1	1	7
D	1	1	3	3
E	1	0	4	2
F	0	1	4	1

If D had a tie with either A or C, F must also have a tie with A or C.

\Rightarrow Both D and E won against F.

\Rightarrow D and E have a tie, this is not possible.

\Rightarrow D had a tie with F.

\Rightarrow A had a tie with C.

\Rightarrow A won against B, D, E and F.

B won against C, D, E and F.

C won against D, E and F.

D won against E.

E won against F.

34. D had a tie with F.
 35. A had a tie with C.
 36. Both E and F lost four matches each.
 37. A had a tie with C Hence, it did not win against C.

Solutions for questions 38 to 40: The total amount given is ₹30,000. 5 cards each of 3 of the given denominations and 6 cards each of the other denominations is required. The denominations are ₹200, ₹700, ₹1000, ₹1500, ₹2000. The key lies in identifying the cards of which 5 are bought.

Take for example, the ₹700 denomination card. If 6 of them are bought, it amounts to ₹4200 and whatever combination of other cards are bought, one cannot round off the hundreds to thousands (since exactly 30,000 is spent). It implies that 5 cards of ₹700 are bought which amounts to ₹3500. To round off the hundreds to the thousands Gopi needs to buy 5 cards of ₹1500 denomination (₹7500). 6 cards of ₹200 denomination will cause the same problem as discussed above. Hence, only 5 cards of ₹200 denomination is purchased. Therefore, 5 cards each of denominations 200, 700 and 1500 are purchased and 6 cards each of ₹1000 and ₹2000 denominations are purchased.

Denomination	Number purchased	Total amount
₹200	5	₹1000
₹700	5	₹3500
₹1000	6	₹6000
₹1500	5	₹7500
₹2000	6	₹12,000

38. The number of cards of denomination ₹200 are 11 and those of denomination ₹2000 are 16.
∴ Ratio is 11 : 16.

39. 5 cards each of ₹200, ₹700 and ₹1500 were bought.
∴ The combined value of these cards is
5 (200 + 700 + 1500) = 12000.

40.

Denomination	Number purchased	Total amount
200	6	1200
700	6	4200
1000	5	5000
1500	6	9000
2000	5	10000

Total amount = 29,400

∴ Gopi would have left with ₹600.

EXERCISE-2

Solutions for questions 1 to 3:

- When $K = 12$ we have to take one ball from the first bag, two from the second and so on. If the total weight is 1 kg less then the required box is the first one. If the weight is 2 kg less, then it is the second box and so on.
∴ Only one weighing is required.
- If $K = 4$ we have to take one ball each from the first two containers, two balls each from the third and fourth containers and so on.
Similar to the logic in the previous question we can find which group of containers consists 1 kg ball. Now by

weighing one ball from one of these two containers we can find that the container having balls of 1 kg.
Thus, two weightings are required.

- If $K = 3$ then we have to take one ball each from the first three containers and two balls each from the next three containers and three balls each from the last two containers.
We can find which group of containers has 1 kg ball. Now one more weighing is required to find the exact container in which 1 kg balls are present.
∴ A total of two weightings are required.

Solutions for questions 4 to 6:

- The money with Mr Helpinghand after giving to each beggar will be as follows:

	Initial	1st beggar	2nd beggar	3rd beggar	4th beggar	5th beggar	6th beggar	7th beggar	8th beggar
Amount given to the beggar	–	12	9	6	6	3	3	3	3
Amount with Mr Helpinghand	45	33	24	18	12	9	6	3	0

∴ Mr Helpinghand gives money to eight beggars.



5. Mr Helpinghand will always be left with money which is a multiple of 3 but the initial amount need not be a multiple of 3.

	Last beggar	Previous one	Previous one	Previous one	First beggar	Initial
Amount to the beggar	3	3	3	3	4	–
Amount with Mr Helpinghand	–	3	6	9	12	16

∴ The last beggar will always get ₹3. The total amount will be minimum, when there is a minimum possible remainder each time. The calculation is shown in the following table from the last to the first beggar.

∴ ₹16 is the minimum possible initial amount.

6. As already explained, the initial steps should be the same. Here, we will try to maximize the remainder.

	Last beggar	Previous one	Previous one	Previous one	Previous one	Previous one	Initial
To the beggar	3	3	3	6	6	10	–
With Mr Helpinghand	–	3	6	9	15	21	31

∴ ₹31 is the maximum possible amount value.

Solutions for questions 7 to 10: Let us represent the people with the first letter of their names.

As per the given information in (ii) the interest earned by them can be written in the following order.

$$S > K > P / B > M$$

From (iii), B earned ₹600 as interest which is possible for an investment of ₹2000 at 6% per annum or an investment of ₹3000 at 4% per annum.

B cannot be the least interest earner.

The least interest would be earned for an investment of ₹2000 at 5% per annum.

It has to be ₹3,000 at 4% per annum for B.

∴ B is the second lowest interest earner.

From (iv), ₹6000 is not invested at 7.5% per annum or at 8% per annum.

Hence, it is invested at 6% per annum.

∴ Interest earned would be ₹1800, which is not the highest interest.

The highest interest would be earned for an investment of ₹5000 either at 7.5% per annum or at 8% per annum and the third highest interest would be earned for the investment of ₹4000 either at 7.5% per annum or at 8% per annum.

∴ The following table shows the distribution of the investment, interest rate and interest earned.

	Investment	Rate of interest (per annum)	Interest earned
Manjeet	2000	5%	500
Biswajeet	3000	4%	600
Paramjeet	4000	7.5/8 %	1500/1600
Karamjeet	6000	6%	1800
Sarvajeet	5000	7.5/8%	1875/2000

7. Investment of Paramjeet is ₹4000.
 8. Sarvajeet earned ₹1875 or ₹2000.
 9. Karamjeet invested at 6% per annum.
 10. The difference between the interest earned by Biswajeet and Karamjeet = ₹1200.

Solutions for questions 11 to 15: Let each contestant be denoted by the first letter of his name.

Given, in the first round all the contestants gave distinct answers.

Let the cumulative scores of K, R, A, V, S at the end of the nth round be denoted by $C(K)_n$, $C(A)_n$, $C(V)_n$ and $C(S)_n$, respectively.

Let the total of cumulative scores at the end of n th round be denoted by $C(\text{Total})_n$.

\therefore The sum of the cumulative scores at the end of the first round is $1 + 2 + 3 + 4 + 5 = 15$.

$$C(K)_1 + C(R)_1 + C(A)_1 + C(V)_1 + C(S)_1 = 15$$

Given the averages of the cumulative scores at the end of the rounds 1 and 2 are the same.

\therefore The total of the cumulative scores of the contestants at the end of the second round is 15.

We can say that at least two contestants given the same answer in the second round.

\therefore The sum of the cumulative scores of R, V, S at the end of the second round is $15 - (9 + 3) = 6$.

$$\Rightarrow C(R)_2 + C(V)_2 + C(S)_2 = 6$$

As K's cumulative score is increased by 1 from round 1 to round 2, K have given the least graded answer.

\therefore If S is not one of the contestants who gave the same answer, then his cumulative score at the end of the second round must be at least 6, if so the sum of the cumulative scores of R and V must be 0, which is not actually possible.

\therefore S must have given the same answer as other in the second round.

If A given the same answer as S, then $C(S)_2 = 3$.

But $C(R)_2 + C(V)_2$ cannot be 3

$\therefore C(\text{Total})_2 > 15$, which is not possible.

Here, A given a distinct answer in the second round.

$\therefore C(A)$ is increased by at least two.

As $C(A)_2 = 3$, $C(A)_1$ must be equal to 1.

$\therefore C(V)_1 = 3$

Hence, V must have given the same answer as S in the second round.

If R given a distinct answer, then

$C(V)_2 + C(S)_2 = 3 + 3$, which results in $C(\text{Total})_2 > 15$.

\therefore R given the same answer as V and S in the second round.

$$C(R)_2 = C(V)_2 = C(S)_2 = 2$$

From (ii), we can say that $C(\text{Total})$ is increased by 15 at the end of the third round comparing to that at the end of the second round.

$$\therefore C(\text{Total})_3 = 15 + 15 = 30$$

From (vii) and (vi), we can say that,

$$\begin{aligned} C(\text{Total})_6 &= C(\text{Total})_7 - 15 \\ &= 71 - 15 = 56 \end{aligned}$$

From (iv) and the above data, we can say that A has given the same answer as at least one of the other in the fourth round.

$$\begin{aligned} \therefore C(\text{Total})_4 &= C(\text{Total})_5 - 15 \\ &= 51 - 15 = 36 \end{aligned}$$

$$\therefore C(V)_4 = 36 - 28 = 8$$

Also, in rounds 1, 3, 5 and 7 all contestants given distinct answers.

$\therefore C(K)_3$ is at least 7.

\Rightarrow K have given the same answer as A in the fourth round.

\therefore Each of $C(K)_3$ and $C(A)_3$ must be at least 7.

From (viii), we can say that V have got 1 point in the fourth round.

$$C(V)_3 = C(V)_{4-1} = 8 - 1 = 7$$

\therefore V got five points in the third round.

A can get at most five points in the third round.

$$\text{As } C(A)_2 = 3, C(A)_3 \geq 7, C(A)_3 = 7$$

\therefore A got four points in the third round.

As $C(R)_3 < 7$, R has given a distinct answer in the fourth round.

Also, we have S, which has got 2 points in the fourth round.

\therefore R must have got 3 points in the fourth round.

$$C(R)_3 = C(R)_4 - 3$$

$$= 7 - 3 = 4$$

\therefore R got 2 points in the third round.

\Rightarrow K got 1 point in the third round.

From (vi), as A given a distinct answer in the sixth round,

$$C(A)_6 \geq C(A)_4 + 2$$

As $C(A)_6 = 9$ and $C(A)_4 = 7$, $C(A)_5$ must be equal to 8.

\therefore A got 1 point each in the fifth round and sixth round.

R and S got 2 and 3 points in the sixth round.

$$\therefore C(R)_6 + C(S)_6 = 9 + 11 + 2 + 3 = 25.$$

As $C(\text{Total})_6 = 56$,

$$C(K)_6 + C(V)_6 = 56 - C(R)_6 - C(S)_6 - C(A)_6$$

$$= 56 - 25 - 9 = 22$$

As K and V given the same answer in the sixth round,

$$C(K)_6 = C(V)_6 = \frac{22}{2} = 11.$$

$\therefore C(K)_5$ or $C(V)_5$ must be equal to 11.

As S got four points in the fifth round, K cannot get four points in the fifth round.

$$C(K)_5 \neq 11 \Rightarrow C(K)_5 = 11$$

$$\therefore C(V)_5 = 11$$

V got 3 points in the fifth round.

\therefore K got 5 points in fifth round and $C(K)_5 = 12$.

As $C(R)_5 = 9$ and $C(R)_7 = 14$, the sum of the points scored in the sixth and the seventh round by R is 5.

Also, R got 2 or 3 points in the sixth round

As K got 2 points in the seventh round, R can not get 2 points in that round.

\therefore R cannot get 3 points in the sixth round.

R got 2 points in the sixth round and 3 points in the seventh round.

$$\therefore \text{S got 3 points in the sixth round and } C(S)_6 = 14$$

From (iii), we can say that $C(A)_7 \neq 14$.

\therefore A did not get five points in the seventh round

A must have scored 1 point and S must have got 5 points in the seventh round.

$$\therefore C(S)_7 = 14 + 5 = 19$$

The final scores will be as follows:

Round no.	Total of cumulative scores	The contestants who gave same answer	K	R	A	V	S
1	15	X	5	2	1	3	4
2	15	RVS	6	2	3	2	2
3	30	X	7	4	7	7	5
4	36	KA	7	7	7	8	7
5	51	X	12	9	8	11	11
6	56	KV	11	11	9	11	14
7	71	X	13	14	10	15	19
Cumulative scores are:			61	49	45	57	62

11. Sashank was the winner.
12. Ranjit, Varun and Sashank gave the same answer in the second round.
13. The score of Ranjit after at the end of the third round = 4.
14. The score of Kamal and Varun at the end of the sixth round are 11 and 11, respectively.
15. Kamal gave the highest graded answer in the fifth round.

Solutions for questions 16 to 19: The teams with better chances of winning are teams A, C and F. The teams that have worst chances of winning are B, D and E.

16. If there is only one upset, in order to maximize Amit's earnings, then let us assume that he put stakes on three winning teams, two that were expected to win and the one that caused an upset.
Among B, D, E, team E has the best odds of 20%.
Hence, if Amit bets ₹100 each on teams A, C and E, then he will maximize his earnings.

$$\begin{aligned}\therefore \text{His earnings} &= \left(100 + \frac{1}{4} \times 100\right) + \left(100 + \frac{2}{5} \times 100\right) + \left(100 + \frac{20}{1} \times 100\right) \\ &= 125 + 140 + 2100 \\ &= 2365\end{aligned}$$

17. In order to maximize his earnings, let us assume that Bhaskar put more money at stake on teams with better odds (among the expected winners only).
Among A, C and F, Bhaskar has the best odds on C followed by A and then F.

$$\begin{aligned}\therefore \text{Bhaskar's earnings} &= \left(60 + \frac{2}{5} \times 60\right) + \left(40 + \frac{1}{4} \times 40\right) + \left(20 + \frac{1}{5} \times 20\right) \\ &= 84 + 50 + 24 \\ &= 158\end{aligned}$$

18. Among the team expected to lose, i.e., B, D and E, B and E have the best odds. Assuming that these two teams caused upsets and the other match went the expected way, teams B, C, E winning would be the most favourable to Ravi.

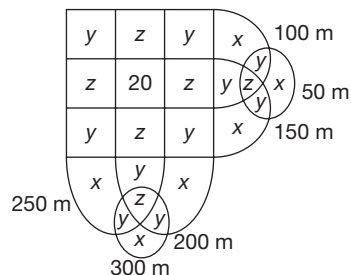
19. Suresh's minimum possible earnings are zero, if both his teams lose.

In Match III, the best possible outcome for Suresh is team F winning, which gives him an earning of $\left(50 + \frac{7}{5} \times 50\right) = ₹ 60$.

In Match II, an upset would maximize his earning. If team D wins and Suresh put his money on that team, his earnings would be $\left(50 + \frac{1}{2} \times 50\right) = ₹ 225$.

\therefore His maximum earnings = Difference between maximum and minimum possible earnings = $225 + 60 = 285$.

Solutions for questions 20 to 23: The given information can be represented in the following Venn diagram.



x represents exactly one.

y represents exactly two.

z represents exactly three.

Since exactly four is 20, $6x + 10y + 6z = 880$.

Given $x : y : z = 1 : 2 : 3$

$6x + 20x + 18x = 880$

$\therefore x = 20$

20. The number of students who participated in 50 m dash
 $= x + 2y + z = 8x = 160$.
21. The number of students who participated in both 100 m and 150 m dashes $= 3z + y + 20 = 9x + 2x + 20 = 11x + 20 = 240$.
22. The number of students who did not participate in 300 m dash $= 900 - 160 = 740$.
23. The number of students who participated in at most two events $= 6x + 10y = 26x = 520$.

Solutions for questions 24 to 27: Assume that A is lying.

$$\Rightarrow \text{Total score is } (11 + 12 + 13) \div 2 = 36 \div 2 = 18 \quad (1)$$

Assume that B is lying.

$$\Rightarrow \text{Total score is } (10 + 12 + 13) \div 2 = 35 \div 2 = 17.5$$

This is not possible.

\Rightarrow B is not lying.

If C is lying:

$$\text{Total score} = (10 + 11 + 13) \div 2 = 34 \div 2 = 17$$

D cannot be wrong, because otherwise the total score will not be an integer.

\Rightarrow Either A or C is lying.

(i) Assume that A lied.

\Rightarrow Total score is 18.

Individual scores are:

$$18 - 11 = 7$$

$$18 - 12 = 6$$

$$18 - 13 = 5$$

(ii) Assume that C lied.

\Rightarrow Total score = 17

Individual scores are:

$$17 - 10 = 7$$

$$17 - 11 = 6$$

$$17 - 13 = 4$$

In both the cases, the first two individual scores are the same, but the least score varies.

If A lied, P, Q, R = 5, 6, 7 (in any order)

If C lied, P, Q, R = 4, 6, 7 (in any order)

24. We can definitely say that B and D are not lying.
25. In this case, A lied as 18 is divisible by 3 but 17 is not.
26. 7 is the highest score.
27. Least score cannot be determined.

Solutions for questions 28 to 31: From (v), we know that Stephanie purchased the Breguet Dupuis and from (iv) and (vi) we know that Henry Ford purchased the Rolex Mercator. From (ii), we know that Oswald did not purchase a Rolex or a Piaget (also, not a Breguet according to (v)). Hence, he must have purchased a Louis Ulysse Chopard which means that Gennady purchased the Piaget.

From (iii) and (v), we know that Gennady paid \$1,80,000 and Stephanie paid \$2,20,000 for their watches, respectively.

From (i) and (iv), we know that all four watches together cost \$8,40,000 of which Gennady had purchased a watch worth \$1,80,000 and Stephanie, a watch that was worth \$2,20,000.

\therefore Cost of the other two watches

$$= 8,40,000 - 4,00,000 = \$4,40,000$$

From (i), we know that the Rolex costs \$1,20,000 more than the Chopard, which means that the Rolex costs \$2,80,000 and the Chopard costs \$1,60,000.

28. Oswald Henry purchased the Chopard at \$1,60,000.

29. Henry Ford's watch costs \$2,80,000 where as Yuganov's watch costs \$1,80,000.

\therefore The difference is \$1,00,000.

30. Choice (D) is the only one that's true from the data given.

31. Choice (C) is the only one that is correct.

Solutions for questions 32 to 35: From (i) and (ii), Piyush spent ₹3783, Saket spent ₹4640 and Uday spent ₹4040.

From (iii) and (iv), the maximum difference between the expenses must be between the highest and lowest spenders. Hence, Tomar's expenses must be the lowest at ₹3505.

From (i) and (v), the minimum difference between the expenses of any two persons is ₹167. The difference between the expenses of Piyush and Tomar is ₹278, whereas the difference between the expenses of Uday and Tomar is ₹535. Hence, Piyush must have spent the second least amount, whereas Uday must have spent the third least amount.

The difference between the expenses of Saket and Uday is ₹600, whereas that between the expenses of Qureishi and Raina is ₹246. Since Raina spent ₹4227, Qureishi must be the second highest spender at ₹4473 and Raina must be the third highest spender.

The descending order of their expenses is as follows:

Saket (₹4640) > Qureishi (₹4473) > Raina (₹4227) > Uday (₹4040) > Piyush (₹3783) > Tomar (₹3505)

32. Qureishi spent ₹4473.

33. Saket spent the highest amount.

34. The difference between the expenses of Raina (₹4227) and Uday (₹4040) is ₹187.

35. Uday spent the fourth highest or the third least amount.

Solutions for questions 36 to 40: The profit per month of E is ₹3,20,000. The only possibility is 8000×40 , i.e., profit per unit is ₹8000 and the number of units sold is 40.

The profit per unit of D is greater than that of E and as profit per month is less than that E, the number of units sold is less than that of E, i.e., less than 40, i.e., 30.

Profit per month of B is greater than the profit per month of one of the other outlets by ₹10,000 and profit per unit of A is greater than that of C.



C is the only outlet that can have least profit per unit, i.e., 5000 and the least profit per month.

∴ C got ₹5,000 per unit.

Given that the selling prices of A, D and E are different.

∴ Selling prices of B and C are same, i.e., ₹20,000.

B's profit per month cannot be 10,000 more than that of E because we cannot get 3,30,000 by multiplying any of the profits per unit given (6000, 7000, 8000, 9000, 10,000) by the number of units sold (40, 45, 50).

If the profit per month of B is more than ₹3,30,000, then there will be a minimum of two outlets with profit per month more than that of outlet E. This is not possible as it is a contradiction of the given data.

Profit per month of B must be less than 3,20,000.

∴ The outlet with profit per month greater than that of E cannot be B, D or C. Therefore, it must be A.

The profit per month of C can be:

(1) $5000 \times 40 \rightarrow ₹2,00,000$

(2) $5000 \times 45 \rightarrow ₹2,25,000$

(3) $5000 \times 50 \rightarrow ₹2,50,000$

Let us take the profit per month of B as 10,000 more than that of C.

B's profit per month can be 2,10,000 or 2,35,000 or 2,60,000. Number of units sold by B = 40 or 45 or 50.

For any of the values of profit per unit, this is not possible.

Hence, the profit per month of B is not 10,000 more than that of C.

B's profit per month is not 10,000 more than that of A or C or E. It should be 10,000 more than that of D.

The possible profits per month of D are:

(1) $10,000 \times 30 = 3,00,000$

(2) $9,000 \times 30 = 2,70,000$

B's profit per month can be 3,10,000 or 2,80,000. Only 2,80,000 is possible, i.e., 40×7000 .

The profits per unit of D and E are 9000 and 8000, respectively. The profit per unit of A must be 8000 or 9000.

The unit that is selling at 22,000 cannot have the cost price of 11,000 or 12,000, i.e., it has 14,000 as the cost price. The outlet that is selling the unit at ₹21,000 cannot have 11,000 as the cost price.

∴ It should have 12,000 as cost price, i.e., a profit of 9000.

The outlet that is selling at 20,000 has a cost price of 11,000, i.e., a profit per unit of 9000.

The profit of different outlets is

Outlets	Selling price(₹) and cost price (₹) respectively	Profit(₹)/ Unit	Unit/ Month
A	20,000 and 11,000 or 21,000 and 12,000	9,000	45/50
B	20,000 and 13,000	7,000	40
C	20,000 and 15,000	5,000	45/50
D	21,000 and 12,000 or 20,000 and 11,000	9,000	30
E	22,000 and 14,000	8,000	40

36. The profit per month of B is $₹7000 \times 40 = ₹2,80,000$.

37. The selling price at the outlet E is ₹22,000.

38. The selling price of A is more than that of D.

∴ The selling price of D is ₹20,000 and the selling price of A is ₹21,000 and the total cost price is ₹12,000, i.e., the transportation cost is ₹2000.

39. The number of units sold by A is more than that by C, i.e., the number of units sold by A is 50 and that by C is 45.

∴ The profit per month of C is $45 \times 5000 = ₹2,25,000$.

40. Profit per unit of E is ₹8000.

EXERCISE-3

Solutions for questions 1 to 4: Each mill has a different downtime and each mill has at least four hours of uptime in a day. Thus, the maximum downtime for any mill is 5 hours so that it has an uptime of one hour for six hours.

From the given information, the difference (in hours) between the two different uptimes of each mill are tabulated as below:

Mill	Difference in hours between the known uptimes	Possible frequency of uptimes (Every nth hour)
P	20 hours	2nd, 4th, 5th
T	21 hours	3rd

Mill	Difference in hours between the known uptimes	Possible frequency of uptimes (Every nth hour)
Q	44 hours	2nd, 4th
R	48 hours	2nd, 3rd, 4th, 6th
S	42 hours	2nd, 3rd, 6th
T	21 hours	3rd

Every mill has a different downtime, it implies that the possible downtimes are 1, 2, 3, 4 and 5 hours.

Thus, mill T runs every 3rd hour \Rightarrow downtime = 2 hours. Only P can run every 5th hour \Rightarrow downtime = 4 hours.

Thus, the possible downtime for the mills are as follows:

Mill	Possible frequency of uptimes (Every nth hour)
P	5th
Q	2nd, 4th
R	2nd, 4th, 6th
S	2nd, 6th
T	3rd

1. Either R or S can have the highest capacity based on the possibility that both can have the highest downtime.
2. The second highest downtime is four hours. Mill P has a downtime of 4 hours.
3. If R is not of the lowest downtime but lesser than that implies that R runs every 4th hour.
Thus, the downtime of mill R is 3 hours.
4. If R has greater downtime than mill S, then mill S has to run every 2nd hour. The only possibility is Q has to run every 4th hour and R has to run every 6th hour.
The frequencies of the mills P, Q, R, S and T will be once every 5th, 4th, 6th, 2nd and 3rd hours, respectively.
The same pattern repeats every 60 hours (LCM of 2, 3, 4, 5 and 6). For this pattern to repeat in the first five hours of a shift, it repeats every 120 hours (LCM of 2, 3, 4, 5, 6 and 8) = Once every 5 days but only in the third shift. Hence, the pattern repeating in the first five hours of the day is not possible.

Solutions for questions 5 to 8: The given information can be tabulated as below:

[**Note:** The subscript under the circuit name (A, B and C) is to differentiate the two tours in the same circuit that start on different days of the week]

Day	Tour package	
	First day	Last day
Sunday	D	D, B
Monday	D	D
Tuesday	D	D, A _m , C _q
Wednesday	D, A _m , C _p	D, A _n
Thursday	D, A _n , B _x	D
Friday	D, B _y	D
Saturday	D, C _q	D, B _x , C _p

The subscript under the circuit name differentiates the two tours in the same circuit that start on different days.

5. Circuit A starts on two days; hence, two cases arise:

Case (a)	Case (b)	
A (Wednesday to Tuesday) 7 days	A (Wednesday to Tuesday) 7 days	A (Thursday to Wednesday) 7 days
D (Wednesday) 1 day	C (Wednesday to Saturday) 4 days	B (Thursday to Saturday) 3 days
B (Thursday to Saturday) 3 days	D (Sunday) 1 day	D (Sunday) 1 day
Wait 3 days	Wait 3 days	Wait 2 days
C (Wednesday to Saturday) 4 days	B (Thursday to Saturday) 3 days	C (Wednesday to Saturday) 3 days
18 days	18 days	17 days

Alternate solution: Starting with circuit A, it is clear that after taking two tours, one has to definitely wait (Wait period is from Sunday to Tuesday). This wait can be minimized if the daily trip is planned in one of these three days. Further, the tour after the wait has to be A or C which starts on a Wednesday. Since, we are starting with A, the last tour has to be C (for minimum wait). Because A ends on Tuesday or Wednesday, D shall not be immediately after A, thus in the order A, B, D and C, with A starting on Thursday, the tour can be completed in 17 days.

6. If we observe the given information, out of all the tours that end and start on two consecutive days, all the tours are available between Tuesday and Thursday. C ends on Tuesday, A starts on Wednesday, which ends on Tuesday, D ends on Wednesday and B starts on Thursday. Hence, the tour shall start with C_q which starts on a Saturday.
7. Only on a Monday, tourists of only one tour come to the office (either start or end the tour).
8. A (Wednesday – Tuesday) + B (Thursday – Saturday) + D (Monday) + C (Wednesday – Saturday).
The tour shall start on a Wednesday.

Solutions for questions 9 to 12: The kid receives ₹5 per day ⇒ earns ₹35 per week but earns a maximum of ₹25 in the first five days. The statement implies that the kid spends a maximum of ₹25 in the first five days ⇒ purchases only two items in the first week.

The amount available by next Monday is the sum of savings during first five days and amount earned during weekend.



The kid earns ₹10 on weekend which is available for next Monday. Thus, from the second week onwards, he can purchase all the items at least once.

Amount available on second Monday will be among ₹15 or ₹20 or ₹10.

Whatever items the kid purchases in the first week, the total amount the kid can spend up to the second week is income of the first week and first five days of the second week, i.e., ₹35 + ₹25 = ₹60.

By repeating the purchase of three items twice, the kid purchases all the items twice.

Starting from the second week, in n weeks the kid purchases all the items at least n times and at most $(n + k)$ times.

In order for the purchases to make a pattern:

$$n(35) = (n + k)(30)$$

$$\Rightarrow n = 6k$$

\Rightarrow For every 6 weeks, ($k = 1$), all the items would be purchased seven times.

$$\text{Pastry} = P = ₹15$$

$$\text{Samosa} = S = ₹10$$

$$\text{Chocolate} = C = ₹5$$

Week	Balance + Income weekday	Expenses	Weekend income	Balance	Purchases
	A	B	C	A – B + C	
1	0 + 25	15 + 5 5 + 10	10	15 10 + 10 = 20	C, S
2	20 + 25	15 + 5 + 10 + 15	10	0 + 10 = 10	P, C, S, P
3	10 + 25	5 + 10 + 15 + 5	10	0 + 10 = 10	C, S, P, C
4	10 + 25	10 + 15 + 5	10	5 + 10 = 15	S, P, C
5	15 + 25	10 + 15 + 5 + 10	10	0 + 10 = 10	S, P, C, S
6	10 + 25	15 + 5 + 10	10	5 + 10 = 15	P, C, S
7	15 + 25	15 + 5 + 10	10	10 + 10 = 20	P, C, S
8	20 + 25	15 + 5 + 10 + 15	10	0 + 10	P, C, S, P

9. From the above, the given data is sufficient to determine that the pattern of the purchases is repetitive. Hence, only II is true.

10. From the table, the maximum savings available on any Monday is ₹20, plus he would receive a pocket money of ₹5, thus the maximum amount available on any Monday is ₹25.

11. Given that the kid makes a purchase as soon as he accumulates sufficient money to make his next purchase as per the defined conditions.

With the new condition, the possible combinations in the five days of the week, for the kid to purchase the four items Chocolate (C), Fruit (F), Samosa (S) and Pastry (P) is:

F/C, S/P, C/F, __, P/S (No purchase on Thursday).

Only (D) is definitely true.

12. In the third week, opening balance = ₹10. Earns ₹25 during the five weekdays. Spends ₹35 during five days and earns ₹10 during weekend.

The kid starts with a balance of ₹10 every week. The maximum amount the kid has on any Monday is ₹15.

Solutions for questions 13 to 16: Let us represent the people name with A, B, C, D and E and also the fields to which each book belongs to A, B, C, D and E.

Person	Book
A	D/E
B	Criminology
C	Biotechnology
D	A/E
E	D/A

13. Annie exchanges with Dan and Dan exchanges with Engel so the book possessed by Annie goes to Engel. Hence, Annie purchased book related to Economics.

Don Purchased book related to Architecture and Engel purchased book related to Demographic.

14. Statement (A) is true.
Statement (B) is true.
Statement (C) is true.
Statement (D) is not necessarily true.
15. Condition (A) Annie and Engel books were interchanged. There can be two possibilities with this condition with Annie taking books related to Demography or Architecture.
Condition (B) states that neither Annie nor Engel possess books related to Economics.
Since Annie and Engel did not get the book related to Economics that means Dan possessed the book related to Economics, Annie passed the book related to Architecture and Engel possessed the book related to Demographics.
16. As condition (d) is not violated, the interchange was between any two among Annie, Dan and Engel. From the above table, and the possibility of interchange between any two among the three, six cases arise as shown below. The statements which are consistent in each of the case are listed accordingly.

Statements consistent			
Interchange between			
Person = Book	A and D	D and E	A and E
A = D E = A D = E	a, d	a, b, c	b
A = E E = D D = A	b, d	a	a, b, c

From the above table, in various cases, the pairs of statements ab, ac, ad, bc and bd are consistent simultaneously while only statements c and d are not consistent simultaneously in any case.

Solutions for questions 17 to 20:

17. A. $29 = 4 + 25 = (2 \times 2) + (2 \times 10) + (1 \times 5)$
Therefore, it is possible.
B. $31 = 6 + 25 = (3 \times 2) + (2 \times 10) + (1 \times 5)$
Therefore, it is possible.
C. $47 = 40 + 7$ or $35 + 12$
Neither of which are possible.
18. X score $33 \Rightarrow 25 + 8 = (1 \times 10) + (3 \times 5) + (4 \times 2)$ or $= (2 \times 10) + (1 \times 5) + (4 \times 2)$

All choices except (B) is not necessarily true.

19. Maximum marks can be obtained as follows:

	Part I	Part II	Total
Rahul/Beena	3×2	4×10	46
Beena/Rahul	3×2	$3 \times 10 + 1 \times 5$	41

Minimum possible marks:

	Part I	Part II	Total
Johan/Bijaya	5×2	2×5	20
Bijaya/Johan	4×2	3×5	23

Maximum difference $= 87 - 43 = 44$.

20. By scoring positive marks in six questions, each of U and V must score two marks each in two questions of Part I. In the remaining four questions, a score of 10 or 5 or 2 is possible. For different marks possible for any of the questions, the difference in marks would be in multiples of $\pm (10 - 5)$ or $\pm (5 - 2)$, i.e., difference of ± 5 or ± 3 will be seen in their totals. To obtain minimum difference of '1', we have to check if the difference of $1 = +5 - 3 - 3$ or $-5 + 3 + 3$ is possible.
The possible marks obtained by U and V in the remaining four questions are as follows.

	Case I	Case II	
U	$(10 + 5 + 5 + 5)$	$10 + 5 + 2 + 2$	15
V	$(10 + 10 + 2 + 2)$	$(5 + 5 + 5 + 5)$	18
Difference	1	1	

The difference is 1.

Solutions for questions 21 to 25: It is given that there are 24 textbooks distributed in four racks. Each rack containing a distinct even number of textbooks. From (2) and (3), it can be concluded that the number of books of Marketing = 12, HR = 6, Operations = 4 and Systems = 2. It is also given that the number of textbooks in each rack remained the same even after misplacement.

From (3), Marketing rack has four textbooks from Operations rack and the rest are from Marketing rack only.

From (4) in HR rack, two books are of HR and the rest four are from a different rack. These textbooks have to be from Marketing rack as Systems rack has only two textbooks.



This implies that the four books from HR rack are placed in Operations rack. Thus, the present position is as follows.

Marketing: Marketing-8 and Operations-4
 Operations: HR-4
 HR: HR-2 and Marketing-4
 Systems: Systems-2

21. None of the books related to Operations was placed in Human Resource.
22. Two textbooks related to Systems were placed correctly.
23. Four of the books related to Human Resource were in Operations rack.
24. Textbooks from Systems rack are in system rack only.
25. No textbook belonging to Operations rack is placed in System rack.

Challenge Your Understanding

Practice Set 1

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

Raju starts going to temple 60 days before the commencement of his exams. Raju offers flowers to God on each day. God accepts these flowers on the next day and leaves two of them, but before Raju offers flowers on that day. Raju takes the two flowers left and then offers flowers for that day. The number of flowers taken by God on the third day is 12 and it is known that on any day, the difference between the number of flowers offered by Raju and that taken by God is constant (No flower is taken by God on the first day).

1. On which of the following days does Raju offer 320 flowers?
2. How many flowers does God take in the first 30 days?
3. How many flowers does Raju offer in the first 45 days?

Directions for questions 4 to 7: Answer the questions based on the information given below. Type your answer in the space provided below.

The following table gives the details about the number of people entering and leaving an exhibition ground at different times on a particular day in a 7-hour period.

	3 p.m.– 4 p.m.	4 p.m.– 5 p.m.	5 p.m.– 6 p.m.	6 p.m.– 7 p.m.	7 p.m.– 8 p.m.	8 p.m.– 9 p.m.	9 p.m.– 10 p.m.
Number of people entering	300	346	562	648	713	–	–
Number of people leaving	200	380	459	520	629	862	900

Also note that:

- (1) People were allowed to enter the ground at 1 minute past ' n ' p.m., where $n = 3, 4, \dots, 9$, for only 30 seconds, after which they were not allowed to enter.
 - (2) People were allowed to leave the ground at 1 minute to ' m ' p.m., where $m = 4, 5, \dots, 10$, for only 30 seconds, after which they were not allowed to leave.
 - (3) The entry was allowed from exactly 3 p.m. and nobody was present in the ground before 3 p.m.
 - (4) The venue was closed at exactly 10 p.m. and everybody left the ground before 10 p.m.
 - (5) The number of people entering the ground in each of the time durations from 8 p.m.–9 p.m. and 9 p.m.–10 p.m. is unknown.
4. At any moment from 3 p.m. to 8 p.m., what was the highest number of people present in the ground? _____
 5. What is the minimum number of people who entered the ground from 8 p.m. to 9 p.m.? _____
 6. What is the least number of people who were in the ground at any moment from 4 p.m. to 8 p.m.? _____
 7. What is the minimum number of people entering the ground at 8 p.m.? _____

Directions for questions 8 to 10: These questions are based on the following information given below. Type your answer in the space provided below for each question.

A cube is dipped in a tank of red paint up to half its height. Then, it is reversed and then dipped in green paint up to half its height. Then the top and the bottom faces of the cube are coloured with blue and yellow, respectively. This cube is now cut into 27 smaller and identical cubes.

8. How many small cubes does not have red paint on any of its faces?
9. How many small cubes have two colours on them?
10. How many small cubes have three colours on them?

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

A survey was conducted among 100 candidates, each of whom passed in at least one paper among Physics, Chemistry and Maths. Among them, 45 failed in Physics, 40 failed in Chemistry, 40 failed in Maths and 40 failed in at least two subjects.

11. How many candidates passed in at most two subjects?
12. How many candidates passed in exactly two subjects?
13. How many candidates passed in all the three subjects?

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

The following table gives the details of the number of new books and the number of 2nd editions of the books which is already in circulation both published by ABC publishers.



Year	2000	2001	2002	2003	2004	2005
New books published	140	180	210	220	260	300
2nd edition books published	90	90	120	145	190	160

Total books published = Fiction books published + Non-fiction books published.

For non-fiction books that are published in a year, 2nd editions will be published for exactly 50% of the books in the next year.

For fiction books published in a year, 2nd edition will be published for all the publications exactly two years later. Further in 2005, the 2nd edition of fiction books published is the same as the 2nd edition of non-fiction books published.

Directions: Type in your answer in the space provided in the question.

14. How many new fiction books were published in 1999? _____
15. How many new non-fiction books were published in 2004? _____
16. For how many non-fiction books published between 2002 and 2004 (both the years included), 2nd edition was not published? _____

Directions for questions 17 to 20: These questions are based on the information given below.

A group of four friends, namely P, Q, R, and S together spent a total amount of ₹9600. Each of them spent some money on shoes, some on clothes and the remaining on books. In total, P spent ₹200 more than Q but ₹200 less than R, who in turn spent ₹200 less than S. The total money spent on clothes is ₹200 less than that on books and ₹200 more than that on shoes. Further, it is also known that:

- (i) Q spent ₹400 on clothes and twice of it on shoes.
- (ii) The amount spent by P on clothes is the same as that spent by R on shoes.
- (iii) The amount spent by S on books is the sum of the amount spent by P on books and the amount spent by S on shoes.
- (iv) The amount spent by Q on shoes and that on books is same as that spent by S on clothes and R on clothes, respectively.

Directions: Type in your answer in the space provided in the question.

17. Among the four, what is the least amount spent in total? _____
18. How much did S spend on books? _____
19. How much did P spend on books? _____
20. How much did Q spend on shoes? _____

Directions for questions 21 to 24: Type in your answer in the space provided below each of the question. These questions are based on the following information.

A print media advertising agency has undertaken a readership survey in a habitat of less than 700 houses for formulating a tariff package for print advertisements in vernacular newspapers in that region. The following information is shared:

It is found that each house in the village is a subscriber to at least one of the dailies among JanSamachar, LokVichar and Veekshan. No other newspaper is under circulation in that village.

The number of subscribers to LokVichar alone is twice the subscriptions to only LokVichar and JanSamachar, as well as only LokVichar and Veekshan.

Subscriptions to only two dailies, one of which is JanSamachar is same as the subscriptions to all the three dailies which are found to be more than 110.

For every subscriber of only JanSamachar and LokVichar, there are three subscribers of only Veekshan. Only 20% of the houses subscribed to all the three dailies, which is not a multiple of 20.

Subscription to only JanSamachar and LokVichar is $41\frac{2}{3}\%$ of number of subscriptions to all the three.

21. What is number of subscriptions to the highest circulated newspaper?
22. What is the number of subscriptions to the least circulated newspaper?
23. What is the total number of houses in the village?
24. What is the total number of newspaper subscriptions in the village?

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

In a group of 50, every member can speak at least one of the four languages, such as English, Hindi, German and Spanish. The number of people who can speak all the languages except Spanish is same as those who speak only Spanish, which in turn is equal to 4. 25 members do not speak German and 7 members speak only German. Number of people who speak exactly two languages is twice that of those who speak exactly three, which in turn is twice that of those who speak all the languages. 15 people speak only one language. 18 people speak English and Hindi, of which 6 people speak no other language. German and Hindi are spoken by 11 people, of which only 1 person does not speak any other language. The number of people who speak Spanish and English is 13, of which the number of people who do not speak any other language is same as those who speak only German and Spanish. The number of people who speak English is 26.

Directions: Type in your answer in the space provided below the question.

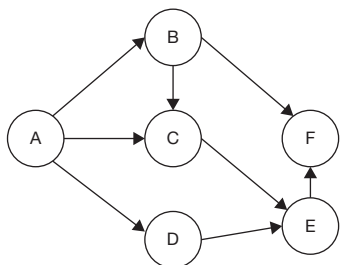
25. How many people speak only Spanish and Hindi? _____

26. How many persons speak only Hindi? _____

27. How many people speak at least three languages? _____

Directions for questions 28 to 31: These questions are based on the following information.

A, B, C, D, E and F are close friends. A has a chocolate factory and he distributes some chocolates to his friends and his friends distribute the chocolates among themselves as shown below.



The following information is also known.

- (i) No person receives the same number of chocolates from two different people.
- (ii) After the distribution, each person has a different number of chocolates, which are consecutive natural numbers.
- (iii) No person gives the same number of chocolates to two different people.
- (iv) The number of chocolates with C after the distribution is four and that with A is the least.
- (v) A gives six chocolates to D and C gives one chocolate to E.
- (vi) The number of chocolates with F is twice that with E.
- (vii) No person gives more than 10 chocolates to any other person.
- (viii) At least one chocolate is passed between two people who are connected in the network.

Directions: Type in your answer in the space provided below the question.

28. What is the total number of chocolates with A before distribution? _____

29. The number of chocolates with D after distribution is _____

30. The number of chocolates given by A to C is _____

31. The total number of chocolates with A, B and D after distribution is _____

Directions for questions 32 to 35: These questions are based on the following information.

A, B, C, D, E and F are six friends appearing for a Management entrance test. They applied together and

were surprised to see that though they were all seated in the same row, their hall ticket numbers were not in serial order. Further, the following information was available.

- (i) Neither A nor F is seated at the ends and the people sitting at any ends do not have hall ticket numbers whose last digit is 2.
- (ii) A and F are adjacent to each other, while B and E are adjacent to each other and are to the left of A. The remaining two friends are also adjacent to each other. Also, A and F have hall ticket numbers whose first digit is 4.
- (iii) Each hall ticket number is of two digits which is a multiple of 6, such that there are three pairs of consecutive multiples of 6. The sum of each pair is a multiple of 10.
- (iv) They are seated in such a way that the hall ticket numbers that end with the same digit are in ascending order from left to right.
- (v) E is not at any end and the same is true of D, who is not adjacent to A.

32. In how many ways can the six friends be seated?

33. If A's hall ticket number ends with the digit '2', then what is the hall ticket number of F?

34. The lowest of the hall ticket numbers of the six friends is

35. What is the hall ticket number of the person sitting to the immediate right of F?

Directions for questions 36 to 39: These questions are based on the following information.

Six MBA aspirants P, Q, R, S, T and U arrived in Hyderabad to participate in a group discussion (GD) for the 20 IIMs spread across India. The number of calls received by each of them is a multiple of either 3, 4 or 5. They are to be seated around a circular table during the GD. Further, the following information is known about them.

- (i) No two of them received the same number of calls. The lowest number of calls that a candidate among them received is 5, while none of them received a call from all the 20 IIMs.
- (ii) The candidates are seated in such a manner that the number of calls received by each person increases as we move in anticlockwise direction starting from the candidate who received the lowest number of calls.
- (iii) P and S are opposite to each other and together they got a call from each of the 20 IIMs. But no IIM sent calls to both of them.
- (iv) The person seated to the immediate left of P is Q, who received the lowest number of calls.
- (v) R received 9 calls and is opposite to T.
- (vi) The highest number of calls received by a person is an odd number.



36. What is the number of calls received by U?
37. What is the difference between the highest and the lowest number of calls received in the group?
38. What is the number of calls received by the person who sits two places away to the right of T?
39. The ratio of number of aspirants with even number of calls to that of odd number of calls is (Give ratio as decimal number)

Directions for questions 40 to 43: These questions are based on the following information.

A team of agricultural scientists is trying to figure out the banana production planning for the forthcoming year. A report on the same has provided the following information.

Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Gujarat are the five major producers of bananas in India. Each state has a production target (in tons) from among 1000, 2000, 3000, 4000, 5000, 7000 and 9000. Each state has a target area for cultivation, which is one among 500, 1000, 1500, 2000, 3000 and 3500 (in hectares). Further, the team gathered the following information.

- (i) Every state has a different targeted yield (in tons per hectares) with Gujarat having the highest target (yield) of 2.5, while Karnataka has the least yield target of 0.86 (Approximately).
- (ii) Andhra Pradesh has the lowest production and area targets among the five states with 2000 tons and 1500 hectares, respectively. Although its targeted yield is greater than that of Maharashtra but less than that of Tamil Nadu.
- (iii) Tamil Nadu has a yield target of 2 and the current area needs to increase production target by 1000 tons to equate Gujarat's target yield.
- (iv) Karnataka has the same production target as Maharashtra but plans to utilize 500 hectares of more land than that of Maharashtra.
- (v) The states are ranked 1 to 5 in each of the parameters production target, area target and yield target, with the best rank being 1 and the last rank being 5. If two or more states have same value in production target or area target, the state with higher yield target is given better rank.

Yield target = Production target in tons/ Area target in hectares

Directions: Write the answer in the below each question.

40. What is Gujarat's rank in terms of area target? _____
41. What is the rank of Karnataka in terms of production target? _____
42. If Karnataka targets to move up three ranks and tie with the state currently holding that position in terms of yield, how much more should it produce (in tons) with the current targeted area? _____
43. If Tamil Nadu's actual yield is likely to fall to 50% of the targeted value, then how much area (in hectares) has to be increased or decreased to keep the production at the targeted level? _____

Directions for questions 44 to 47: These questions are based on the following information.

Santiago, Benjamin and Mateo are three friends from Brazil visiting India. Each of them purchased a different item, such as a shawl, Darjeeling tea and a saree from the Rajasthan State Tourism Development Handicraft outlet with each item bearing a different cost. Additionally, they had to pay a tax of 10% on the cost of the item purchased. While exiting the outlet they were required to show the bills of the purchased items, which could not be found.

When asked by the outlet security about the purchases each of them made three statements.

It is known that each of them belongs to a different group among truth teller, alternator and liar.

Truth tellers always speak the truth, liars always lie and alternators alternate between truth and lies in any order.

Santiago:

- (i) Benjamin bought a saree.
- (ii) Mateo paid a tax of ₹300.
- (iii) I bought an item which is worth ₹2000.

Benjamin:

- (i) Santiago purchased a shawl.
- (ii) Mateo paid a tax of ₹300.
- (iii) I bought an item for a price of ₹2000.

Mateo:

- (i) I purchased Darjeeling tea.
- (ii) Benjamin paid a tax of ₹100.
- (iii) Santiago purchased an item which is priced for ₹2000.

Directions: Write your answer in the space provided below each question.

44. What is the total price paid for Darjeeling tea? _____
45. The cost of the saree is how many times the cost of the product purchased by Benjamin? _____
46. If the sum of the cost of product Benjamin purchased and the shawl is equal to the cost of the of product purchased by Mateo, then what is the total money spent by Santiago for the purchase of his product (tax included)? _____
47. What is the total amount spent by all the three at the outlet, if the conditions in the previous question remains the same? _____

Directions for questions 48 to 51: These questions are based on the following data.

A survey was conducted in a community of 350 people regarding three games, such as Chess, Carroms and Chinese Checkers. The following information is obtained in the survey.

- (i) Thrice the number of people who play all the three games is equal to the number of people who play Chinese Checkers.
- (ii) The number of people who play Chinese Checkers and Carroms is equal to the number of people who play Chess only.
- (iii) For every three people who play Chess and Chinese Checkers only, there are five people who play none of the three games.
- (iv) In every seven people who play Chinese Checkers, four people play Carroms also.
- (v) For every six people who play only Carroms, there is one who plays Chinese Checkers only.
- (vi) For every four people who play exactly two games, there is one who plays Carroms and Chinese Checkers only and two people who play none of the three games.

Directions: Fill the space below the questions with appropriate value.

48. How many people play exactly two games? _____
49. How many people play Chess but not Carroms? _____
50. How many people do not play Chinese Checkers? _____
51. How many people play Chess or Carroms? _____

Directions for questions 52 to 55: These questions are based on the following information.

In a colony of 280 families, which use mobile phones of different companies, like Panasonic, Sony Ericsson, Motorola and Nokia, 175 families use Sony Ericsson, 155 families use Panasonic, 165 families use Motorola and 150 families use Nokia. Each of the families use mobile phones of at least one company. The number of families using Sony Ericsson and Motorola is same as those using Nokia and Panasonic which in turn is same as those using mobiles of exactly three different companies, which is 75. Also, it is known that the sum of the number of families using Sony Ericsson and Motorola only, and the number of families using Nokia and Panasonic only is 25. The number of families using mobiles of exactly two companies is 100 more than that using mobiles of exactly one company.

Directions: Fill the space below each question with appropriate value.

52. How many families use mobiles of all the four companies? _____
53. How many families use mobiles of at least two of the four companies but at most three of the four companies? _____
54. How many families use mobiles of exactly one of the four companies? _____
55. If the sum of the number of families using Sony Ericsson, Motorola and Nokia but not Panasonic and the number of families using Sony Ericsson, Motorola and Panasonic but not Nokia is 35, then what is the sum of the number of families who use Nokia only and the number of families using Panasonic only? _____

Directions for questions 56 to 60: These questions are based on the following information.

In a college of 500 students, each student belongs to either the first year or the second year only but not to both. Each student belongs to exactly one of the two streams, such as Commerce and Science, each student is either an NSF member or an SFI member but not both. 90 first year Commerce students are SFI members. There are 270 NSF members. 50 Commerce students are neither first year students nor NSF members. 140 first year students are NSF members. 150 NSF members are either first year students or Commerce students but not both. 120 second year students are not Science students. 100 Science students are either first year students or NSF members but not both.

Directions: Fill the space below each question with appropriate value.

56. Find the number of second year Science students who are SFI members. _____
57. Find the number of first year Science students who are not NSF members. _____
58. Find the number of first year Commerce students who are NSF members. _____
59. Find the number of Commerce students who are either NSF members or second year students but not both. _____
60. Find the total number of students who are NSF members or second year students. _____



ANSWER KEYS

- | | | | | | | |
|---------|----------|----------|--------|----------|----------|---------|
| 1. 53 | 10. 0 | 19. 700 | 28. 21 | 37. 10 | 46. 1100 | 55. 5 |
| 2. 2610 | 11. 85 | 20. 800 | 29. 2 | 38. 8 | 47. 6600 | 56. 50 |
| 3. 6300 | 12. 45 | 21. 429 | 30. 4 | 39. 1 | 48. 100 | 57. 40 |
| 4. 1010 | 13. 15 | 22. 330 | 31. 8 | 40. 3 | 49. 90 | 58. 60 |
| 5. 481 | 14. 60 | 23. 660 | 32. 1 | 41. 4 | 50. 245 | 59. 110 |
| 6. 65 | 15. 160 | 24. 1111 | 33. 48 | 42. 4000 | 51. 285 | 60. 370 |
| 7. 481 | 16. 195 | 25. 5 | 34. 12 | 43. 2000 | 52. 25 | |
| 8. 11 | 17. 2100 | 26. 3 | 35. 72 | 44. 2200 | 53. 215 | |
| 9. 24 | 18. 1300 | 27. 15 | 36. 10 | 45. 1.5 | 54. 40 | |

SOLUTIONS

Solutions for questions 1 to 3: Let x be the flowers offered by Raju on the first day. And it is given that God takes none of them on the first day.

\therefore The difference between the number of flowers offered and that taken = $x - 0 = x$.

The flowers offered is x more than the flowers taken.

On the second day, God takes all the flowers that were offered on the first day except two, i.e., $x - 2$.

\therefore The number of flowers offered by Raju on the second day $\Rightarrow x - 2 + x = 2x - 2$

On the third day God takes $(2x - 2) - 2 = 2x - 4$ flowers.

But given is 12.

$$\therefore 2x - 4 = 12 \Rightarrow x = 8$$

The flowers offered and taken is as follows:

Day \rightarrow	1	2	3	4
Offered	8	14	20	26
Taken	0	6	12	18

The flowers offered is in arithmetic progression with a common difference of 6 and also the number of flowers taken is in arithmetic progression with a common difference of 6.

$$\text{Flowers offered} = 2 + 6n$$

$$\text{Flowers taken} = 6(n - 1)$$

When n = the number of the day.

$$1. \quad 2 + 6n = 320$$

$$\Rightarrow 6n = 318 \Rightarrow n = 53$$

$$2. \quad \text{The sum of first } n \text{ terms in an arithmetic progression}$$

$$= \frac{n}{2} [2a + (n - 1)d]$$

$$\text{Here, } n = 30, a = 0 \text{ and } d = 6$$

$$\Rightarrow \text{Sum} = \frac{30}{2} [(30 - 1)6]$$

$$= 15 [29 \times 6] = 2610$$

$$3. \quad \text{The sum of the first } n \text{ terms in an arithmetic progression}$$

$$= \frac{n}{2} [2a + (n - 1)d]$$

$$\text{Here, } n = 45, a = 8, d = 6 \Rightarrow \text{Sum} = \frac{45}{2} [16 + 44 \times 6]$$

$$= 45 [8 + 132] = 6300.$$

Solutions for questions 4 to 7: People enter the ground from $n : 01 : 00$ p.m. to $n : 01 : 30$ p.m., where $n = 3, 4, \dots, 9$, and leave the ground from $n : 59 : 00$ p.m. to $n : 59 : 30$ p.m., where $n = 3, 4, \dots, 9$. From $n : 01 : 31$ p.m. to $n : 59 : 00$ p.m., where $n = 3, 4, \dots, 9$, the number of people in the mall remain constant.

	The number of people entering from $n : 01:00$ p.m. to $n : 01:30$ p.m.	The number of people leaving from $n : 59:00$ p.m. to $n : 59:30$ p.m.	The number of people present from $n : 01:30$ p.m. to $n : 59:00$ p.m.
$n = 3$	300	200	300
$n = 4$	346	380	$(300 - 200) + 346 = 446$
$n = 5$	562	459	$(446 - 380) + 562 = 628$
$n = 6$	648	520	$(628 - 459) + 648 = 817$
$n = 7$	713	629	$(817 - 520) + 713 = 1010$

4. From the above table, the highest number of people in the ground at any time would be 1010.

5. The number of people who were present in the ground after $7 : 59 : 30 = 1010 - 629 = 381$

As 862 people left between 8 p.m. and 9 p.m., at least $862 - 381 = 481$ people must enter the ground from 8 p.m. to 9 p.m.

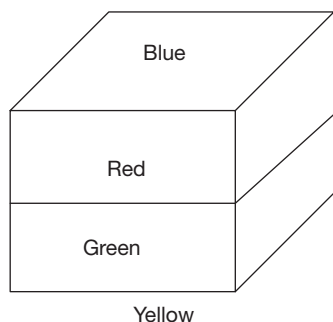
6. The number of people present in the ground from 3 : 59 : 30 to 4 : 01 : 00 = $300 - 200 = 100$

The number of people present in the ground from 4 : 59 : 30 to 5 : 01 : 00 = $446 - 380 = 66$.

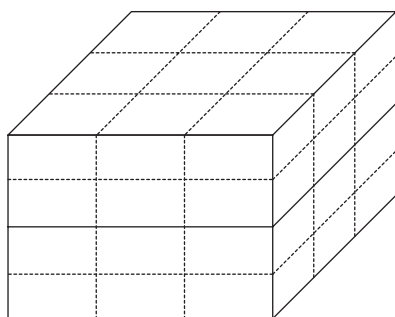
Proceeding similarly, we find that the minimum number of people present at any moment in the ground from 4 p.m. to 8 p.m. was 66.

7. At 8 p.m., 381 people remain in the ground before the entry and we know that at 9 p.m. 862 people left the ground
 \therefore Minimum people entering the ground would be $862 - 381 = 481$.

Solutions for questions 8 to 10: After painting, the cube would appear as given below.

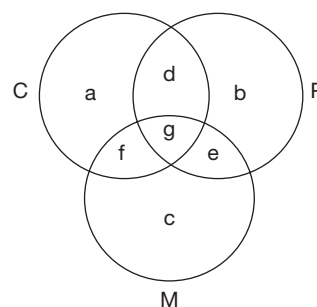


After cutting the cube into 27 smaller and identical cubes, we get:



8. The cubes on the bottom plane, the one at the middle of the top face and the middle one does not have red colour on any of its faces. So, the number of cubes which do not have red paint on them is $3 \times 3 + 1 + 1 = 11$.
9. All the cubes on the outer surface except the centre cubes on the top and the bottom faces, i.e., 24 cubes.
10. None of the cubes have three different colours on them.

Solutions for questions 11 to 13:



Here P, C and M represent those who passed in Physics, Chemistry and Mathematics, respectively.

Given information is as follows:

$$a + f + c = 45 \quad (1)$$

$$b + e + c = 40 \quad (2)$$

$$a + d + b = 40 \quad (3)$$

$$a + b + c = 40 \quad (4)$$

$$(a + b + c) + (d + e + f) + g = 100 \quad (5)$$

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

$$2(a + b + c) + (d + e + f) = 125$$

$$d + e + f = 125 - 2 \times 40 = 45 \text{ [From (4)]}$$

$$\text{From (5), } g = 100 - 45 - 40 = 15$$

11. Passed in at most two subjects
 = Exactly two subjects + Exactly one subject
 = $45 + 40 = 85$

12. Passed in exactly two subjects = 45

13. Passed in exactly three subjects = 15

Solutions for questions 14 to 16: It is given that the number of 2nd edition of fiction books is same as that of non-fiction books in 2005.

\Rightarrow 80 books are fiction and 80 books are non-fiction.

\Rightarrow 160 of the newly published books in 2004 are non-fiction and 100 are fiction.

\Rightarrow In 2003, 140 are non-fiction and 80 are fiction.

\Rightarrow In 2004, of the 2nd edition, 70 are non-fiction and 120 are fiction. Similarly, we can work out other values.

New publications

	2000	2001	2002	2003	2004	2005
Non-fiction	60	80	90	140	160	Y
Fiction	80	100	120	80	100	$300 - y$

2nd edition

	2000	2001	2002	2003	2004	2005
Non-fiction	x	30	40	45	70	80
Fiction	$90 - x$	60	80	100	120	80



14. As 60 fiction books had a 2nd edition in 2001, all these 60 were published in 1999.
15. The new non-fiction books published in 2004 is 160.
16. Of the total non-fiction books published,
i.e., $(90 + 140 + 160) = 390$
195 have 2nd edition, but the remaining 195 do not have 2nd edition.

Solutions for questions 17 to 20: Assume that Q spent ₹ x .

P spent ₹200 more than Q.

\Rightarrow P spent $(x + 200)$

R spent ₹200 more than P.

\Rightarrow R spent $(x + 200 + 200) = (x + 400)$

S spent ₹200 more than R.

\Rightarrow S spent $(x + 400 + 200) = (x + 600)$

We have:

$P + Q + R + S = 9600$

$\Rightarrow x + 200 + x + x + 400 + x + 600 = 9600$

or $x = 2100$

\therefore P spent ₹2300; Q spent ₹2100;

R spent ₹2500 and S spent ₹2700.

Now, assume that amount spent on shoes = x .

Amount spent on clothes = $(x + 200)$

Amount spent on books = $(x + 400)$

$\Rightarrow x + x + 200 + x + 400 = 9600$

or $x = 3000$

From (i) and the above data, we get

	Shoes	Clothes	Books	Total
P				2300
Q	800	400		2100
R				2500
S				2700
Total	3000	3200	3400	9600

Q spent $2100 - (800 + 400) = 900$ on books.

From (iv), we get:

S spent ₹800 on clothes and

R spent ₹900 on clothes.

\therefore P's expenditure on clothes = $3200 - (400 + 800 + 900)$
 Total Q S R
 $= ₹1100$

Also, from (ii), the table will be

	Shoes	Clothes	Books	Total
P		1100		2300
Q	800	400	900	2100
R	1100	900		2500
S		800		2700
Total	3000	3200	3400	9600

Amount spent by R on books = $2500 - (1100 + 900) = 500$.

Let the amount spent by S on books = x

Amount spent by P on books = a

Amount spent by S on shoes = b

From (iii), we get

$n = a + b$

The total of books purchased by P, Q, R and S is 3400.

Hence, $a + 900 + 500 + x = 3400$

$a + 900 + 500 + x = 3400$

or $a + x = 2000$

(1)

From row S,

$b + 800 + x = 2700$

or $b + x = 1900$

(2)

(1) + (2)

$\Rightarrow a + b + 2x = 3900$

We have: $a + b = x$

$\Rightarrow 3x = 3900$

(or) $x = 1300$

$a + x = 2000 \Rightarrow a = 700$

$b + x = 1900 \Rightarrow b = 600$

Hence the final table will be

	Shoes	Clothes	Books	Total
P	500	1100	700	2300
Q	800	400	900	2100
R	1100	900	500	2500
S	600	800	1300	2700
Total	3000	3200	3400	9600

17. Q spent ₹2100 only.

18. S spent ₹1300 on books.

19. P spent ₹700 on books.

20. Q spent ₹800 on shoes.

Solutions for question 21 to 24: Given information:

Total number of houses is less than <700 .

From (ii), (Only LokVichaar) = $2 \times$ (Only LokVichaar and JanSamachar)

= $2 \times$ (Only LokVichaar and Veekshan).

From (iii), only JanSamachar and (LokVichaar or Veekshan) = (JanSamachar and LokVichaar and Veekshan)

i.e., (Only JanSamachar and Veekshan) + (Only JanSamachar and LokVichaar) = (JanSamachar and LokVichaar and Veekshan)

From (iv), (Only Veekshan) = $3 \times$ (Only JanSamachar and LokVichaar).

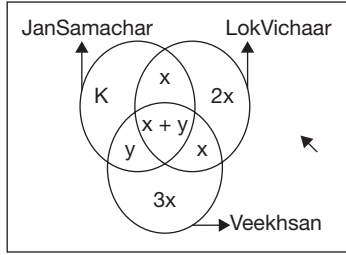
20% (Total number of houses) = Subscriptions to all the three dailies \neq Any multiple of 20.

\Rightarrow (Total number of houses) = $5 \times$ (Subscriptions to all the three dailies)

(Only JanSamachar and LokVichaar) = $41\frac{2}{3}\%$ of number of subscriptions to all the three.

If we calculate by letting (Only JanSamachar and LokVichaar) = x .

The given information can be represented in the following Venn diagram:



From the above information, we can deduce the following:

$$41\frac{2}{3}\%(x+y) = x \Rightarrow \frac{125}{300}(x+y) = x \Rightarrow 5y = 7x \Rightarrow y = \frac{7x}{5}$$

$$\Rightarrow \text{Subscriptions to all the three dailies} = \left(x + \frac{7x}{5}\right) = \frac{12x}{5}$$

$$\text{Total number of houses} = 5 \times (x+y) = 12x$$

$$\Rightarrow k + x + 2x + \frac{7x}{5} + \frac{12x}{5} + x + 3x = 12x \Rightarrow k = 5x - \frac{19x}{5}$$

$$\Rightarrow k = \frac{6x}{5}$$

Also, we know that $12x < 700$ and $\frac{12x}{5} > 110 \Rightarrow 550 < 12x < 700 \Rightarrow 48.5 < x < 58.3$

But each of x , y and k are integers and $k = \frac{6x}{5} \Rightarrow x$ is a multiple of 5.

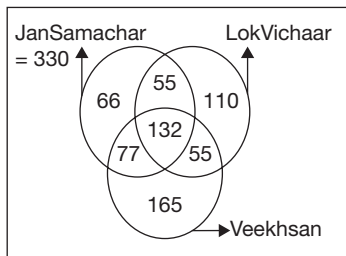
Thus, the possible values for x are $x = 50$ or $x = 55$.

$$\text{If } x = 50, \text{ then } \frac{12x}{5} = 120.$$

This is not possible because subscriptions to all the three dailies is not a multiple of 20.

$$\text{Therefore, } x = 55; \Rightarrow k = 66 \text{ and } y = 77$$

The resultant Venn diagram would be as follows:



21. Veekhsan is having the highest number of subscriptions = 429.

22. JanSamachar is having the lowest number of subscriptions = 330.

23. Total houses in village = $132 \times 5 = 660$.

24. Total subscriptions = $330 + 352 + 429 = 1111$.

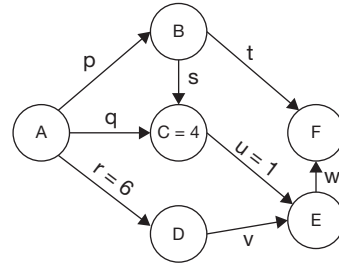
Solutions for questions 25 to 27:

25. 5 people speak only Spanish and Hindi.

26. 3 people speak only Hindi.

27. The number of people who speak at least three languages are $1 + 2 + 3 + 4 + 5 = 15$.

Solutions for questions 28 to 31: The network can be represented as follows.



Given that, $r = 6$, $u = 1$, $C = 4$ and $F = 2E$.

As $C = 4$ and the number of chocolates with them are consecutive natural numbers, the maximum number of chocolates with any person can be 8 (As A is the least).

As $F = 2E$, (E, F) can be $(1, 2)$, $(2, 4)$, $(3, 6)$ or $(4, 8)$.

E cannot be 1 as A has the least number of chocolates or E and F cannot have 4 chocolates (as $C = 4$).

$\therefore E = 3$ and $F = 6$

As the number of chocolates are consecutive natural numbers, there should be five chocolates with A, B or D ($E = 3$, $C = 4$ and $F = 6$).

As A has the least number, he cannot have 5 chocolates.

$$\text{If } D = 5, r = D + v$$

$$\Rightarrow v = 1$$

Now $u = v = 1$, which does not satisfy the condition that a person should not receive the same number of chocolates from two different people.

$$\therefore B = 5$$

Now D should be either 2 or 7 to form consecutive numbers. As $r = 6$, D cannot be 7.

$$\therefore D = 2 \text{ and } A = 1 \text{ (the least)}$$

$$v = r - D = 6 - 2 = 4$$

$$w = v + E - w = 4 + 1 - 3 = 2$$

$$t = F - w = 6 - 2 = 4$$

$$\text{Now } p = B + s + t = 5 + s + 4$$

$\Rightarrow p = 9 + s$ and s should be at least 1 and p must be at most 10.

$$\therefore s = 1 \text{ and } p = 10$$

$$q + s = C = 4 \Rightarrow q = 4 + 1 - 1 = 4$$

Solutions for questions 28 to 31: Type in your answer in the space provided below the question.

28. The number of chocolates with A before distribution is equal to the total number of chocolates with A, B, C, D, E and F after distribution = $1 + 2 + 3 + 4 + 5 + 6 = 21$.

29. $D = 2$ _____

30. $q = 4$ _____

31. $A + B + D = 1 + 5 + 2 = 8$ _____

Solutions for questions 32 to 35: From condition (1), A and F are not seated at the ends, also the people sitting at the ends do not have hall tickets whose number ends with 2.

From condition (2), since neither A nor F is at the ends they form the middle pair.

B/E E/B A/F F/A C/D D/C

Since the last two digits of the hall ticket numbers are multiples of 6: 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96.

Using condition (4), we get

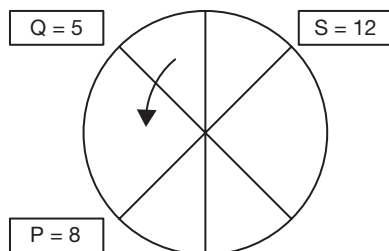
B/E E/B A/F F/A C/D D/C
18 42/48 48/42 78

Using condition (5), we get

B E A F D C
18 12 42/48 48/42 72 78

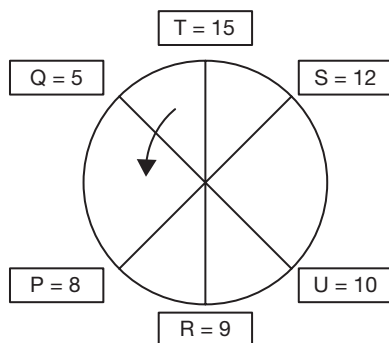
Solutions for questions 36 to 39: From (4), Q is the individual who has received 5 calls (minimum).

Therefore, using 1, 2, and 3 we have:



Calls are any number from of: 3, 6, 9, 12, 15, 18, 4, 8, 12, 16, 5, 10, 15.

With condition (3), $P = 8$ and $S = 12$ is the only possibility. Using condition (5), we get



Between 9 and 12 we have only 10, so $U = 10$. $T = 15$, 16 or 18 but since it has to be odd, only 15 is possible.

36. U received ten calls.

37. The difference is $15 - 5 = 10$.

38. P is second to the left of 8, who received eight calls.

39. The ratio is $3 : 3 = 1$

Solutions for questions 40 to 43: From (2), we have

AP \rightarrow Production target is 2000 tons (least) and area target is 1500 hectares (least).

Hence, from (1), yield target 2.5 for Gujarat's possible with yield target of 5000 tons and area target of 2000 hectares. Similarly, for Karnataka $2.86 = 3000/3500$.

From (2), for Andhra Pradesh yield target
 $= 2000/1500 = 1.33$

Tamil Nadu $> 1.33 >$ Maharashtra

From (3), for Tamil Nadu yield target 2 is possible, under the given condition, only for a production target of 4000 tons and area target of 2000 hectares.

From (4), it can be said that for Maharashtra, the production target is 3000 tons, area target is 3000 hectares. Hence, yield target is 1.

The final table is as follows:

State	Yield	Production target	Area target
Gujarat	2.5 (1)	5000 (1)	2000 (3)
Karnataka	0.86 (5)	3000 (4)	3500 (1)
Andhra Pradesh	1.33 (3)	2000 (5)	1500 (5)
Tamil Nadu	2 (2)	4000 (2)	2000 (4)
Maharashtra	1 (4)	3000 (3)	3000 (2)

40. The rank of Gujarat in terms of area target is 3.

41. The rank of Karnataka in terms of production target is 4.

42. Karnataka's $2 \times 3500 = 7000$

New target = 7000

So, excess target = $7000 - 3000$
 $= 4000$

43. New yield = 1, so production is 2000.

\Rightarrow 2000 hectares more required to maintain production target.

Solutions for questions 44 to 47: Let's assume Santiago is TT then all his statements would be true.

	S_1	S_2	S_3
Santiago	T	T	T

	Santiago	Benjamin	Mateo
Product	DT	Saree	Shawl
Cost	2000		3000
Tax @10%	200		300

So, now Benjamin's statement should be analysed (DT stands for Darjeeling tea) using the above table.

	S_1	S_2	S_3
Santiago	T	T	T
Benjamin	?	T	F

Since, there is one true and false statement Benjamin is an alternator.

$\therefore S_1$ is false \Rightarrow Mateo purchased Shawl.

Now, the above information is compared with Mateo's statement.

		S_1	S_2	S_3
Truth teller	Santiago	T	T	T
Alternator	Benjamin	F	T	F
Liar	Mateo	F		T

Here, S_3 is true. But Mateo must be a liar. We have come across a contradiction. Hence, Santiago cannot be the truth teller.

Let Benjamin be truth teller (TT).

	S_1	S_2	S_3
Benjamin	T	T	T

	Santiago	Benjamin	Mateo
Product	Shawl		
Cost		2000	3000
Tax @10%		200	300

With the above table let us analyse Santiago's statement.

	S_1	S_2	S_3
Benjamin	T	T	T
Santiago	?	T	F

So, Santiago $S_1 = F$

Therefore, Benjamin bought Darjeeling tea.

	Santiago	Benjamin	Mateo
Product	Shawl	DT	Saree
Cost		2000	3000
Tax @10%		200	300

Now, Mateo's statement can be analysed using the above table.

	S_1	S_2	S_3
Benjamin	T	T	T
Santiago	F	T	F
Mateo	F	F	F

So, Benjamin = Truth teller

Santiago = Alternator

Mateo = Liar

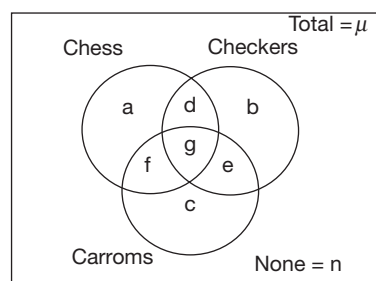
44. ₹2200 is paid for Darjeeling tea.

45. 1.5 times.

46. ₹1100 is paid by Santiago.

47. In all, ₹6600 is spent.

Solutions for questions 48 to 51:



Let us represent the given information in the form of a Venn diagram.

Let the number of people who play Checkers = $21x$

From (iv), $b + d + g + e = 21x$ and $g + e = 12x \Rightarrow b + d = 9x$

From (ii), $g + e = a = 12x$

From (i), $3g = 21x$ (or) $g = 7x \Rightarrow e = 5x$

From (vi), $e : n = 1 : 2$

$\therefore n = 10x$

From (iii), $d : n = 3 : 5$

$\therefore d = 6x \Rightarrow b = 3x$

From (vi), $d + e + f : e = 4 : 1$

$\therefore f = 9x$

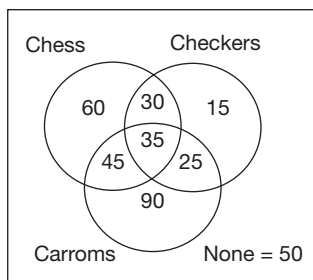
From (v), $c : b = 6 : 1$

$\therefore c = 18x$

$a + b + c + d + e + f + g + n$

$= 12x + 3x + 18x + 6x + 5x + 9x + 7x + 10x = 70x$

Given that $70x = 350$
 $\Rightarrow x = 5$

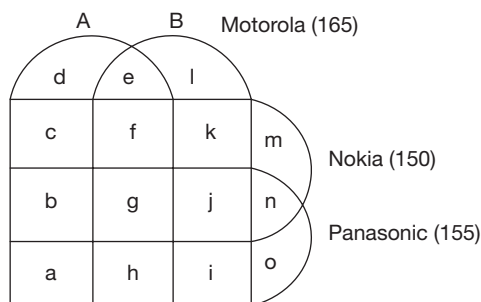


\therefore The final Venn diagram is as follows:

48. $30 + 45 + 25 = 100$ people play exactly two games.
49. Chess but not Carroms = $60 + 30 = 90$.
50. Do not play Chinese Checkers = Total – Chinese Checkers
 $= 350 - (30 + 15 + 35 + 25) = 300 - 105 = 245$.
51. Chess or Carroms = Total – (None + Chinese Checkers only) = $350 - (50 + 15) = 285$.

Solutions for questions 52 to 55:

Sony ericsson (175)



It is given that Sony Ericsson and Motorola = 75
 $\Rightarrow e + f + g + h = 75$

Also,

Nokia and Panasonic = $75 \Rightarrow b + g + j + n = 75$

(1) + (2) = $e + b + f + j + h + n + 2g = 150$

Given that exactly three = 75

$\therefore f + b + j + h = 75 \Rightarrow e + n + 2g = 75$

Also, given that sum of the number of families using Sony Ericsson and Motorola only and the number of families using Nokia and Panasonic only is 25.

$\Rightarrow e + n = 25$

$\therefore g = 25$

52. All the four = $g = 25$
53. Exactly one + Exactly two + Exactly three + Exactly four = 280.
 Given that: Exactly two = Exactly one + 100
 As Exactly four = 25 and Exactly three = 75. Exactly two = 140.
 \therefore Exactly two + Exactly three = 215.

54. Exactly two + Exactly three = 215 and Exactly four = 25
 \therefore Exactly one = (Exactly one + 100) = $280 - (75 + 25)$
 \Rightarrow Exactly one = 40

55. Given, $f + h = 35$.

We have, $e + f + g + h = 75 \Rightarrow e + g = 75 - 35 = 40$.

Also, $g = 25 \Rightarrow e = 15$

Also, we know that $e + n = 25 \Rightarrow n = 10$

Sony Ericsson + Motorola = $175 + 165 = 340$

$\therefore a + b + c + d + i + j + k + l + 2(e + f + g + h) = 340$

$a + b + c + d + e + f + g + h + i + j + k + l = 340 - 75 = 265$
 (1)

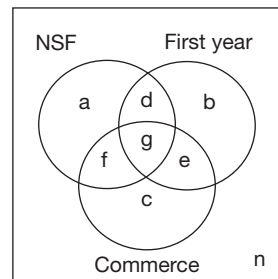
Total – (1) = $m + n + o = 280 - 265 = 15$

We have: $n = 10$

$\therefore m + o = 5$

The required value is 5.

Solutions for questions 56 to 60: Consider the following Venn diagram. Group total (GT) = 500



$a + b + c + d + e + f + g + n = 500$ (1)

In the above Venn diagram, the number inside each circle is the number of students who belong to that group and the remaining belong to the other group in the category.

Example: Number of NSF members is $a + d + f + g$.

and the number of SFI members is $b + c + e + n$.

Here, 'n' represents the second year Science students who are SFI members. Also, the number of the first year Science students who are NSF members is d.

Given $e = 90$ (2)

$a + d + f + g = 270$ (3)

$c = 50$ (4)

$d + g = 140$ (5)

$d + f = 150$ (6)

$f + c = 120$ (7)

$a + b = 100$ (8)

From (4) and (7), $f = 120 - 50 = 70$ (9)

From (9) and (6), $d = 150 - 70 = 80$ (10)

From (10) and (5), $g = 140 - 80 = 60$

\therefore From (3), $a = 270 - (d + f + g)$

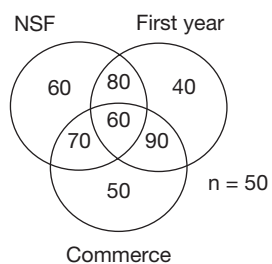
$= 270 - (150 + 60) = 60$

From (8), $b = 100 - 60 = 40$

From the above results, we calculate the final result:

$n = 500 - (270 + 90 + 40 + 50) = 50$

∴ The final Venn diagram is as follows.
GT = 500



- 56. The required number is n , i.e., 50.
- 57. The required number is b , i.e., 40.
- 58. The required number is g , i.e., 60.
- 59. The required number is $c + g$, i.e., $50 + 60 = 110$.
- 60. The required number is $GT - (b + e)$,
i.e., $500 - 40 - 90 = 370$.

Challenge Your Understanding

Practice Set 2

Directions for questions 1 to 4: Answer the questions on the basis of the information given below.

A group of six children, namely Sanjay, Srikanth, Mandira, Jeffery, Charu and Rameez each of a different height are asked to bring as many books as possible from a room in which exactly 21 books from A through U are kept distributed among six shelves, each of which contains a distinct number of books and is at a height equal to the height of exactly one of the six children.

The children bring the books from the room, one after the other, such that no two children are in the room at the same time and each child brings all the books contained in all the shelves which are accessible to him/her, i.e., all the shelves that are at his/her height and below. The following information is further available:

- (i) There is at least one book in each shelf and the total number of books in all the shelves that are accessible to at most two children is the same as that in all the shelves that are accessible to at least five children, which in turn is the same as that in all the shelves that are accessible to less than five but more than two children.
 - (ii) Though Rameez is taller than Jeffery, he returns without bringing any book.
 - (iii) The number of books that each of Srikanth, Mandira and Sanjay bring is the same.
 - (iv) Rameez enters the room immediately before Srikanth, who is taller than Mandira.
 - (v) Though, Charu, who enters the room after Rameez and Srikanth is not the shortest, he does not bring any book.
 - (vi) Jeffery brings six books, while Sanjay is the last one to enter the room.
1. Who is the third to enter the room?
 (A) Mandira (B) Rameez
 (C) Srikanth (D) None of these
 2. How many of the children are shorter than Charu?
 (A) Two (B) One
 (C) Three (D) Four
 3. What is the number of books kept in the shelf which is at the height of Srikanth?
 (A) Two (B) Three
 (C) Four (D) Five
 4. If the children are ranked according to their heights, such that the tallest child is ranked 1st, then who brings as many books as his/her respective rank in terms of height?

- | | |
|--------------|-------------|
| (A) Mandira | (B) Sanjay |
| (C) Srikanth | (D) Jeffery |

Directions for questions 5 to 7: These questions are based on the following information.

Top 64 players participated in a knock out tennis tournament. This tournament has five knock out rounds before the final, i.e., first round, second round, third round, quarter finals and semi-finals. In the first round, the highest seeded player (Seed 1) plays the lowest seeded player (Seed 64) and this match is designated as Match 1 of the first round; the 2nd seeded player plays the 63rd seeded player and this match is designated as Match 2 of the first round and so on. Thus, for instance Match 32 of the first round is to be played between the 32nd seeded and the 33rd seeded players. In the second round, the winner of Match 1 of the first round plays the winner of Match 32 of the first round and this match is designated as Match 1 of the second round. Similarly, the winner of Match 2 of the first round plays the winner of Match 31 of the first round and this match is designated as Match 2 of the second round. Thus, for instance, Match 16 of the second round is to be played between the winner of Match 16 of the first round and the winner of Match 17 of the first round. The same pattern is followed for later rounds as well. An upset is said to be taken place if a lower seeded player beats a higher seeded player.

5. What is the maximum possible number of upsets in the tournament?
 (A) 64 (B) 63
 (C) 127 (D) 32
6. If there is no upset in the tournament, with whom does Seed 3 play in the quarterfinals?
 (A) Seed 6 (B) Seed 2
 (C) Seed 4 (D) Seed 5
7. If Seed 43 reaches the third round, who among the following players could he have played in that round?
 (A) Seed 52 (B) Seed 36
 (C) Seed 54 (D) Seed 38

Directions for questions 8 to 10: These questions are based on the following information.

Each of the three people, namely Mamta, Madhuri and Mithu, belong to different city among Hyderabad, Delhi and Mumbai and also each work in a different city among the cities mentioned above. A person, who belongs to a city, does not work in the same city. When they were asked about themselves, they gave the following replies.

Mamta: I belong to Delhi. Mithu does not work in Delhi.
 Madhuri: I work in Delhi. Mithu belongs to Mumbai.
 Mithu: I do not work in Delhi. Mamta belongs to Mumbai.
 It is also known that, each of them alternates between truth and lie in any order.

8. If Mamta works in Delhi, where does Mithu belong to?
 (A) Hyderabad
 (B) Delhi
 (C) Mumbai
 (D) Hyderabad or Delhi
9. If the first statement of the person, who belongs to Delhi is true, where does Mamta work?
 (A) Mumbai (B) Delhi
 (C) Hyderabad (D) Either (A) or (B)
10. Who belongs to Hyderabad?
 (A) Madhuri (B) Mamta
 (C) Mithu (D) Either (A) or (B)

Directions for questions 11 to 15: These questions are based on the following data.

In a medical college, the courses being offered in a semester are Anatomy, Physiology, Pathology, Ophthalmology, Microbiology, Pharmacology, Biochemistry, Forensic Medicine and Cardiology. Every student is expected to enrol for 6 subjects, subject to the following conditions:

- (i) The student must always choose only one subject between Anatomy and Pathology.
 - (ii) The student must enrol for two and only two subjects from among Physiology, Ophthalmology and Cardiology.
 - (iii) The student must also opt for Anatomy, Physiology and Biochemistry, if he or she enrolls for Pharmacology.
 - (iv) The student cannot opt for Microbiology, if he or she has not chosen Pathology or Biochemistry.
 - (v) The student who does not enrol for Physiology or Pathology cannot choose Forensic Medicine.
11. If a student enrolls for Cardiology and Forensic Medicine, then he or she must enrol for
 (A) Biochemistry and Microbiology
 (B) Anatomy and Pharmacology
 (C) Ophthalmology and Microbiology
 (D) Biochemistry and Pharmacology
 12. If a student enrolls for Microbiology, then the courses he or she cannot opt for are
 (A) Pathology and Physiology
 (B) Microbiology and Biochemistry
 (C) Forensic Medicine and Microbiology
 (D) Anatomy and Pharmacology
 13. The two courses which can never be taken up together are

- (A) Pharmacology and Microbiology
- (B) Physiology and Pathology
- (C) Biochemistry and Ophthalmology
- (D) Cardiology and Pathology

14. If a student enrolls for Microbiology and Forensic Medicine, then he or she must enrol for
 (A) Ophthalmology
 (B) Cardiology
 (C) Pharmacology
 (D) Either (A) alone or (B) alone
15. If a student chooses Ophthalmology and Cardiology, then the maximum number of courses that he or she can enrol for are (given that the condition regarding number of courses to be selected could be violated)
 (A) Six (B) Five
 (C) Four (D) Three

Directions for questions 16 to 19: These questions are based on the following information.

A logician is telling his wife about four pieces of jewellery he has just seen in an exhibition. 'I have seen a watch, a ring, a necklace and a brooch. The heavier of the necklace and the brooch is the costliest, while the costlier of the watch and ring is the lightest. The cheaper of the ring and the brooch is the heaviest, while the heavier of the necklace and the ring is the cheapest. Also, if the brooch is costlier than the necklace, then it is lighter than the watch'. His intelligent wife immediately ranks them in terms of their cost and weight and says, 'We cannot determine the ranks of two of the pieces in one of the comparisons'.

16. Which of the following pairs is the wife of the logician talking about?
 (A) Necklace and Brooch
 (B) Brooch and Watch
 (C) Watch and Ring
 (D) Ring and Necklace
17. The logician then gave his wife an additional statement which was sufficient to determine the complete rank-list in both the comparisons. Which one of the following statements did the logician give his wife?
 (A) If the ring is lighter than the necklace, then the necklace is costlier than the brooch.
 (B) If the necklace is lighter than the brooch, then the brooch is costlier than the watch.
 (C) If the watch is cheaper than the ring, then the ring is heavier than the watch.
 (D) If the ring is not lighter than the watch, then the watch is costlier than the brooch.
18. Which of the following is the costliest?
 (A) Necklace (B) Brooch
 (C) Watch (D) Either (A) or (B)



19. Which of the following is the lightest?
 (A) Ring (B) Watch
 (C) Necklace (D) Either (B) or (C)

Directions for questions 20 to 24: These questions are based on the following information.

A group of six football teams from Maharashtra, Tamil Nadu, West Bengal, Delhi, Karnataka and Andhra Pradesh participated in a tournament. After the first two rounds, it is known that every team played with two different teams, one in each round and won one of the matches and lost the other.

Each team scored a different number of goals, such as 2, 3, 4, 5, 6 and 7 in the first round of tournament and each team scored a different number of goals, such as 1, 3, 4, 5, 6 and 8 in their second round of tournament. We know the following information about their scores.

- (i) West Bengal scored nine goals in total, but it scored less number of goals in the match they won with respect to that in the match they lost.
 - (ii) The number of goals scored by Tamil Nadu in the first round is the same as that conceded by it in the second round.
 - (iii) The number of goals conceded by Karnataka is the same in both the rounds and in both the matches the difference of goals between the winner and the loser is two.
 - (iv) The total number of goals scored in each of the two matches of Maharashtra is 10 but the total number of goals scored by Maharashtra is not 10.
 - (v) Delhi is the only team that scored the same number of goals in both the matches. But in total, it scored less number of goals than any of the other teams.
20. What is the maximum number of goals scored in any match?
 (A) 14 (B) 11
 (C) 12 (D) 13
21. Which team scored the least number of goals in a match?
 (A) Delhi (B) Karnataka
 (C) Andhra Pradesh (D) West Bengal
22. Which team scored the maximum number of goals in both the matches together?
 (A) West Bengal (B) Tamil Nadu
 (C) Karnataka (D) Maharashtra
23. Against which team did Delhi win the match in the first two rounds?
 (A) West Bengal (B) Maharashtra
 (C) Tamil Nadu (D) Andhra Pradesh
24. What is the number of goals scored by Maharashtra in the match it won?
 (A) Six (B) Five
 (C) Seven (D) Four

Directions for questions 25 to 28: These questions are based on the following information.

Harish, Mahesh, Divya, Rohini, Dilip and Seema are a group of people, who are performing in six cities across India. The cities are Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad. All six of them can sing, dance and play music. In each of the six cities they perform all the three activities one after the other. They stage three shows in each city and in each show, they perform one of the activity. Each of them has a fixed partner and perform only with their partners in any city or any show or in any activity. Each pair performs only one activity in a city. Further the following information is known.

- (1) Divya sings in Delhi but does not dance in Bangalore.
 - (2) Rohini sings in Hyderabad and Harish who dances in Delhi sings in Chennai.
 - (3) Seema plays music in Delhi and Rohini plays music in Mumbai.
 - (4) Harish does not sing in Kolkata and Mahesh do not sing in Hyderabad but sings in Bangalore.
 - (5) Divya plays music in two cities only and Harish sings in three cities.
 - (6) In Chennai, Dilip is one of the dancers.
25. Which pair dances in Mumbai?
 (A) Harish – Mahesh (B) Dilip – Divya
 (C) Rohini – Seema (D) Cannot be determined
26. Which of the following is true?
 (A) Harish and Mahesh will dance in Kolkata.
 (B) Rohini and Seema dance only in two cities.
 (C) Dilip and Divya play music in Bangalore.
 (D) None of the above
27. If Harish and Mahesh play music in Kolkata, then who plays music in Hyderabad?
 (A) Harish and Mahesh
 (B) Dilip and Divya
 (C) Rohini and Seema
 (D) Cannot be determined
28. Which of the following statement is sufficient to know the complete schedule?
 (A) Harish and Mahesh dance in Kolkata.
 (B) Dilip and Divya play music in Hyderabad.
 (C) Rohini and Seema dance in Kolkata.
 (D) Harish and Mahesh dance in Hyderabad.

Directions for questions 29 to 33: These questions are based on the following information.

The Dean of a college, Prof. Himanshu, asked Prof. Deodhar to provide him with the analysis of the results of recently completed semester exams in the college, which was written by 108 students. Prof. Deodhar analysed the performance of students in five different subjects, such as Business Statistics (BS), Micro Economics (ME), Supply

Chain Management (SCM), Marketing Management (MM) and Consumer Behaviour (CB). The following are some of his observations.

- (i) The students who passed in MM failed in all other subjects except CB.
- (ii) The students who did not fail in BS, passed in ME.
- (iii) The number of students who failed in four subjects is seven less than those who did not pass in ME. The number of students who passed in three subjects is 18.
- (iv) The students who failed in CB passed in ME and none passed in both the subjects.
- (v) The number of students who passed only in ME is 17 and those passed in MM is 13.
- (vi) The number of students who passed in SCM is 46 and the number of students who passed only in CB is 10.

29. How many students passed in exactly two subjects?

- (A) 46 (B) 52 (C) 41 (D) 63

30. How many students who passed in BS also passed in at least one of the other subjects?

- (A) 22 (B) 40
(C) 18 (D) 57

31. How many students passed in all subjects except ME and MM?

- (A) 21 (B) 11 (C) 10 (D) 0

32. How many students passed in SCM but not in BS?

- (A) 18 (B) 28
(C) 38 (D) None of these

33. Which of the following statements is/are true?

- I. The number of students who passed in at least two subjects is 81.
 - II. The number of students who passed in only SCM and ME is 17.
- (A) Only I (B) Only II
(C) Both I and II (D) Neither I nor II

Directions for questions 34 to 38: These questions are based on the following information.

In the year 2012, KBC Inc., started a GK training institute for general public. It offers certifications in five grades. (In each grade there may be students who newly enrolled or students promoted from a lower grade or students retained from the same grade of previous year.)

A consultant who wanted to perform an audit of the institute's performance collected the following data:

New Enrolments:

- (i) In the first year, 50 students each have enrolled in each of the grades. The number of enrolments in Grade I is the same every year.
- (ii) In grades II, III, IV and V, there were no new enrolments in a grade whenever the number of students retained in that grade is more than or equal to the number of promotees to that grade. In all other cases, their number is equal to the difference of numbers of the students retained and the students promoted.
- (iii) No student has left the institute.

Retention of Students:

- (iv) The number of students retained in any grade is at most 50 and is a multiple of 10.
- (v) Year 2015 has the lowest number of students retained, i.e., 140.
- (vi) In any year, no two grades have the same number of retained students.
- (vii) For any grade, no two years have the same number of retained students.

Promotions:

- (viii) Every student who is not retained is awarded the grade certificate and is promoted to the next higher grade for the next year.
- (ix) In no grade among I, II, III and IV, in any year, all the students have been promoted. In Grade V, only in 2014 all the students have been issued certificates.

Further, the following incomplete table is shared by one of the employees:

	2012		2013				2014				2015				2016			
	T		N	R	P	T	N	R	P	T	N	R	P	T	N	R	P	T
Grade I	50					100		40				30						70
Grade II	50					40						20		120		50		
Grade III	50							30										
Grade IV	50				30	60												
Grade V	50			30					10					20		10		40

N = New enrolments

R = Number of students retained from the same grade previous year

P = Students of one lower grade promoted from previous year

T = Total number of students



Directions: Type in your answer in the space provided below the question.

34. How many Grade V certifications were issued in all, during the given period? _____
35. What is the highest number of new enrolments in any grade across all years? _____
36. How many new enrolments were made in the year 2014? _____
37. What was the total strength of the students in the year 2015? _____
38. In which year KBC Inc. had seen the highest 'New total enrolments'? _____

Directions for questions 39 to 42: These questions are based on the following information.

A, B, C, D and E are five friends each of whom answered five questions in an examination. Each question has five answer choices a, b, c, d and e. The answers marked by the five friends are given in the following table:

	Q.no.1	Q.no. 2	Q.no. 3	Q.no. 4	Q.no. 5
A	b	c	a	e	d
B	b	e	b	b	d
C	e	c	b	e	a
D	b	c	a	b	d
E	b	b	a	e	d

The following information is known regarding them:

- (i) Each person has answered at least one question correct/right in the examination.
- (ii) Only one person has got all the answers correct in the examination.
- (iii) But for B and E, no two among the others have got the same number of questions correct in the examination.
- (iv) Each question has only one correct answer.
39. Which of the following person has got all the questions correct?
(A) A (B) B
(C) D (D) C
40. What is the right choice/answer for Question 2?
(A) e (B) c
(C) b (D) a
41. How many questions were answered correctly by B?
(A) Two (B) One
(C) Four (D) Three
42. Which of the following combination is correct?
(A) A – 1 (B) D – 5
(C) B – 5 (D) C – 5

Directions for questions 43 to 45: These questions are based on the following information.

There are 10 boxes, each containing n balls. Each of the balls in nine boxes weigh 1 kg whereas each of the balls in the remaining box weighs 2 kg. A spring balance is used to weigh these balls and m is the minimum number of weighing required to find the box that contains the 2 kg balls.

43. If $n = 10$, then $m =$
(A) One (B) Two
(C) Three (D) Four
44. If $n = 2$, then $m =$
(A) Two (B) Three
(C) Four (D) Five
45. If $n = 3$, then $m =$
(A) Two (B) Three
(C) Four (D) Five

Directions for questions 46 to 48: These questions are based on the following information.

A group of five friends, namely A, B, C, D and E purchased exactly one fruit basket from among the five fruit baskets, such as P, Q, R, S and T. Each of the five baskets contained four apples or five bananas or six oranges or seven mangoes or eight guavas. No two baskets contained the same variety of fruits. Q contained six fruits in it. Each of the five friends, then transferred at least one and at most two fruits from her respective basket to each of the other baskets. None of the friends transferred any fruit that they received from another. After all the transfers, it is observed that

- (i) R has no guavas in it.
(ii) P has a total of ten fruits, at least three of which are mangoes.
(iii) T has six fruits in all, none of which is an apple.
46. How many fruits were there in S initially?
(A) Six (B) Seven
(C) Four (D) Five
47. Which fruit is present in all the baskets after all the transfers?
(A) Banana (B) Orange
(C) Mango (D) Both Orange and Mango
48. Which of the following statements is true?
(A) The baskets having the same total number of fruits after all the transfers have an equal number of each kind of fruit.
(B) The two baskets which have a difference of four in the total number of fruits after all the transfers have an equal number of fruits of exactly three kinds.
(C) After all the transfers, no two baskets have an equal number of fruits of more than two kinds.
(D) The basket which was initially having the highest total number of fruits, now has the lowest total number of fruits.

Directions for questions 49 to 52: Answer these questions on the basis of the information given below.

The company XYZ Ltd. recruited 80 trainees, of which it was observed that every trainee has

- (i) Exactly one qualification among
 - (a) B.E. (b) M.Sc.
- (ii) At least one feature among the following two
 - (a) He is from a reputed college.
 - (b) He has a good academic record.
- (iii) Experience in exactly one of the following two domains
 - (a) Programming (b) Testing

Further it is also known that:

- (a) 20 trainees who are B.Es have good academic record as well as experience in Testing. These trainees form 50% of those with experience in Testing.
- (b) No trainee with experience in Programming has both the features mentioned in (ii), i.e., being from a good college and having a good academic record.
- (c) 30 trainees were M.Sc.s, of which 15 have experience in Programming.
- (d) Of the trainees with experience in Testing, 15 were from a reputed college and they have good academic record.
- (e) In total, 45 trainees have good academic record, of which two-thirds were B.Es and one-third have experience in Programming.

49. How many of the trainees with experience in Programming are B.Es and also have good academic record?

- (A) 8 (B) 10
- (C) 12 (D) Cannot be determined

50. How many trainees with experience in Testing have good academic record and also are B.Es and are from a reputed college?

- (A) 5 (B) 7
- (C) 12 (D) Cannot be determined

51. How many M.Sc.s are from a reputed college but have neither a good academic record nor any experience in Programming?

- (A) 5 (B) 6
- (C) 7 (D) Cannot be determined

52. If 18 B.Es have good academic record but are not from a reputed college, how many M.Sc.s are from a reputed college and with good academic record?

- (A) 3 (B) 4
- (C) 5 (D) Cannot be determined

Directions for questions 53 to 56: These questions are based on the following information.

A group of six people, namely Anand, Bindu, Charu, Dilip, Indu and Kiran stay in rooms numbered from 1 through 6. There are two types of products, such as books

and mobiles. Among them, three people bought books and the others bought mobiles. The books are Maths, Physics and Chemistry and the mobiles are Nokia, LG and Samsung. The following is also known.

- (1) No two people with consecutive room numbers bought the same type of product.
- (2) Charu stays in room number 6 and Anand in room number 3.
- (3) Bindu and Charu bought the same type of product; Anand and Dilip bought different types of product.
- (4) Indu bought LG mobile and Bindu bought Maths book.
- (5) The person who stays in room number 4 bought Chemistry book.
- (6) The person in room number 5 bought Nokia mobile.

53. Who bought the Chemistry book?

- (A) Anand (B) Charu
- (C) Dilip (D) Kiran

54. Who stays in room number 2?

- (A) Bindu (B) Dilip
- (C) Indu (D) Kiran

55. The person who is in room number 1 bought ____.

- (A) LG mobile (B) Maths book
- (C) Samsung mobile (D) Physics book

56. The person who bought Samsung mobile is in the room number adjacent to that of ____.

- (A) Indu
- (B) Charu
- (C) The person who bought Physics book.
- (D) The person who bought Maths book.

Directions for questions 57 to 59: These questions are based on the following information.

A group of people, namely Ram, Shyam, Tarun and Uday belong to Zig-zag island. In that island, there are four different types of people. Yes-Yes type, who always speak truth, No-No type who always lie, Yes-No type who speak truth first followed by a lie and No-Yes type people who speak a lie first followed by a true statement.

No two people belong to the same category. The following are the statements made by them.

- Ram: Shyam is No-No type.
Uday is Yes-No type.
- Shyam: Tarun is No-No type.
I am Yes-Yes type.
- Tarun: I am Yes-No type.
Shyam is Yes-No type.
- Uday: Tarun is No-No type.
Shyam is No-No type.

57. Who belongs to Yes-No type?

- (A) Ram (B) Shyam
- (C) Uday (D) Tarun



58. Who belongs to No-No type?
 (A) Ram (B) Shyam
 (C) Uday (D) Tarun

59. Who belongs to No-Yes type?
 (A) Ram (B) Shyam
 (C) Tarun (D) Uday

Directions for questions 60 to 63: These questions are based on the following information.

In a cricket trophy, a group of six teams, such as Australia, India, New Zealand, South Africa, Sri Lanka, England are competing against each other.

Matches are held in 2 stages. In Stage-1, each team plays 3 matches and in the Stage-2, each team plays 2 matches. Each team plays against the other only once. Tie breakers are used to avoid draw matches.

The observations after Stage-1 and Stage-2 are as given below:

STAGE-1:

- (i) One team won all the matches in this stage.
- (ii) Two teams lost all the matches played in this stage.
- (iii) England lost to Australia but won against Sri Lanka and New Zealand.
- (iv) South Africa lost to India but won against Sri Lanka and New Zealand.
- (v) India won at most 2 matches.
- (vi) New Zealand did not play against the top-team in Stage-1.

STAGE-2:

- (i) The top-team of Stage-1 lost all the remaining matches.
- (ii) Of the two teams at the bottom after Stage-1, one team won both matches, while other lost both matches.
- (iii) In all, 3 teams lost both matches in Stage-2.

60. The team which lost the highest number of matches is
 (A) Sri Lanka
 (B) New Zealand
 (C) South Africa
 (D) Sri Lanka and England
61. The team (s) that lost exactly two matches in the event is/are
 (A) India (B) Australia
 (C) New Zealand (D) Australia and India
62. The total number of teams that lost two matches in any stage is
 (A) Two (B) Three
 (C) Four (D) One
63. The team which won against Australia can be
 (A) India (B) South Africa
 (C) New Zealand (D) Both (B) and (C)

Directions for questions 64 to 67: These questions are based on the following information.

The Sports Authority of India (SAI), in its 'catch them young' drive selected 215 sprinters, from all over the country to be trained for the 2020 Olympics in three events, such as in 100 m, 200 m and 400 m. These sprinters were divided into three categories A, B and C.

'A' – The sprinters who are suitable for all the three events.

'B' – The sprinters who are suitable for only two events.

'C' – The sprinters who are suitable for only one event.

Further it is known that:

- (1) The number of sprinters in categories A, B and C is 35, 60 and 120, respectively.
- (2) Every sprinter is trained in at least one of the three events.
- (3) From the sprinters in each category, an equal number of sprinters are trained in every possible combination of events, for which the sprinters of that category are suitable.

64. How many sprinters are trained in exactly two events?

- (A) 60 (B) 45
 (C) 30 (D) 50

65. If during training, 60% of the sprinters of Category A who are trained in only the 400 m were selected for training in the 100 m as well, then how many sprinters are trained only in the 100 m and the 400 m events?

- (A) 21 (B) 15
 (C) 18 (D) 24

66. It is known that VISAS can be issued to only 35 athletes to participate in the Olympics. If SAI wants to put its athletes to optimum utilization, then how many times the names of the Indian athletes appear in the list of participants in these three events together?

- (A) 60 (B) 85
 (C) 75 (D) 50

67. In view of the conditions imposed in the previous question, what is the least possible number of athletes who participate in the 200 m sprint event?

- (A) 35 (B) 20
 (C) 15 (D) 10

Directions for questions 68 to 70: These questions are based on the information given below.

A group of five friends, namely Tushar, Bhupen, Jemmy, Arpit and Manas went to a shop with ₹75, ₹150, ₹40, ₹300 and ₹200, respectively. Five materials, such as Pen, Bracelet, Perfume, Wristwatch and Teddy Bear are available in that shop and the costs per unit of the above items are ₹20, ₹30, ₹50, ₹70 and ₹100, respectively. Each of the five people bought at least one of the items and on each item they together spent at least ₹100. At the end of their shopping,

the shopkeeper received ₹610 in total. None of them bought more than one quantity of any item.

68. Who among them was left with the maximum amount of money at the end of the shopping?
 (A) Bhupen (B) Arpit
 (C) Manas (D) Tushar
69. Who among them did not buy the Bracelet?
 (A) Tushar
 (B) Bhupen
 (C) Jemmy
 (D) More than one of the above
70. Which of the following is false regarding the exact amount which they were left with?
 (A) Exactly two among them was left with ₹30 each.
 (B) Exactly one among them was left with ₹20.
 (C) None of them was left with ₹40.
 (D) Exactly two among them was left with ₹20 each.

Directions for questions 71 to 74: Answer the following questions based on the information given below.

Six teams (P, Q, R, S, T and U) are taking part in a cricket tournament. Matches are scheduled in two stages. Each team plays three matches in Stage-I and two matches in Stage-II. No team plays against the same team more than once in the event. No ties are permitted in any of the matches. The observations after the completion of Stage-I and Stage-II are as given below.

Stage-I:

- One team won all the three matches.
- Two teams lost all the matches.
- S lost to P but won against R and U.
- T lost to Q but won against R and U.
- Q lost at least one match.
- U did not play against the top team of Stage-I.

Stage-II:

- The leader of Stage-I lost the next two matches.
- Of the two teams at the bottom after Stage-I, one team won both matches, while the other lost both the matches.
- One more team lost both matches in Stage-III.

71. The two teams that defeated the leader of Stage-I are
 (A) U and S (B) T and U
 (C) Q and S (D) T and S
72. The only team(s) that won both matches in Stage-II are
 (A) Q (B) T and U
 (C) P, T and U (D) Q, T and U
73. The teams that won exactly two matches in the event are
 (A) S and U (B) S and T
 (C) T and U (D) S, T and U

74. The team(s) with the most wins in the event is (are)
 (A) Q and T (B) P and R
 (C) U (D) T

Directions for questions 75 to 78: Answer the questions on the basis of the information given below.

Two persons, Arjun and Madhu were involved in buying and selling of gold over five trading days. At the beginning of the first day, the price of a gram of gold was ₹1000, while at the end of the fifth day it was priced at ₹1100. At the end of each day, the gold price (per gram) went up by ₹100 or it came down by ₹100. Both Arjun and Madhu took buying and selling decisions at the end of each trading day. The beginning price of gold on a given day was the same as the ending price of the previous day. Arjun and Madhu started with the same quantity of gold and amount of cash and had enough of both. Below are some additional facts about how Arjun and Madhu traded over the five days.

- Each day, if the price went up, Arjun sold 10 grams of gold at the closing price. On the other hand, each day if the price went down, he bought 10 grams at the closing price.
- If on any day, the closing price was above ₹1100, then Madhu sold 10 grams of gold, while if it was below ₹900, he bought 10 grams, all at the closing price.

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

75. If Arjun sold 10 grams of gold on three consecutive days, while Madhu sold 10 grams only once during the five days, the price of gold (per gram) at the end of day 3 was ₹. _____
76. If Arjun ended up with ₹13000 more cash than Madhu at the end of day 5, the price of gold (per gram) at the end of day 4 was ₹. _____
77. If Madhu ended up with 20 grams of gold more than Arjun at the end of day 5, the price of a gram of gold at the end of day 3 was ₹. _____
78. If Madhu ended up with ₹1000 less cash than Arjun at the end of day 5, what was the difference in the quantity of gold with Madhu and Arjun (at the end of day 5)?
 (A) Madhu had 10 grams more than Arjun.
 (B) Madhu had 20 grams more than Arjun.
 (C) Arjun had 10 grams more than Madhu.
 (D) Both had the same quantity of gold.

Directions for questions 79 to 82: These questions are based on the information given below:

In factory XYZ, the factory raw material passes through five stages during processing. The five stages of processing require machines A, B, C, D and E, respectively. The processing



can be done only in the above-mentioned order. The capacity and time taken for processing by each machine is as given below.

Machine	Max capacity	Time taken
A	50 kgs	4 hours
B	25 kgs	3 hours
C	10 kgs	1 hours
D	20 kgs	1 hours
E	50 kgs	4 hours

Time taken by each machine to process the material is called a cycle.

Machine A needs a break of two hours after every cycle.

Machine B and E can run continuously. Machine C needs a break of 1 hour after a maximum of three cycles. After every break it can run for three continuous cycles.

Machine D needs a break of 1 hour after a maximum of two cycles.

A machine takes the same time to process irrespective of the capacity used.

There is 100 kg raw material in the factory which needs to be processed.

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

79. The minimum time taken to process the 100 kg raw material is hours. _____
80. By doubling the capacity of which of the following machines can the maximum time be reduced?
(A) Machine B (B) Machine D
(C) Machine E (D) Machine C
81. By doubling the capacity of any one machine, the processing time can be reduced by a maximum of _____ hours.
82. If the raw material available was only 50 kgs, then the minimum time required to process it is _____ hours.

Directions for questions 83 to 86: These questions are based on the following information.

A group of eight lecturers, from A to H are scheduled to teach five subjects, such as Maths, Physics, Chemistry, Biology, and English during a week starting on Monday and ending on Friday such that each lecturer teaches only one subject and is scheduled to teach only once during the week. At least 1 and at the most 2 lecturers teach each subject. Each day has two slots, whereas it is only the morning slot and the

afternoon slot such that no subject is taught more than once in the same slot (morning or afternoon) during the week. In addition to that, the same subject is not taught twice during a single day. No two lectures are scheduled simultaneously.

Further:

- (i) A and C are scheduled to teach on the same day. G and H are scheduled to teach on the same day.
- (ii) C and F teach the same subject. Also, E and H teach the same subject.
- (iii) B teaches Chemistry and D teaches Biology. No one else teaches the subjects B and D teach.
- (iv) D and E alone are scheduled to teach on their respective days.
- (v) F teaches Maths during the morning slot on Friday.
- (vi) Biology is taught during the morning slot on Tuesday.
- (vii) Maths is taught immediately after the day D teaches. Physics is taught both immediately before and immediately after the day D teaches.
- (viii) G is scheduled to teach before A, not necessarily immediately.

83. Which subject does E teach?

- (A) Maths (B) Physics
- (C) English (D) Cannot be determined

84. Which subject is not taught during the morning slot?

- (A) Chemistry (B) English
- (C) Physics (D) Maths

85. Which of the following slots is free (i.e., no lecture is scheduled)?

- (A) Monday – Morning slot
- (B) Wednesday – Afternoon slot
- (C) Thursday – Morning slot
- (D) Thursday – Afternoon slot

86. Which of the following pairs of subjects is not taught on the same day?

- (A) English and Physics
- (B) English and Maths
- (C) Chemistry and Maths
- (D) Maths and Physics

Directions for questions 87 to 91: Answer the questions on the basis of the information given below.

Kalyan, Laxman, Mohan, Naveen, Pranav, Qureshi, Rahul, Sanjay, Uday and Watson are the only ten people working in the HR department of a company. There is a proposal to form a team from within the members of the department, subject to the following conditions.

- A team must include exactly one among Pranav, Rahul and Sanjay.
- A team must include either Mohan or Qureshi but not both.

- If a team includes Kalyan, then it must also include Laxman and vice versa.
- If a team includes one among Sanjay, Uday and Watson, then it must also include the other two.
- Laxman and Naveen cannot be the members of the same team.
- Laxman and Uday cannot be the members of the same team.

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

87. Who cannot be a member of a team of Size 3?
 (A) Laxman (B) Mohan
 (C) Naveen (D) Pranav
88. Who can be a member of a team of Size 5?
 (A) Kalyan (B) Laxman
 (C) Mohan (D) Pranav
89. What is the maximum possible size of the team? _____
90. What could be the size of a team that includes Kalyan?
 (A) 2 or 3 (B) 2 or 4
 (C) Only 4 (D) Only 2
91. What is the number of ways in which a team can be constituted so that the team includes Naveen? _____

Directions for questions 92 to 96: Answer the questions independently of each other.

A group of 21 sports people from four southern states (Kerala, Karnataka, Tamil Nadu and Andhra Pradesh) are selected to receive the Arjuna Award. Each of the 21 people had represented India in one of the four disciplines, such as in Athletics, Basketball, Football and Cricket. The following facts about the sports people are known.

- The number of Basketball players was exactly half the number of sports people in each of the three other disciplines.
- There was no Basketball player from Kerala. Otherwise, every state, including Kerala sent at least one sports person in each discipline.
- None of the states had more than three sports person in any discipline.
- Had there been one less sports person from Tamil Nadu, then there would have been twice as many sports people from Karnataka than each of the other states.
- Selvan and Muthuraj are two Football players among the 21 selected. They are from Tamil Nadu

92. Which of the following cannot be determined from the information given?

- Number of Basketball players from Karnataka.
- Number of athletes from Andhra Pradesh.
- Number of athletes from Tamil Nadu.
- Number of cricket players from Kerala.

93. Which of the following combinations is not possible?
 (A) 2 Football players from Karnataka and 2 athletes from Kerala were among those selected.
 (B) 2 Football players from Karnataka and 1 athlete from Kerala were among those selected.
 (C) 3 cricket players from Karnataka and 1 athlete from Kerala were among those selected.
 (D) Exactly 1 Football player from each of Kerala and Karnataka were among those selected.
94. If Arjun is the only Football player from Karnataka, then which of the following is not true about the number of sports people from the four states?
 (A) There is one athlete from Kerala.
 (B) There is one cricket player from Kerala.
 (C) There are two athletes from Karnataka.
 (D) There are three cricket players from Karnataka.
95. If the number of Football players from Karnataka is equal to the number of cricketers from that state, then what is the number of Cricket players from Karnataka?
 (A) Two (B) Three
 (C) One (D) Cannot be determined
96. Which of the following is true about the number of Football players from Tamil Nadu?
 (A) It is twice the number of athletes from Kerala.
 (B) It is twice the number of Football players from Kerala.
 (C) It is twice the number of Cricket players from Kerala.
 (D) None of these

Directions for questions 97 to 101: These questions are based on the following information:

A group of five students Anil, Sunil, Pavan, Naveen and Sravan appeared for an exam consisting of five questions. Each question is having five answer choices A, B, C, D and E and only one of them is the correct answer choice. The answers given by them is as follows.

Q. No.	Anil	Sunil	Pavan	Naveen	Sravan
1	B	C	D	B	C
2	A	D	B	A	C
3	C	A	D	A	D
4	A	B	C		A
5	E	B	B	E	C



It is also given that four marks are awarded to each correct answer while one mark is deducted for every wrong answer. No marks are awarded or deducted for the questions that are not attempted.

Further, it is known that:

- (i) Naveen did not attempt the fourth question and the total score of Anil is zero.
- (ii) Only one student answered the first question correctly, only one student answered the second question correctly, two students answered the third question correctly, only one student answered the fourth question correctly while two students answered the fifth question correctly.
- (iii) Naveen's score is the highest among the five students and choice (A) is the correct answer for exactly one question.
- (iv) The number of questions for which the correct answer choice is (B) is the maximum.

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

97. Who scored the lowest number of marks?
 - (A) Anil
 - (B) Sunil
 - (C) Pavan
 - (D) Sravan
98. What is the total marks scored by Naveen?_____
99. Which pair of students scored the same number of marks?
 - (A) Pavan and Sravan
 - (B) Anil and Sunil
 - (C) Anil and Sravan
 - (D) Pavan and Sunil
100. The difference between the highest score and the lowest score is_____.
101. If Naveen had marked the fourth question with an answer choice that he has not marked in any other question who would be scoring the second highest?
 - (A) Naveen
 - (B) Pavan
 - (C) Anil
 - (D) Both (A) and (B)

Directions for questions 102 to 104: These questions are based on the data given below.

A survey was conducted among 200 mobile subscribers of three different companies Airtel, IDEA and Cellone. It was found that 50 members do not subscribe to Cellone, 75 members do not subscribe to Airtel and 100 members do not

subscribe to Idea. 125 subscribed to at least two of the three companies.

Directions: Type in your answer in the space provided in the question.

102. The number of customers who subscribe to exactly one service is_____.
103. The number of customers who subscribe to exactly two services is_____.
104. The number of customers who subscribe to exactly three services is_____.

Directions for questions 105 to 109: Answer the questions on the basis of the information given below.

Five friends met at a restaurant one evening. Each one brought some money. They had only ₹10 notes and ₹5 coins with them. Each had a different number of notes and coins. The number of notes they had were 2, 6, 8, 9 and 12. While the number of coins they had were 0, 3, 4, 8 and 12. Below are some more facts.

- (i) The number of coins with Harish was three times the number of coins with the person who had six notes.
 - (ii) Three people, including the one who had eight coins, did not keep a wallet.
 - (iii) Dinesh did not keep a wallet
 - (iv) The one who had only two notes with him, did not have any coins or a wallet.
 - (v) Arpit had notes and coins and also had a wallet.
 - (vi) Manjeet, who did not have a wallet, had half as many coins as the person who had twice as many notes as he had.
 - (vii) Sohan had four more notes than Harish, but Harish had four more coins than Sohan.
105. Which of the following statements is true?
 - (A) Manjeet had 3 coins.
 - (B) Arpit had no coins.
 - (C) Harish had 4 coins.
 - (D) Sohan had 8 coins.
 106. Which of the following statements is true?
 - (A) Manjeet had 8 notes.
 - (B) Arpit had 9 notes.
 - (C) Sohan had 6 notes.
 - (D) Dinesh had 9 notes.
 107. Which of the following statements is true?
 - (A) Dinesh had 6 notes, no coins and no wallet.
 - (B) Sohan had 12 coins and 8 notes but no wallet.
 - (C) Harish had 8 notes and 12 coins but no wallet.
 - (D) Manjeet had 6 notes and 4 coins but no wallet.

108. Which of the following is the ratio of number of coins to that of notes with Arpit?

- (A) 1 : 1 (B) 3 : 8
(C) 1 : 3 (D) 2 : 3

109. Which of the following statements is true?

- (A) Sohan has twice as many coins as the number of notes that Mahesh has.
(B) Mahesh has twice as many coins as the number of notes that Arpit has.
(C) Harish has twice as many coins Mahesh has.
(D) Mahesh has twice as many notes as the number of coins that Arpit has.

Directions for questions 110 to 113: These questions are based on the following information.

A school allows its students to choose their courses according to certain restrictions. Each course has a certain number of credits. The respective credits for each course are given below.

For example: Hindi has 2 credits; Physics has 4 credits and so on.

Each student must pick exactly one course from Group 1, exactly two courses from Group 2 and exactly two courses from Group 3. The courses and their respective credits are shown in the tables below.

Group 1		
Hindi	English	French
2	3	1

Group 2			
Physics	Biology	Chemistry	Maths
4	4	3	5

Group 3			
Sports	Arts and Crafts	Music	Dance
5	3	3	3

110. Manju chose courses with a total of 17 credits. If she did not pick Hindi, then which of the following courses cannot be picked together?

- (A) French and Physics
(B) English and Chemistry
(C) French and Music
(D) English and Sports

111. If Ajay picked French and Chemistry and his aim is to choose maximum possible number of credits, then which course should not be picked by him?

- (A) Music (B) Dance
(C) Biology (D) Maths

112. Surabhi has chosen a total of 18 credits. Which of the following is a possible combination of courses she picked?

- (A) French and Chemistry
(B) Hindi and Biology
(C) English and Maths
(D) Both (B) and (C)

113. Madhuri has picked Maths and Music. She wants to choose a total of 19 credits. Which of the following pairs of courses can she pick?

- (A) Hindi and Chemistry
(B) English and Biology
(C) English and Chemistry
(D) French and Sports

Directions for questions 114 to 117: These questions are based on the following data.

Five colleagues from different divisions of a company met in the club discussing their Sunday's winnings at cards games.

- Mathur and the person from Engineering division together had won ₹1500.
- Sastry and Saxena together won ₹1400.
- Saxena and the senior Vice President together won ₹1200.
- Verma and the Production Manager had together won ₹1000.
- The General Manager and the International Trading Division person together won ₹900.
- The Foods Division man and the Soaps Division person together won ₹700.
- The Vice President and the Oil Seeds Division person together won ₹600.
- Rao and the Soaps Division person together won ₹400.
- The Deputy General Manager together with the only person in Churidar-kurta won ₹800.
- The two people in three-piece suit together won ₹1100.
- The person in Safari-suit has won more than the person in two-piece suit.

114. Which of the following statements are false?

- The Production Manager is in Soaps Division.
 - The Deputy General Manager is in Oil Seeds Division.
 - Rao is the Vice President.
- (A) Only I and II (B) Only II and III
(C) Only III and I (D) All three statements.

115. How much have Rao and Saxena together earned (in ₹)?

- (A) 900 (B) 1100
(C) 1300 (D) None of these



116. Which of the following statements are not true?
- The Vice President and the Senior Vice President together have earned more than the Production Manager and the General Manager put together.
 - The person from Foods Division earned less than the person from the Oil Seeds Division.
 - The person from International Trading earned the same amount as the person in two-piece suit.
- (A) I and II
(B) II and III
(C) III and I
(D) All three statements
117. Who has won the maximum amount?
- (A) Mathur (B) Saxena
(C) Verma (D) Rao

Directions for questions 118 to 121: Answer the questions on the basis of the following information.

In the manufacturing unit of a company, seven machines are used to manufacture a particular product. These machines are named as M1, M2, M3, M4, M5, M6 and M7. On observing the working of these machines, the following facts were known.

- M1: It started first and the next two machines to start were M4 and M3. When it was stopped, M2 and M7 started running. M5 was stopped with it.
- M2: It started with M7 at the time when M1 was already running. One more machine was running at that time.
- M3: It was operated for a short duration and M1, M4 and M5 were running at that time.
- M4: It was stopped immediately after M3 was stopped.
- M5: It was used with M1, M2, M3, M4 and M7 for the first time, when it was started again, M2 and M7 were running.
- M6: It was operated for a small duration. M2 and M5 were running during that time.
- M7: Nothing is known about it.

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

118. Which of the two, M2 or M5 was started first?
- (A) M2
(B) M5
(C) Both started together
(D) Cannot be determined
119. Which machine was running with M1 when M2 was started?
- (A) M3 (B) M4
(C) M5 (D) M6

120. The number of machines that were operated with M7 is _____.

121. Which were the two machines that were the last to be stopped?
- (A) M2 and M6 (B) M6 and M7
(C) M5 and M6 (D) M2 and M5

Directions for questions 122 to 125: Answer the questions on the basis of the information given below.

Physicists have assigned a number called Einstein number (named after the famous physicist Albert Einstein). Only Einstein himself has an Einstein number of zero. Any physicist who has written a research paper with Einstein has an Einstein number of 1. For other physicists, the calculation of his/her Einstein number is illustrated below:

Suppose that a physicist M has co-authored papers with several other physicists. From among them, physicist N has the smallest Einstein number. Let the Einstein number of N be n . Then M has an Einstein number of $n + 1$. Hence, any physicist with no co-authorship chain connected to Einstein has an Einstein number of infinity.

In a seven-day long mini-conference organized in memory of Einstein, a close group of eight physicists, namely P, Q, R, S, T, U, V and W, discussed some research papers. At the beginning of the conference, P was the only participant who had an infinite Einstein number. Nobody had an Einstein number less than that of U.

- On the third day of the conference U co-authored a paper jointly with P and R. This reduced the average Einstein number of the group of eight physicists to 3. The Einstein numbers of Q, S, T, V and W remained unchanged with the writing of this paper. Further, no other co-authorship among any three members would have reduced the average Einstein number of the group of eight to as low as 3.
 - At the end of the third day, five members of this group had identical Einstein numbers while the other three had Einstein numbers distinct from each other.
 - On the fifth day, T co-authored a paper with U which reduced the group's average Einstein number by 0.5. The Einstein numbers of the remaining six were unchanged with the writing of this paper.
 - No other paper was written during the conference.
122. How many participants in the conference did not change their Einstein number during the conference?
- (A) two (B) three
(C) four (D) five
123. The person having the largest Einstein number at the end of the conference must have had how many Einstein number (at that time)?
- (A) Five (B) Seven
(C) Nine (D) Fourteen

124. How many participants had the same Einstein number at the beginning of the conference?
 (A) Two (B) Three
 (C) Four (D) Five
125. What could be the maximum possible number of people with distinct Einstein numbers at the beginning of the third day of the conference?
 (A) Five (B) Six
 (C) Two (D) Three

ANSWER KEYS

1. (B)	19. (B)	37. 470	55. (A)	73. (A)	91. 6	109. (D)
2. (C)	20. (D)	38. 2012	56. (D)	74. (A)	92. (D)	110. (D)
3. (A)	21. (C)	39. (C)	57. (C)	75. 1100	93. (D)	111. (C)
4. (D)	22. (B)	40. (B)	58. (D)	76. 1000	94. (C)	112. (D)
5. (B)	23. (D)	41. (D)	59. (A)	77. 900	95. (C)	113. (C)
6. (A)	24. (C)	42. (B)	60. (A)	78. (D)	96. (D)	114. (C)
7. (D)	25. (B)	43. (A)	61. (B)	79. 25	97. (D)	115. (D)
8. (C)	26. (C)	44. (B)	62. (C)	80. (D)	98. 6	116. (D)
9. (A)	27. (B)	45. (A)	63. (D)	81. 2	99. (D)	117. (B)
10. (B)	28. (C)	46. (D)	64. (B)	82. 18	100. 11	118. (B)
11. (A)	29. (D)	47. (C)	65. (C)	83. (C)	101. (C)	119. (C)
12. (D)	30. (B)	48. (D)	66. (C)	84. (A)	102. 75	120. 3
13. (A)	31. (D)	49. (B)	67. (B)	85. (C)	103. 75	121. (D)
14. (D)	32. (B)	50. (D)	68. (A)	86. (B)	104. 50	122. (D)
15. (B)	33. (C)	51. (A)	69. (C)	87. (A)	105. (D)	123. (B)
16. (B)	34. 120	52. (A)	70. (D)	88. (C)	106. (B)	124. (B)
17. (D)	35. 130	53. (C)	71. (B)	89. 5	107. (D)	125. (A)
18. (A)	36. 100	54. (A)	72. (D)	90. (C)	108. (C)	

SOLUTIONS

Solutions for questions 1 to 4: The number of books are 21 (i.e., A through U). It is given that at least one book is kept in each shelf and the number of books in different shelves are distinct. Hence, the number of books in different shelves are 1, 2, 3, 4, 5 and 6.

Let us indicate the six different shelves by I, II, III, IV, V and VI, respectively in decreasing order.

It is given that the sum of the number of books in shelves I and II (i.e., accessible to five or more children) is equal to the sum of the number of books in shelves V and VI, and also III and IV.

⇒ The sum of the number of books at levels III and IV = I and II = V and IV = 7.

From (vi), Jeffery brought six books, from (ii), Rameez did not bring any book, from (v), Charu did not bring even one book.

⇒ Srikanth, Mandira and Sanjay together brought fifteen books. From (iii), each of Srikanth, Mandira and Sanjay brought five books.

From (vi), Sanjay is the last one to enter the room and he brought five books.

⇒ Sanjay is the tallest among the six and he brought all the books kept at the highest level only.

Hence, Sanjay is the tallest and the number of books at level I is five.

⇒ Number of items at level II is two.

⇒ Each of Mandira and Srikanth brought books kept at two different levels of height, i.e., 3 + 2 or 4 + 1.

⇒ Mandira and Srikanth together brought books kept at four different levels of height.

⇒ Jeffery brought all the books kept at only one level of height.

Since, Mandira and Srikanth brought books kept at different levels, neither of them is the shortest.

From (ii), Rameez is not the shortest.

From (v), Charu is not the shortest.

Hence, Jeffery is the shortest but still he brought 6 items.

⇒ Jeffery is the first to enter the room.



From (iv), Srikanth is taller than Mandira.

⇒ Mandira entered the room before Srikanth.

From (v), Charu entered the room after Rameez and Srikanth.

⇒ Charu entered after Mandira, Rameez and Srikanth.

Hence, Charu is the fifth to enter the room.

Since, Charu could not bring any book, he is not the second tallest.

⇒ Mandira is the second or the third to enter the room.

Since, six books are in shelf VI, the number of books at level V is one since five books are at level I, the number of books at level II is true.

Hence, we obtain the number of books at different levels as follows.

I	–	5
II	–	2
III	–	3/4
IV	–	4/3
V	–	1
VI	–	6

Since, Mandira and Srikanth brought five books each and Srikanth is taller than Mandira, Mandira is the fourth tallest and the number of books in shelf IV is four. Similarly, Srikanth is the second tallest and the number of books in shelf III is three.

⇒ Rameez is the third or the fifth tallest.

Since Rameez entered the room before Srikanth he must be the second or the third to enter the room.

⇒ Mandira and Rameez are the second and the third to enter the room in any order.

Since, Mandira is the fourth tallest and she brought books kept in two different shelves. Rameez who could not bring any book is shorter than Mandira. Hence, Rameez is the fifth tallest.

⇒ Charu is the third tallest. From (v), Rameez is the third to enter the room.

Hence, the final arrangement is as follows.

Order of entering the room	Name	Rank in height	Number of books brought
1	Jeffery	6	6
2	Mandira	4	5
3	Rameez	5	0
4	Srikanth	2	5
5	Charu	3	0
6	Sanjay	1	5

1. Rameez is the third to enter the room.

2. As Charu is the third tallest, there are three children shorter than him.

3. Two books are kept in the shelf which is at the height of Srikanth.

4. Jeffery's rank in height is six and he brought six books.

Solutions for questions 5 to 7: As it is a knockout tournament for eliminating any single player, one match is needed. Now only one of the 64 players has to be the winner. Hence, the remaining 63 players are to be eliminated. Therefore, 63 matches are required.

5. If each match is an upset, we will get a maximum of 63 upsets.

6. As there are no upsets, all the top 8 players will reach quarter finals. In the quarter-finals, Seed 1 plays Seed 8, Seed 2 plays Seed 7, Seed 3 plays Seed 6, Seed 4 plays Seed 5.

7. In the first round, Seed 43 plays Seed 22. In the second round, Seed 43 plays with the winner of the match between Seed 11 and Seed 54. In the third round, Seed 43 and the winner of the matches between 59th and 6th seeded players or the winner of 27th and 38th seeded players are played.

∴ 43rd seeded player would have played with 6th or 27th or 38th or 59th seeded player in the third round.

Solutions for questions 8 to 10: First, let us observe the second statements made by Madhuri and Mithu. Clearly, both of them cannot be true simultaneously. First, let us assume the second statement made by Madhuri is true, so the second statement of Mithu is false, which implies the first statement of Mithu is true.

∴ The second statement of Mamta is true.

Therefore, we get:

Case (1):

Name	I	II	Belongs to	Working in
Mamta	F	T	Hyderabad	Delhi
Madhuri	F	T	Delhi	Mumbai
Mithu	T	F	Mumbai	Hyderabad

Now, let us assume that the second statement of Madhuri is false. So, her first statement is true.

∴ The second statement of Mamta is true and also, the first statement of Mithu is true. So, we get:

Case (2):

Name	I	II	Belongs to	Working in
Mamta	F	T	Hyderabad	Mumbai
Madhuri	T	F	Mumbai	Delhi
Mithu	T	F	Delhi	Hyderabad

8. In Case (1), Mithu belongs to Mumbai.

9. In Case (2), the first statement of the person from Delhi is true. So, Mamta works in Mumbai.

10. Mamta belongs to Hyderabad.

Solutions for questions 11 to 15:

11. If a student enrolls for Forensic Medicine, he must enrol for Physiology and Pathology.

Pathology enrolled \Rightarrow No Anatomy and hence, no Pharmacology.

Since Physiology and Cardiology are taken \Rightarrow Cannot enrol for Ophthalmology.

Hence, choices (B), (C) and (D) are eliminated and choice (A) does not violate any condition.

12. If a student takes up Microbiology, then he must also take Pathology and Biochemistry. This implies that Anatomy cannot be chosen. Since Anatomy cannot be chosen, even Pharmacology cannot be selected.

13. Since Pathology and Anatomy cannot be selected together, those courses, requiring these two as prerequisites, cannot be selected together. Hence, Microbiology or Forensic Medicine cannot be taken with Pharmacology.

14. If a student enrolls for Microbiology and Forensic Medicine, then he must also enrol for Biochemistry, Physiology and Pathology.

Since Pathology is taken, Anatomy and Pharmacology cannot be taken.

Since he has to take Physiology, he cannot take both Ophthalmology and Cardiology but only one of these two.

15. If D chooses Ophthalmology and Cardiology, then he cannot choose Physiology.

\Rightarrow He cannot choose Pharmacology or Forensic Medicine. He cannot enrol for 3 courses. Also, out of Anatomy and Pathology, he can enrol only for one course. Hence, he cannot enrol totally for 4 courses.

\Rightarrow He can take up a maximum of 5 courses.

Solutions for questions 16 to 19:

Statement I:

Costlier of watch and ring is the lightest.

Let us assume that ring is the lightest.

Statement II:

Heavier of necklace and ring is the cheapest.

Statement III:

Heavier of necklace and brooch is the costliest.

Statement IV:

Cheaper of ring and brooch is the heaviest.

If ring is the lightest, it cannot be the heaviest.

\Rightarrow Brooch is the heaviest [statement IV].

\Rightarrow Brooch is the costliest [statement III].

\Rightarrow Necklace is the cheapest [statement II].

But brooch is the heaviest.

\Rightarrow Brooch is heavier than ring.

\Rightarrow Brooch is cheaper than ring [statement IV].

'Brooch is the costliest' and 'Brooch is cheaper than ring' are contradicting each other. Hence, our assumption is wrong.

\Rightarrow Ring is not the lightest.

\Rightarrow Watch is the lightest.

Statement V:

If brooch is costlier than necklace, then it is lighter than watch. But we know that watch is the lightest.

\Rightarrow Necklace is not lighter than watch.

\Rightarrow Brooch is not costlier than necklace.

\Rightarrow Necklace is costlier than brooch.

\Rightarrow Necklace is the costliest [statement III].

\Rightarrow Necklace is heavier than brooch.

\Rightarrow Brooch is not the heaviest.

\Rightarrow Ring is the heaviest [statement IV].

\Rightarrow Ring is the cheapest [statement II].

Let us now rank the pieces of jewellery and show them in the following table.

Rank	Cost	Weight
1	Necklace	Ring
2	Brooch (or) Watch	Necklace
3	Brooch (or) Watch	Brooch
4	Ring	Watch

In the above table, 1st rank represents the costliest or the heaviest as the case may be.

Observation:

We do not know the rank of brooch and watch in terms of cost.

16. The logician's wife is talking about brooch and watch.

17. If we know the comparison between brooch and watch in terms of cost, we can determine the ranks list in both the comparisons.

18. Necklace is the costliest.

19. Watch is the lightest.

Solutions for questions 20 to 22: From the given information.

I round scores – 2, 3, 4, 5, 6, 7

II round scores – 1, 3, 4, 5, 6, 8.

From (5), if Delhi scored 4 goals in each round, then the team which scored one goal in 2nd round can never score more goals than Delhi, which contradicts (5).

\therefore Delhi score of 3 goals in each of the first two rounds.

From (4), the only possibility of getting 10 goals in a match is 6 and 4 in 2nd round. Now, as the total number of goals of Maharashtra is not 10, in the first match the number of goals scored must be 7 and the number of goals conceded must be 3. [\because 3 goals are scored by Delhi is known for us].



∴ In the first round, Delhi and Maharashtra played and Maharashtra won.

∴ Delhi won in the second round.

It must have conceded 1 goal in the second round.

∴ In the second round, as the total number of goals scored is 10 in the match which Maharashtra played, Maharashtra loses it by scoring 4 goals and conceding 6 goals.

From (3) and the above results, as Maharashtra conceded 6 goals in the second round; Karnataka cannot concede 6 goals each in the first two rounds. If Karnataka conceded 5 goals each in the first two matches, then in the first match it has scored either $5 + 2$ or $5 - 2$ goals, i.e., either 7 or 3 goals, which is not possible as Maharashtra and Delhi scored 7 and 3 goals, respectively in the first round matches.

For the same reason as above, it cannot concede 3 goals each in the first two matches.

∴ Karnataka conceded 4 goals each in the first two matches.

It scored one of $(4 + 2)$ and $(4 - 2)$ are the number of goals in the first round and in the second round.

In the second round, no team scored 2 goals.

∴ Karnataka scored 2 goals in the first round and 6 goals in the second round.

From (1) and the above results, as West Bengal scored a total of 9 goals, it must have scored 4 and 5 goals in the first two matches [∴ It cannot have scored 6 and 3 goals as Delhi scored 3 goals in each of the first two rounds]. In the second round as Maharashtra scored 4 goals, West Bengal have scored 4 goals and 5 goals in the first and the second rounds, respectively. As Karnataka conceded 4 goals in the first round, it played against West Bengal in the first round.

As West Bengal won in the first round, it should lose in the second round.

∴ It should concede 8 goals in the second round.

From (2) and the above results, Tamil Nadu cannot score 6 goals in the first round, if so it has to concede 6 goals in the second round, which is not possible as Maharashtra conceded 6 goals in the second round.

∴ Tamil Nadu must have scored 5 goals in the first round and conceded 5 goals in the second round.

It had scored 8 goals in the second round. (West Bengal scored 5 goals and conceded 8 goals in the second round)

∴ Tamil Nadu has to lose in the first round. So, it must have conceded 6 goals in the second round.

AP scored 6 goals and Tamil Nadu conceded 6 goals in the first round and Andhra Pradesh scored 1 goal and conceded 3 goals in the second round.

∴ The final table for the 1st round will be as follows:

- | | | |
|-----------------------------|---|---|
| (1) AP – Tamil Nadu | 6 | 5 |
| (2) West Bengal – Karnataka | 4 | 2 |
| (3) Delhi – Maharashtra | 3 | 7 |

2nd round:

- | | | |
|------------------------------|---|---|
| (1) AP - Delhi | 1 | 3 |
| (2) Karnataka - Maharashtra | 6 | 4 |
| (3) West Bengal – Tamil Nadu | 5 | 8 |

20. Maximum number of goals scored in any match is $5 + 8 = 13$.

21. Andhra Pradesh scored the least number of goals (1) in the second round match.

22. Tamil Nadu scored $5 + 8 = 13$ goals in the first two rounds, which is the maximum.

23. Against Andhra Pradesh, Delhi won the match in the first two rounds.

24. Maharashtra scored 7 goals in the match it won.

Solutions for questions 25 to 28: We can get the following table from the given information.

	Sing	Dance	Play music
Delhi	Divya	Harish	Seema
Mumbai			Rohini
Kolkata	~ Harish	Dilip	
Chennai	Harish	~ Divya	
Bangalore	Mahesh		
Hyderabad	Rohini		
	~ Mahesh		

In Delhi, as Harish is not performing with Divya or Seema they are not his partners. In Chennai, as Dilip is not performing with Harish, they are not partners.

If Rohini is Harish's partner then Harish can sing in Chennai and Hyderabad only, but Harish has to sing in three cities. So, Mahesh is Harish's partner and they will be singing in Chennai, Bangalore and Mumbai.

Now, Divya and Rohini or Divya and Dilip can be partners.

If Divya and Rohini are partners, then they will play music in at least three cities (Chennai, Bangalore, Mumbai). As Divya plays music in only two cities, Divya and Dilip have to be partners.

So, Seema and Rohini are partners.

We will get the final performances as below.

	Sing	Dance	Play music
Delhi	D, D	H, M	R, S
Mumbai	H, M	D, D	R, S

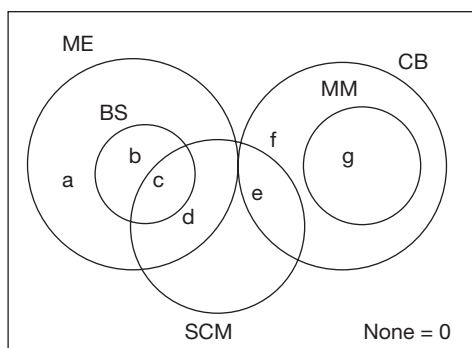
(Continued)

	Sing	Dance	Play music
Kolkata	D, D/R, S	H, M/D, D/R, S	H, M/D, D/R, S
Chennai	H, M	D, D	R, S
Bangalore	H, M	R, S	D, D
Hyderabad	R, S	D, D/H, M	D, D/H, M

D, D → Dilip and Divya
H, M → Harish and Mahesh
R, S → Rohini and Seema

25. Dilip and Divya dance in Mumbai.
26. Dilip and Divya play music in Bangalore is true.
27. If Harish and Mahesh play music in Kolkata and since Divya plays music in two cities, then Dilip and Divya will play music in Hyderabad.
28. If Rohini and Seema dance in Kolkata then Dilip and Divya will Sing in Kolkata. So, Harish and Mahesh will play music in Kolkata. As Divya plays music in at least two cities she has to play music in Hyderabad. So Rohini and Seema will dance in Kolkata. This statement is sufficient to know the complete schedule. Choice (C)

Solutions for questions 29 to 33: From (1), (2) and (4), the information can be represented as follows:



From (3), the number of students who failed in four subjects is equal to the number of student who passed in only one subject = $a + f$.

Enrolments in 2013:

	'12		2013			
	T	N	R	P	T	
I	50	50	50	0	100	N is 50; $\Rightarrow R = 100 - 50 = 50$
II	50	0	40	0	40	$P = 50 - 50 = 0$; $\Rightarrow R > P \Rightarrow N = 0$
III	50	0	20	10	30	$P = 50 - 40 = 10 \Rightarrow N = 0$; $R = 20$ as 30 from previous year are promoted.
IV	50	20	10	30	60	$R = 10$ (only possibility), $N = 30 - 10$
V	50	10	30	40	80	$P = 50 - 10 = 40$; $N = 40 - 30 = 10$; $T = 80$

The number of students who failed in Micro Economics = $e + f + g$

$$a + f = e + f + g - 7 \Rightarrow a + 7 = e + g \quad (1)$$

$$\text{From (4), } c = 18 \quad (2)$$

$$\text{From (6), } c + d + e = 46 \Rightarrow d + e = 28 \quad (3)$$

$$\text{From (5), } a = 17 \text{ and } g = 13, f = 10$$

$$a = 17, g = 13$$

$$\Rightarrow e = 11 \text{ (from (1)) } \Rightarrow d = 17 \text{ (From (3))}$$

$$\text{As } a + b + c + d + e + f + g = 108 \Rightarrow b = 22$$

29. The number of students who passed in exactly two subjects = $b + d + e + g = 22 + 17 + 11 + 13 = 63$.
30. The required number of students = $b + c = 22 + 18 = 40$.
31. No student passed in all the subjects except ME and MM.
32. The required number of students = $d + e = 17 + 11 = 28$.
33. (I) $b + d + e + g + c = 22 + 17 + 11 + 13 + 18 = 81$ is true
(II) $d = 17$ is true
 \therefore Both (I) and (II) are true.

Solutions to questions 34 to 38: The table in the given data can be filled in completely, by filling in the data year wise using the given conditions.

From (i), $N = 50$ for Grade I across all years 2012 to 2016.

From (ii), for any grade either $P = N + R$ or, $N = 0$, if $R > P$, thus for all grades except Grade I, $N = 0$ if $P = 0$ or $P = 10$; R is always a multiple of 10.

From (ix), all students of only Grade V of 2014 are promoted, therefore, $R \neq 0$ except for Grade V in 2015.

Therefore, from (iv), value of R for all five grades in a year will be five different values among 10, 20, 30, 40 and 50. Thus the total number of students retained in any year will be $10 + 20 + 30 + 40 + 50 = 150$ except for the year 2015, where Grade V has $R = 0$ and from (v), the lowest number of students retained in a year is 140. Thus, in the year 2015, the values of R are five different values among 0, 20, 30, 40 and 50.

Further, from (vii), for any grade across each of the years 2013, 2014, 2015 and 2016, the value of R will be four different values among 10, 20, 30, 40 and 50.

Across all years promotees in Grade I, i.e., 'P' will be zero, i.e., for Grade I, $P = 0$.



Enrolments in 2014:

	'13		2014				
	T	N	R	P	T		
I	100	50	40	0	90	N is 50; $\Rightarrow T = 50 + 40 = 90$	
II	40	50	10	60	120	$P = 100 - 40 = 60; \Rightarrow R$ cannot be 30(III), 40(I), 20(2015) or 50(2016); so, $R = 10 \Rightarrow N = 50; T = 120$	
III	30	0	30	30	60	$P = 40 - 10 = 30 \Rightarrow N = 30 - 30 = 0; T = 30 + 30 = 60$	
IV	60	0	50	0	50	$P = 30 - 30 = 0 \Rightarrow N = 0; 10$ promoted $\Rightarrow R = 50 \Rightarrow T = 50$	
V	80	0	20	10	30	$R = 20$ (only possibility). $R > P \Rightarrow N = 0; T = 20 + 10 = 30$	

Enrolments in 2015:

	'14		2015				
	T	N	R	P	T		
I	90	50	30	0	80	N is 50; $\Rightarrow T = 50 + 30 = 80$	
II	120	40	20	60	120	$P = 90 - 30 = 60; \Rightarrow N = 60 - 20 = 40$	
III	60	50	50	100	200	$R = 50$ (only possibility); $\Rightarrow N = 100 - 50 = 50$ and $T = 200$	
IV	50	0	40	10	50	R cannot be 10(2013) or 50(2014); $R = 40; P = 60 - 50 = 10; R > P \Rightarrow N = 0; T = 50$	
V	30	10	0	10	20	$R = 0$ in 2015 (given); $P = 50 - 40 = 10; \Rightarrow N = 20 - 10 = 10$	

Enrolments in 2016:

	'14		2015				
	T	N	R	P	T		
I	80	50	20	0	70	N is 50; $\Rightarrow R = 70 - 50 = 20$	
II	120	10	50	60	120	$P = 80 - 20 = 60; N = 60 - 50 = 10; T = 10 + 50 + 60 = 120$	
III	200	30	40	70	140	$R = 40$ (only possibility). $P = 120 - 50 = 70; N = 70 - 40 = 30; T = 140$	
IV	50	130	30	160	320	$R = 30$ (only possibility). $P = 200 - 40 = 160; N = 160 - 30 = 130 \Rightarrow T = 320$	
V	20	10	10	20	40	$P = 50 - 30 = 20; N = 20 - 10 = 10$	

Thus, the complete data will be as follows.

	2012		2013		2014				2015				2016				
Grade	T	N	R	P	T	N	R	P	T	N	R	P	T	N	R	P	T
I	50	50	50	0	100	50	40	0	90	50	30	0	80	50	20	0	70
II	50	0	40	0	40	50	10	60	120	40	20	60	120	10	50	60	120
III	50	0	20	10	30	0	30	30	60	50	50	100	200	30	40	70	140
IV	50	20	10	30	60	0	50	0	50	0	40	10	50	130	30	160	320
V	50	10	30	40	80	0	20	10	30	10	0	10	20	10	10	20	40
Certifications	20				60				30				10				

34. Total Grade V certifications issued = The total number of completed Grade V.
 $= (50 - 30) + (80 - 20) + (30 - 0) + (20 - 10) = 20 + 60 + 30 + 10 = 120$.

35. 130 enrolments for Grade IV in 2016 is the highest.

36. In all total, 100 new enrolments made in 2014.

37. The total strength of students in the year 2015 = $80 + 120 + 200 + 50 + 20 = 470$.

38. From the above total it can be seen that the highest new enrolment KBC Ltd. had seen is in 2012. Ans: (2012)

Solutions for questions 39 to 42: From the following given information.

Case (1):

Let us assume that A is the person who answered all the questions correctly.

Then the answers of the remaining person would be as follows.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
B	✓	✗	✗	✗	✓
C	✗	✓	✗	✓	✗
D	✓	✓	✓	✗	✓
E	✓	✗	✓	✓	✓

From (iii), A is not the person who answered all questions correctly.

Case (2):

Let us assume that B is the person who answered all the questions correctly.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
A	✓	✗	✗	✗	✓
C	✗	✗	✓	✗	✗
D	✓	✗	✗	✓	✓
E	✓	✗	✗	✗	✓

From (iii), B is not the person who answered all questions correctly.

Case (3):

Let us assume that C is the person who answered all the questions correctly.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
A	✗	✓	✗	✓	✓
B	✗	✗	✓	✗	✗
D	✗	✓	✗	✗	✗
E	✗	✗	✗	✓	✗

From (iii), C also cannot be the person who answered all questions correctly.

Case (4):

Let D be the person who answered all questions correctly. Then the answers of the remaining people would be as follows.

	Question no. 1	Question no. 2	Question no. 3	Question no. 4	Question no. 5
A	✓	✓	✓	✗	✓
B	✓	✗	✗	✓	✓
C	✗	✓	✗	✗	✗
E	✓	✗	✓	✗	✓

From (ii) and (iii), D is the person who has got all the questions correct in the examination.

39. D is the person who has got all the questions correct.

40. The right choice for question 2 is 'c'.

41. B answered 3 questions correctly.

42. D - 5 is the correct combination.

Solutions for questions 43 to 45:

43. When $n = 10$, we have to take one ball from the first box, two from the second and so on.

If the total weight is 1 kg more, then the required box is the first. If it is 2 kg more, then it is the second box and so on.

∴ Only one weighing is required.

44. Take one ball each from the first five boxes and two balls each from the remaining. If the weight is 1 kg more, then the required box is in the first five. If it is 2 kg more, then it is in remaining five. Now, number of these boxes is from 1 to 5. Take one ball each from first two and two balls each from the next two. If the weight is same, then the required box is the fifth one. If it is 1 kg more, then it is between the first two. If it is 2 kg more, then it is between the next two. Now, one more weighing is required to find the required box.

∴ A total of 3 weighing is required.

45. Take one ball each from the first three, two balls each from the next three and three balls each from the next three. If the weight is same, then the 10th box is the required one. If it is 1 kg more, then it is between the first three. Similarly, we can find for the other groups. Now, number of these three boxes and one more weighing is required (similarly as described earlier).
 ∴ Two weighings are sufficient.

Solutions for questions 46 to 48: From the given information, it can be understood that each basket received at least one fruit or at most two fruits from each of the other baskets.



From (i), R has no guava in it, implies that the guavas which were there in R (eight in number) have been transferred to other baskets.

\Rightarrow P, Q, S and T now contain 2 guavas each.

From (ii), P has at least three mangoes implies that P was originally having mangoes as every basket received at least one fruit from each of the other baskets. It is also mentioned that P now has ten fruits in all.

As there are only four apples, P could have received only one apple. Hence, the other six fruits in P consist two bananas, two oranges and 2 guavas.

\therefore P = One apple + Three mangoes + Two bananas + Two oranges + Two guavas = 10 fruits.

From (iii), T has no apple in it but has six fruits in all. This implies that T was initially having apples in it. We know that T received two guavas.

As two out of five bananas are transferred to P, none of the other baskets can receive more than one banana.

Out of seven mangoes contained in P only four are transferred to other baskets. This implies that each basket received only one mango. Hence, the other two fruits in T are oranges.

\therefore T = One banana + Two guavas + One mango + Two oranges = 6 fruits.

As there are six oranges in all and two oranges are transferred to each of T and P, R received only one orange.

\therefore R = One mango + One apple + One banana + One orange = 4 fruits.

The basket which was initially containing oranges does not contain any orange now. Similarly, the one initially containing bananas now does not contain banana.

Hence, S initially contained bananas and Q does not contain any orange now.

Thus, we get the following arrangement.

Basket (Initially)		After changes					Total
		A	B	O	M	G	
P	7 Mangoes	1	2	2	3	2	10
Q	6 Oranges	1	1	0	1	2	5
R	8 Guavas	1	1	1	1	0	4
S	5 Bananas	1	0	1	1	2	5
T	4 Apples	0	1	2	1	2	6

46. S initially contained five fruits.

47. Mango is contained in all the baskets.

48. The fourth statement is true.

Solutions for questions 49 to 52: It is given that:

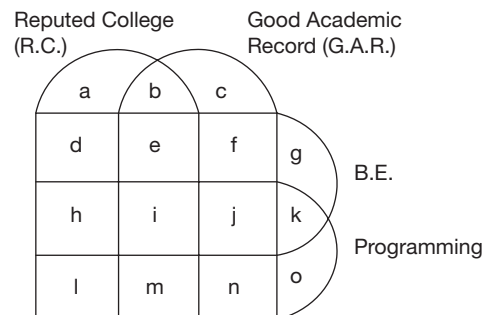
Each of the trainees are B.Es or M.Sc.s but not both.

\Rightarrow B.Es + M.Sc.s = 80

Similarly, the number of people with experience in Programming + Testing = 80.

Further, each person is either from a reputed college or with good academic background.

Let us represent the given data as follows.



Here, the features of trainees represented by 'a' represents neither B.Es nor programmers.

\therefore They are M.Sc.s and testers.

$a = (\text{M.Sc., Testing, R.C.})$

$b = (\text{M.Sc., Testing, R.C., G.A.R.})$

$c = (\text{M.Sc., Testing, G.A.R.})$

$d = (\text{Testing, R.C., B.E.})$

$e = (\text{R.C., G.A.R., B.E., Testing})$

$f = (\text{G.A.R., Testing, B.E.})$

$g = 0$ as every person must have either G.A.R. or R.C.

Similarly, $k = 0$ and $o = 0$.

Similarly, the features of h, i, j, l, m and n can be written.

Now, it is given that:

$$\left. \begin{aligned} a + b + c + d + e + f &= 40 \\ \text{Testing} &= 40 \text{ and } e + f = 20 \end{aligned} \right\} \text{From statement (a)}$$

$$\left. \begin{aligned} i &= m = 0 \\ h + j &= 25 \end{aligned} \right\} \text{From statement (b)}$$

$$\left. \begin{aligned} l + n &= 15 \\ \text{and } a + b + c + l + n &= 30 \end{aligned} \right\} \text{From statement (c)}$$

$$b + e = 15 \text{ From statement (d)}$$

$$\left. \begin{aligned} b + c + e + f + j + n &= 45 \\ e + f + j &= 30 \\ j + n &= 15 \end{aligned} \right\} \text{From statement (e)}$$

$$\text{As } e + f = 20 \text{ and } e + f + j = 30$$

$$j = 10$$

$$\text{As } j + n = 15, n = 5$$

$$\text{As } h + j = 25, h = 15$$

$$\text{As } l + n = 15, l = 10$$

$$\text{As 50 trainees are B.Es:}$$

$$d + e + f + h + j = 50,$$

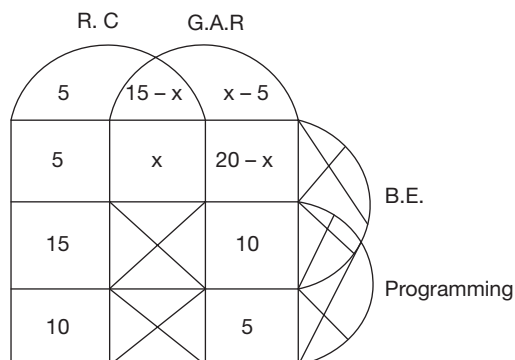
$$\text{As } h + j = 25$$

$$d + e + j = 25,$$

$$\Rightarrow d = 5$$

$$\text{Similarly, } b + c = 10 \Rightarrow a = 5$$

$$\text{Let } e = x$$



49. $j = 10$

50. Here, x cannot be determined.

51. $d = 5$

52. As $10 + 20 - x = 18$
 $x = 12 \Rightarrow 15 - x = 3$

Solutions for questions 53 to 56: Given that no two people with consecutive room numbers bought the same type of product and the people with even numbered room numbers bought one type of products and others bought another type of products.

Given that B and C bought the same type of products. Also, A stays in odd numbered room and C stays in even numbered room.

\Rightarrow A and C bought different types of products.

As A and D bought different types of products, B, C and D bought the same type of products, i.e., books as Bindu bought Maths book) and A, I and K bought mobiles.

As A stays in 3 and I, who bought LG cannot be in 5, K is in 5 and bought Nokia mobile. Hence, A bought Samsung and I is in 1.

As C stays in 6 and the person in 4 bought Chemistry book, B stays in 2 (\because she bought maths book), C bought Physics and D stays in 4.

Room no.	Name	Item bought
1	Indu	LG
2	Bindu	Maths
3	Anand	Samsung
4	Dilip	Chemistry
5	Kiran	Nokia
6	Charu	Physics

53. Dilip bought the Chemistry book.

54. Bindu stays in room number 2.

55. The person in room number 1 bought LG mobile.

56. The person who bought Samsung mobile is adjacent to the person who bought Maths book.

Solutions for questions 57 to 59: Among Tarun and Uday, at least one statement must be false.

Let the first statement of Ram be true, then Shyam will be of No-No type.

Let Ram be Yes-Yes type.

So, Ram's second statement 'Uday is Yes-No' must be true.

\Rightarrow 'Tarun is No-No' type. As Uday is 'yes - No' type.

But Shyam and Tarun both cannot be of the same type, so Ram's first statement must be false.

\Rightarrow Now Ram, Tarun and Uday each have at least one false statement. Hence, Shyam must be Yes-Yes type and Tarun must be No-No type.

We know that Ram's first statement is false.

\therefore Ram is No-Yes type and Uday is Yes-No type.

57. Uday belongs to Yes-No type.

58. Tarun belongs to No-No type.

59. Ram belongs to No-Yes type.

Solutions for questions 60 to 63: Given that England lost to Australia but won against Sri Lanka and New-Zealand. And South Africa lost to India but won against Sri Lanka and New-Zealand. These results can be written as:

Team \ Playing against	Australia	India	Sri Lanka (SL)	England (Eng)	South Africa (SA)	New Zealand (NZ)
Australia	×			W		
India		×			W	
Sri Lanka			×	L	L	
England	L		W	×		W
South Africa		L	W		×	W
New Zealand				L	L	×

Hence, Eng and SA won two matches each and lost one match each.

But from the Stage-1 observations:

Two teams lost all matches and therefore, they are SL and NZ.

India lost 1 match and Australia won all 3 matches. So, NZ did not play Australia.

Team \ Playing against	Australia	India	Sri Lanka	England	South Africa	New Zealand
Australia	×	W	W	W	NS	NS
India	L	×	NS	NS	W	W
Sri Lanka	L	NS	×	L	L	NS
England	L	NS	W	×	NS	W
South Africa	NS	L	W	NS	×	W
New Zealand	NS	L	NS	L	L	×

Now in the second stage. Australia lost both the matches.

NS-next stage

Australia played against NZ and SA where NZ and SA won.

Hence, SL lost the next 2 matches it played and NZ won both the matches in Stage-2.

∴ The other team that lost both the games in Stage-2 is England.

Now after Stage-2, the results are as follows:

Wins	Loses	Team \ Playing against	Australia	India	Sri Lanka	England	South Africa	New Zealand
3	2	Australia	X	W	W	W	L	L
4	1	India	L	×	W	W	W	W
0	5	Sri Lanka	L	L	×	L	L	L
2	3	England	L	L	W	×	L	W
4	1	South Africa	W	L	W	W	×	W
2	3	New Zealand	W	L	W	L	L	×

60. From the above table, Sri Lanka lost all the matches.

61. Australia lost 2 matches.

62. In Stage-1, New Zealand and Sri Lanka lost two each in Stage-2, Australia and England lost two each.

63. South Africa and New Zealand played in Stage-2 with Australia.

Solutions for questions 64 to 67: It is given that total 215 sprinters are selected.

Sprinters in category A – 35

Sprinters in category B – 60

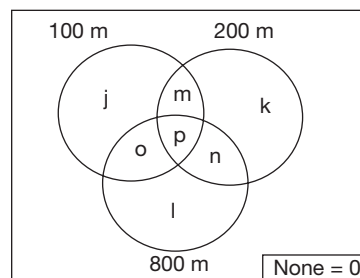
Sprinters in category C – 120

As each sprinter is trained in one or the other events, the number of sprinters who are not trained in any of the events is zero.

The sprinters of Category A are trained in at most three events, i.e., one event, two events or three events.

Similarly, the sprinters of Category B are trained in one of two events, the sprinters of Category C are trained in only one event.

The base Venn diagram is as follows.

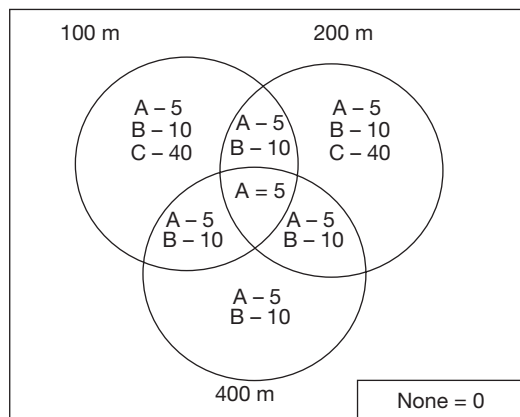


The diagram represents all the possible combination of events. As it is given that equal number of sprinters are trained in all the possible combination of events.

For sprinters in Category A = $j = k = l = m = n = o = p$
 $= \frac{35}{7} = 5$

For sprinters in Category B = $j = k = l = m = n = o = \frac{60}{6} = 10$

For sprinters in Category C = $j = k = l = \frac{120}{3} = 40$



64. The number of sprinters who are trained in exactly two events = $3(5 + 10) = 45$.
65. The number of sprinters who are trained for only 400 m from Category A is 5. 60% of 5 is 3. Now the number of sprinters who are trained in only 100 m and 400 m is $10 + 5 + 3 = 18$.
66. Here we have to select those 35 athletes who can participate in the maximum possible number of events. Take the five athletes from Category A, who are trained in the three events. The names of these five athletes appear fifteen times. Take the fifteen athletes from Category A, who are trained in two events. The names of these fifteen athletes appear thirty times. Take the fifteen athletes from Category B, who are trained in two events. The names of these fifteen athletes appear thirty times. Hence, the names of athletes appear $15 + 30 + 30 = 75$ events. This value holds good for other possible combination also.
67. The thirty athletes can be selected from the region common to 100 m and 400 m only, 200 m and 400 m only and the region common for all the three. In such case, the number of athletes who can participate in 200 m is 20.

Solutions for questions 68 to 70: Total expense = ₹610

They spent at least ₹100 per item.

∴ They have to buy at least 5 pens, 4 bracelets, 2 perfumes, 2 wristwatches and 1 teddy bear.

Then total cost = ₹560.

None of them purchased more than one of any items.

They cannot buy more than 5 pens.

∴ They bought 3 perfumes.

One of them bought each one of the five items.

Total cost to buy each one of the five items

= $(20 + 30 + 50 + 70 + 100) = 270$.

So, it can be Arpit only.

Now one of them bought a pen, a bracelet, a perfume and a wristwatch.

Total cost of those = $20 + 30 + 50 + 70 = 170$.

∴ Manas is that person.

Jemmy can buy one pen only.

Similarly, Tushar can buy a pen and a bracelet.

∴ Bhupen will buy a pen, a bracelet and a perfume.

The following distribution table represents the final result.

	Tushar	Bhupen	Jemmy	Arpit	Manas
Pen	✓	✓	✓	✓	✓
Bracelet	✓	✓	✗	✓	✓
Perfume	✗	✓	✗	✓	✓
Wristwatch	✗	✗	✗	✓	✓
Teddy bear	✗	✗	✗	✓	✗
Expenditure	50	100	20	270	170
Remaining	25	50	20	30	30

68. Bhupen is left with the maximum amount of money.

69. Jemmy did not buy bracelet.

70. The fourth statement is false.

Solutions for questions 71 to 74:

Stage I:

As P, Q, S and T won at least one match, R and U lost all the three matches.

As Q, S and T lost at least one match, P won all the three matches.

In Stage I, there are a total of 9 matches and so 9 wins. Q, S and T won two matches each.

As P (the top team in Stage-I) did not play against U, P played matches against Q and R.

∴ The ninth match was between Q and U.

So, the nine matches that have taken place are as follows.

Won	Lost	Won	Lost	Won	Lost
P	S	S	R	S	U
Q	T	T	R	T	U
P	Q	P	R	Q	U

Stage-II:

As each team played a total of five matches, in Stage-II, the matches that take place between the following pairs of teams.

P – T, P – U, Q – R, Q – S, T – S and R – U



Given that, in Stage-II, three teams lost all the two matches.

Given that P lost both the matches in Stage-II.

∴ Each of T and U won the two matches.

⇒ R and S lost the two matches.

∴ Q also won two matches.

71. T and U defeated P (the top team in Stage-I).

72. Only Q, T and U won both their matches in Stage-II.

73. S and U won exactly two matches in the event.

74. Q and T won exactly four matches each in the event.

Solutions for questions 75 to 78:

75. As Arjun sold gold on three consecutive days while Madhu sold gold on only one day, the only possibility is that the price of one gram at the end of day 1, day 2, day 3, day 4 and day 5 was ₹900, ₹1000, ₹1100, ₹1200 and ₹1100 respectively, i.e., on three consecutive days it increased and on the closing day it closed above ₹1100.

76. As the price at the beginning of the first day was ₹1000 and at the end of the fifth day was ₹1100, it means that the price increased by ₹100 on three days and decreased by ₹100 on two days. Therefore, effectively Arjun sold 10 grams of gold. If Arjun ended up with ₹13,000 more, it means that he sold 10 grams more than Madhu. Therefore, Madhu effectively sold zero grams of gold. As she could not both buy and sell 10 grams of gold in this 5-day period, she did not buy or sell any gold during this 5-day period. Therefore, on day 4, the price (per gram) of gold can only be ₹1000.

77. Since Arjun sold on three days and bought on two days, he would have ended up with 10 grams less than what he started with and since he ended up with 20 grams less than what Madhu had, Madhu would have bought 10 grams and it is possible only if the price of gold (per gram) on the five days are ₹900, ₹800, ₹900, ₹1000 and ₹1100, respectively.

78. If Madhu ended up with ₹1000 less than Arjun at the end of day 5, it can only be because the quantity of gold with them is equal as gold is only bought and sold in multiples of 10 grams and if the difference in the quantity with them is 10 grams, the difference in amounts with them must be close to ₹10,000.

Solutions for questions 79 to 82:

79. Machine A will take 10 hours (4 hours + 2 hours break + 4 hours), Machine B will start after 4 hours from start when 50 kgs raw material is passed. B will work from fourth hour to 16th hour (4 cycles). Machine C will start from the 7th hour, work for 2 cycles taken a break, work for 3 cycles, break and continue till 20th hour. Machine D should start in 9th hour from start when 20 kgs of raw

material reaches from C. Last cycle of D will be 20th to 21st hour. E should start when a minimum of 50 kgs of material resells from D, i.e., at 16th hour. Second cycle of E should start from 21st hour as only then all raw materials will reach C. Last cycle of E will be from 21st to 25th hour.

∴ It will take minimum 25 hours to process 100 kg raw material.

80. The processing rate of A, B, C, D and E including breaks is as follows.

A = 100/10 kg/hr, B = 100/12 kg/hr, C = 100/13 kg/hr, D = 100/8 kg/hr, E = 100/8 kg/hr

If capacity of A, B, D or E is doubled it wouldn't affect the time taken as the immediate next step is at most of equal speed, if not slower. If capacity of C is changed, there may be a decrease in processing time.

81. By doubling the capacity of C, the total time taken will be 23 hours. [Last cycle of D can complete in 18th to 19th hour and last cycle of E from 19th to 23rd hour].

The minimum time taken with old capacity was 25 hours. Difference = 2 hours.

82. If the raw material was only 50 kgs. A would be fourth from start till 4th hour, B till 10th hour, C till 13th hour from start, D would work three cycles last been 13th hour to 14th hour. E will work only one cycle from 14th to 18th hour.

Solutions to questions 83 to 86: This given information can be tabulated as follows:

Day	Morning slot		Afternoon slot	
	Name	Subject	Name	subject
Monday				
Tuesday	D	Biology	X	X
Wednesday				
Thursday				
Friday	F	Maths		

Since there are 8 lecturers who teach only once during the week, two slots will be free. From (iii), (iv) and (vi), it can be concluded that one of those slots is Tuesday – afternoon slot.

From (vii), Maths should be taught on Wednesday. Since no subject is taught more than once in the same slot, Maths is taught on Wednesday afternoon. Also, from (vii), Physics is taught on both Monday and Wednesday.

∴ Physics is taught on Wednesday–morning slot and Monday–afternoon slot.

From (ii) and (iii), C and F teach the same subject. E and H teach the same subject. B teaches Chemistry and D teaches Biology and no one else teaches Biology or Chemistry.

∴ A and G teach the same subject and C and F teach Maths.

C is scheduled on Wednesday afternoon.
 From (i), A is also scheduled on Wednesday.
 \therefore A teaches Physics on Wednesday – morning.
 G also teaches Physics on Monday – afternoon.
 From (i), H is also scheduled on Monday.
 \therefore H teaches English on Monday–morning.
 From (ii) and (iii), E also teaches English and nobody else is scheduled to teach on the day E teaches.
 \therefore E teaches English on Thursday – afternoon and Thursday – morning slot is free.
 Finally, B teaches Chemistry on Friday – afternoon.
 The resulting table is as follows.

Day	Morning slot		Afternoon slot	
	Name	Subject	Name	Subject
Monday	H	English	G	Physics
Tuesday	D	Biology	X	X
Wednesday	A	Physics	C	Maths
Thursday	X	X	E	English
Friday	F	Maths	B	Chemistry

83. E teaches English.
 84. Chemistry is not taught during the morning slot.
 85. Thursday – morning slot is free.
 86. English and Maths are not taught on the same day.

Solutions for questions 87 to 91:

87. If Laxman is included in the team, then the size of the team would be at least four. All others can be a member of a team of size 3.
 88. A team of five must include Sanjay, Uday and Watson which means one of Mohan and Qureshi must be a member of the team along with Naveen.
 89. The size of the largest possible team is five as exactly two of Pranav, Rahul and Sanjay, exactly one of Mohan and Qureshi and either Naveen and Uday or Kalyan and Laxman must not be selected.
 90. The size of a team that includes Kalyan can only be four as Laxman, exactly one of Qureshi and Mohan and exactly one of Pranav and Rahul must be selected.
 91. A team which includes Naveen can be constituted in six ways as given.
 (1) Mohan, Rahul, Naveen
 (2) Qureshi, Rahul, Naveen
 (3) Mohan, Pranav, Naveen
 (4) Qureshi, Pranav, Naveen
 (5) Mohan, Sanjay, Uday, Watson, and Naveen
 (6) Qureshi, Sanjay, Uday, Watson and Naveen

Solutions for questions 92 to 96: The following table can be made from the available information.

Games	Kerala	Karnataka	Tamil Nadu	Andhra Pradesh	Total
Athletes			1	1	6
Basketball	0	1	1	1	3
Football			2	1	6
Cricket			1	1	6
Total	4	8	5	4	21

92. Only the number of Cricket players from Kerala cannot be determined.
 93. Since Tamil Nadu and Andhra Pradesh had a total of 3 Football players. Kerala and Karnataka should together have a total of 3 Football players.
 94. Since Karnataka had a total of 8 sports people selected and if there is only Football player, there should be 3 Athletes and 3 Cricket players.
 95. The number of Cricket players is one.
 96. None of the given statements is true.

Solutions for questions 97 to 101: It is given that five students, namely Anil, Sunil, Pavan, Naveen and Sravan answered five questions. Each question has five answer choices A, B, C, D and E.

	Anil	Sunil	Pavan	Naveen	Sravan
1	B	C	D	B	C
2	A	D	B	A	C
3	C	A	D	A	D
4	A	B	C		A
5	E	B	B	E	C

As only one student answered the first question correctly, the correct choice for the first question cannot be B or C.

Hence, the correct choice for the first question is choice (D) and that is correctly marked by Pavan.

As only one student answered the second question correctly, the correct choice for the second question cannot be A. The correct choice is B or C or D.

As two students answered the third question correctly, the correct answer is either A or D.

As only one student answered the fourth question correctly, the correct answer is not A, it is either B or C.

As two students answered the fifth question correctly, the correct answer is either B or E.

From (iii), the correct choice for the third question is A.

As Naveen scored the maximum marks, the correct choice for the 5th question is E.

From (iv), the correct choice for the second and the fourth questions is B.

The above information can be represented as follows.

Q. No.	Correct choice	Correctly marked by
1	D	Pavan
2	B	Pavan
3	A	Sunil, Naveen
4	B	Sunil
5	E	Anil, Naveen

The marks scored by them is as follows.

	Questions attempted	Correct	Wrong	Net score
Anil	5	1	4	0
Sunil	5	2	3	5
Pavan	5	2	3	5
Naveen	4	2	2	6
Sravan	5	0	5	-5

97. Sravan scored the least.

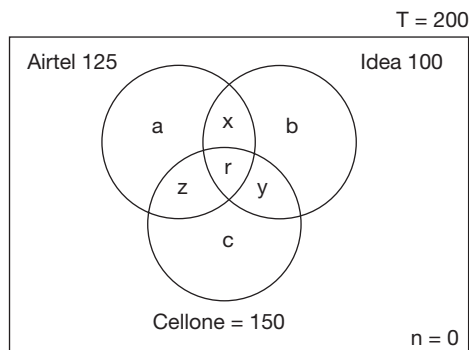
98. Naveen scored 6 marks.

99. Sunil and Pavan scored equal marks.

100. Highest score (Naveen) = 6
Lowest Score (Sravan) = -5
Diff = 6 - (-5)
= 6 + 5
= 11

101. The correct choice for question 4 is B. Naveen marked it as either C or D. In both the cases he get '-1' score. Hence, his net score becomes 5.
Naveen, Pavan and Sunil are the highest scorers with 5 marks each.
Anil is the second highest with a score of zero.

Solutions for questions 102 to 104:



50 members do not subscribe to Cellone which implies that 150 subscribe to Cellone.

$$a + b + x = 50 \quad (1)$$

75 do not subscribe to Airtel which implies that 125 subscribe to Airtel.

$$b + y + c = 75 \quad (2)$$

100 do not subscribe to Idea which implies that 100 subscribe to Idea.

$$a + z + c = 100 \quad (3)$$

125 subscribe to at least two companies.

$$x + y + z + r = 125 \quad (7)$$

$$\text{Airtel subscribers} = a + x + r + z = 125 \quad (4)$$

$$\text{Idea subscribers} = b + x + r + y = 100 \quad (5)$$

$$\text{Cellone subscribers} = c + z + r + y = 150 \quad (6)$$

$$(4) + (5) + (6)$$

$$\Rightarrow a + b + c + 2(x + y + z) + 3r = 375 \quad (8)$$

$$a + b + c + x + y + z + r = 200 \quad (9)$$

Subtracting (9) from (8), we get:

$$x + y + z + 2r = 175 \quad (10)$$

Subtracting (10) from (7), we have:

$$r = 50$$

Hence, $x + y + z = 75$.

$$(1) + (2) + (3) \Rightarrow 2(a + b + c) + x + y + z = 225$$

But $x + y + z = 75$

$$\Rightarrow 2(a + b + c) = 150$$

$$\Rightarrow a + b + c = 75$$

102. 75 customers subscribe to exactly one service.

103. 75 customers subscribe to exactly two services.

104. 50 customers subscribe to exactly three services.

Solutions for questions 105 to 109: Given that the number of notes they had are 2, 6, 8, 9 and 12, and the number of coins they had are 0, 3, 4, 8 and 12. Now, from (vi), we know that the number of coins Manjeet had is half of the number of coins somebody else had. This is possible only when if he had 4 coins. Now, condition (i) will satisfy only when Harish had 12 coins (thrice of 4). Thus, Manjeet had six notes. From (vii), we can say that Sohan had 8 coins. Also, only the pair 8 and 12 (notes) satisfy the condition (vii). Thus, Sohan had 12 notes and Harish had 8 notes.

Now, from (ii), (iii) and (vi) we can say that Dinesh, Manjeet and Sohan do not keep a wallet. Hence, Harish and Arpit had a wallet.

From (iv) and (v), we can say that Dinesh had two notes and no coins.

Thus, Arpit had 9 notes and 3 coins.

So, we get the following table:

Person	Notes	Coins	Wallet
Harish	8	12	✓
Dinesh	2	0	✗
Manjeet	6	4	✗
Arpit	9	3	✓
Sohan	12	8	✗

105. Sohan had 8 coins is true.

106. Arpit had 9 notes is true.

107. Manjeet having 6 notes, 4 coins but no wallet is true.

108. Arpit has three coins and nine notes, i.e., 1 : 3.

109. Only choice (D) is true.

Solutions to questions 110 to 113: Exactly one course should be picked from Group 1. Therefore, the number of credits that can be picked from Group 1 are 1 or 2 or 3.

Exactly 2 courses are to be picked from Group 2. Therefore, the numbers of credits that can be picked from Group 2 are

$$3 + 4/4 + 4/5 + 3/5 + 4.$$

∴ 7/8/9 credits can be picked from Group 2. 8 credits can be picked in 2 ways. 7 credits can be picked in 2 ways. 9 credits can be picked in 2 ways. Exactly 2 courses are to be picked from Group 3. Therefore, the numbers of credits that can be picked from Group 3 are 3 + 3/3 + 5.

∴ 6/8 credits can be picked from Group 3.

6 credits can be picked in 3 ways.

8 credits can be picked in 3 ways.

110. Manju picked 17 credits but did not choose Hindi. Therefore, her possible credits from each Group are:

	Group 1	Group 2	Group 3
Case (i)	1	8	8
Case(ii)	3	8	6

Choice (A): If she picks French, then as per case (i), she has to pick 8 credits from Group 2. It is possible to pick Physics (along with Biology).

Choice (B): If she picks English, as per case (ii), she has to pick 8 credits from Group 2. She can choose Chemistry and Maths.

Choice (C): If she picks French, as per case (i), she needs 8 credits from Group 3. She can pick Sports and Music.

Choice (D) If she picks English, as per case (ii), she needs to pick 6 credits from Group 3. Therefore, she cannot pick Sports.

111. Ajay has already picked French and Chemistry. Group 1 is done. If he wants to maximize his credits, he has to pick Maths from Group 2 and Sports from Group 3 along with any one of the other three (Music/Dance/Arts and Crafts).

Choice (A), (B), and (D) are possible.

Choice (C) is not possible since Biology cannot be picked from Group 2.

112. Surabhi has chosen 18 credits. The possible combinations are:

	Group 1	Group 2	Group 3
Case (i)	1	9	8
Case (ii)	2	8	8
Case (iii)	3	7	8
Case (iv)	3	9	6

Choice (A): As per case (i), if she chooses French, she needs 9 credits from Group 2. It is not possible to get 9 credits by picking Chemistry.

Choice (B): As per case (ii), if she chooses Hindi, she needs 8 credits from Group 2. She can choose Biology and Physics.

Choice (B) is possible.

Choice (C): As per case (iii) or (iv), if she chooses English, she will need either 7 or 9 credits from Group 2. She can pick Maths and either Physics or Biology to get 9 credits.

Choice (C) is also possible.

∴ Choice (D) is the answer.

113. Madhuri needs 19 credits and she has already picked Maths and Music. The possible numbers of credits she can choose from each group are:

	Group 1	Group 2	Group 3
Case (i)	2	9	8
Case (ii)	3	8	8

Choice (A): As per case (i) if she picks Hindi, she needs 9 credits from Group 2. Since Madhuri has already picked Maths, choosing Chemistry will only give her 8 credits from Group 2. This choice is not possible.

Choice (B): As per case (ii), if she picks English, she needs 8 credits from Group 2. Since Maths is already chosen, she cannot choose Biology. This choice is also not possible.

Choice (C): As per case (ii), if she picks English, she needs 8 credits from Group 2. She has already chosen Maths. Therefore, Chemistry can be picked. This choice is possible.

Choice (D): French cannot be picked either in case (i) or in case (ii).



Solutions for questions 114 to 117: From the statements, we can make out that there are ten different amounts and each is the combined earnings of two people. Since there are five people and taking two at a time we can make 5C_2 or $(5 \times 4)/2$, i.e., 10 amounts. Since there are ten amounts given, it means they are all possible combinations of the five people taking two at a time. Also, since none of the ten amounts are equal, we can conclude that no two out of the five people had the same amount. Let us denote the five amounts with the five of them as a, b, c, d and e in descending order, i.e., a is the largest amount and e is the smallest amount. When we make combinations of two at a time out of five given items, each item occurs in four combinations. So, if we add up all the ten amounts, it should be equal to four times the sum of five amounts, i.e., $(a + b + c + d + e)$. If we add all the amounts given, it comes to ₹9600. Hence,

$$a + b + c + d + e = 2400 \quad (i)$$

Since a, b, c, d and e are in descending order, among the amounts that we can make taking two at a time, $a + b$ will be the largest, $a + c$ will be the second largest, $d + e$ will be the smallest and $c + e$ will be the second smallest. From this data and looking at the amounts given, we have:

$$a + b = 1500 \quad (ii)$$

$$a + c = 1400 \quad (iii)$$

$$d + e = 400 \quad (iv)$$

$$c + e = 600 \quad (v)$$

From the five equations (i), (ii), (iii), (iv) and (v), we can very easily get the values of the five variables [For example: Add (ii) and (iv) together and subtract it from (i) to get c] as

$$a = 900; b = 600; c = 500; d = 300; e = 100$$

Once we know the five amounts, we proceed as below (by taking the statements given regarding the amounts earned) to identify the names, designations, etc. As we get all the required information one by one, we shall fill up the following table.

Amount	Name	Division	Designation	Dress
900 (a)	Saxena	Engineering	Production Manager	Safari
600 (b)	Mathur	Foods	General Manager	3-piece
500 (c)	Sastry	Oil Seeds	Deputy General Manager	3-piece
300 (d)	Verma	International Trading	Senior Vice President	Churidar kurta
100 (e)	Rao	Soaps	Vice President	2-piece

Since Mathur and the person from Engineering division together won 1500 and since we know $a + b = 1500$, we can then write:

$$\text{Mathur} + \text{Engineering division} = a + b \quad (1)$$

Similarly, since Sastry and Saxena together earned 1400 and we know that $a + c = 1400$, we can write:

$$\text{Sastry} + \text{Saxena} = a + c \quad (2)$$

By comparing the two equations (1) and (2), we find that ' a ' is common on the RHS in both equations. Then looking at the LHS, because Mathur is not common, we can conclude that Mathur is ' b ' and ' a ' belongs to the person from Engineering division. Fill this information in the appropriate cells in the table.

Similarly, Saxena and the Senior Vice President earn 1200 together and we know $a + d = 1200$, we can write:

$$\text{Saxena} + \text{Senior Vice President} = a + d \quad (3)$$

From equations (2) and (3), where ' a ' is common on the RHS of both equations and Saxena common on the LHS of both equations, we can conclude that ' a ' belongs to Saxena. Then from equation (2), ' c ' belongs to Sastry. From equation (3), ' d ' belongs to the Senior Vice President. This information also should be filled in the table.

In this manner, we can write down the equations for all the other seven amounts also and make similar conclusions and fill in the table completely.

$$\text{Verma} + \text{Production Manager} = a + e \quad (4)$$

$$\text{General Manager} + \text{International Trading division} = b + d \quad (5)$$

$$\text{Foods division} + \text{Soaps division} = b + e \quad (6)$$

$$\text{Vice President} + \text{Oil Seeds division} = c + e \quad (7)$$

$$\text{Rao} + \text{Soaps division} = d + e \quad (8)$$

$$\text{Deputy General Manager} + \text{Churidar} = c + d \quad (9)$$

$$3\text{-piece suit} + 3\text{-piece suit} = b + c \quad (10)$$

From (4), we get Production Manager is ' a ' (since Verma cannot be ' a ') and hence, Verma is ' e '. Thus Rao will be ' d ' who is the only person left out. From (8), Soaps division is ' e '; from (6), Foods division is ' b '; from (7), VP is ' e ' (because Oil Seeds division cannot be ' e ') and Oil seeds division is ' c '; from (5), International Trading division is ' d ' (because ' d ' cannot be GM since he is already Senior Vice President) and so ' b ' is General Manager; the only slot left for Deputy General Manager is ' c '. Hence, from (9) we get ' d ' as Churidar-kurta; from (10) ' b ' and ' c ' are 3-piece suit.

The last condition in the problem states that Safari-suit person won more than the person in 2-piece suit; the only two people left are ' a ' and ' e '; so ' a ' is Safari-suit and ' e ' is 2-piece suit. This completes the table.

Once we have the table filled, we can answer the questions easily.

114. Only I and III are false.

115. None of these.

116. All the three statements are not true.

117. Saxena won the maximum amount.

Solutions for questions 118 to 121: From the facts about M1 we can observe that M1 was the first to start. After then, M3 and M4 started. M2 and M7 were started before M1 and M5 were stopped. Also, we can say that M3 and M4 were stopped before M1 was stopped.

From the facts about M3, we can say that M3 was started after M4 and M5 were started.

From the facts known of M4, we can say that M3 was the first to be stopped and M4 was the next.

Now, from the facts of M2, we can say that M2 was started with M7 and at that time M3 and M4 had already stopped.

The information is tabulated as follows

Machines	Order of starting	Machines running with it	Order of stopping
M1	1	M2, M3, M4, M5, M7	
M2	5 (with M7)	M1, M5	
M3	3	M1, M4, M5	1
M4	2	M1, M3, M5	2
M5	4	M1, M3, M4	
M6			
M7	5 (with M2)	M2, M7	

Now, from the information about M5, we can say that at the first time it was stopped, M2 and M7 were running. And when it was started again only M2 and M7 were running. Also, from the information known about M6 as it was operated with M5, we can say that no other machine was started or stopped when M5 was not running (between its two shifts of operations).

Now, from the information known about M6 we can say that M7 was stopped before M6 was started. After that M6 was stopped. Thus, M2 and M5 were the last to stop.

Thus, we get the following arrangement:

Machine	Order of starting	Machines running with it	Order of stopping
M1	1	M2, M3, M4, M5, M7	3 (with M5)
M2	5 (with M7)	M1, M5, M6, M7	7/6
M3	3	M1, M4, M5	1
M4	2	M1, M3, M4	2

(Continued)

Machine	Order of starting	Machines running with it	Order of stopping
M5 (A)	4	M1, M2, M3, M4, M7	3 (with M1)
M5 (B)	6	M2, M6, M7	6/7
M6	7	M2, M5	5
M7	5 (With M2)	M1, M5, M2)	4

118. M5 was started first.

119. M1 and M5 were running at the time M2 was started.

120. Three machines _____ 00M1, M5 and M2 were operated with M7.

121. M2 and M5 were the last to stop.

Solutions for questions 122 to 125:

122. Only P, R and T who co-authored a paper with U had a change in their Einstein numbers. The other 5 participants did not have a change in their Einstein number.

123. It is given that on the third day, U co-authored a paper jointly with P and R. They would have reduced the Einstein number of P and R to $x + 1$ where x was U's Einstein number. As P had an infinite Einstein number at the beginning and as no co-authorship among any three other numbers would have made the average Einstein number to as low as 3, it means R initially did not have an Einstein number $x + 1$.

Now, since it is given that five of them had the same Einstein number at the end of day 3 and that the average of all the eight was 3 and as the three (other than the five) had Einstein number distinct from each other, the only possibility is that U had an Einstein number 1, five of them including P and R had an Einstein number 2 and the other two had an Einstein number which added up to $24 - 10 - 1$, i.e., 13.

Now as it is given, that T co-authored a paper with U, the average of the group reduced by 0×5 , i.e., the total reduced by $0 \times 5 \times 8 = 4$ and that of T became 2 or it was initially $4 + 2 = 6$, which means the eighth person had an Einstein number $13 - 6$, i.e., 7.

124. Only three of the five participants who had an Einstein number of 2 at the end of day 3 had the same Einstein number at the beginning of the conference.

125. At the end of the third day each of P and R, have Einstein number $x + 1$, where x is the Einstein number of U. It is given that five scientists have the same number at the end of the third day it implies that three among Q, S, T, V and W also have $x + 1$, at the beginning of day one. But for these three, the rest of the five can have distinct Einstein numbers.

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Unit 4

OMET-based LR

- Chapter 1 Series
- Chapter 2 Analogies
- Chapter 3 Odd Man Out
- Chapter 4 Coding and Decoding
- Chapter 5 Symbols and Notations
- Chapter 6 Blood Relations
- Chapter 7 Direction Sense
- Chapter 8 Clocks
- Chapter 9 Calendars
- Chapter 10 Decision Making
- Chapter 11 Non-verbal Reasoning

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1

Series

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn about Number series and Letter series
- Learn about different types of series, like
 - Difference series
 - Product series
 - Squares/Cubes series
 - Miscellaneous series
 - Combination of two or more series types
- Learn different ways to identify patterns and find the missing term in a series
- Learn how to convert alphabets into their equivalent number and vice-versa

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

□ SERIES

Number and Letter Series form an important part of the 'Reasoning' section in various competitive examinations. There are two or three broad categories of questions that appear in various exams from this particular chapter.

In the first category of questions, a series of numbers/letters is given with one number/letter (or two numbers/letters) missing, represented by a blank or a question mark. The given series of numbers/letters will be such that each one follows its predecessor in a certain way, i.e., according to a definite pattern. Students are required to find out the way in which the series is formed and hence, work out the missing number/numbers or letter/letters to complete the series.

Under these questions, there are a large variety of patterns that are possible and the student requires a proper understanding of various patterns to be able to do well in these types of questions.

Number Series

For better understanding, we will classify this into the following broad categories.

1. Difference series
2. Product series
3. Squares/Cubes series
4. Miscellaneous series
5. Combination series



Difference Series

The difference series can be further classified as follows.

1. Number series with a constant difference.
2. Number series with an increasing or decreasing difference.

In the number series with a **constant difference**, there is always a constant difference between two consecutive numbers. For example, the numbers of the series 1, 4, 7, 10, 13, ... are such that any number is obtained by adding a constant figure of 3 to the preceding term of the series.

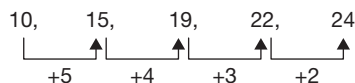
If we have to find the next number in the above series, we need to add 3 to the last term 13. Thus, 16 is the next term of the series.

Under the series with constant difference, we can have series of odd numbers or series of even numbers also.

In the series with **increasing/decreasing difference**, the difference between consecutive terms keeps increasing (or decreasing, as the case may be). For example, let us try to find out the next number in the series 2, 3, 5, 8, 12, 17, 23, ...

Here, the difference between the first two terms of the series is 1; the difference between the second and third terms is 2; the difference between the third and the fourth terms is 3 and so on. That is, the difference between any pair of consecutive terms is one more than the difference between the first number of this pair and the number immediately preceding this number. Here, since the difference between 17 and 23 is 6, the next difference should be 7. So, the number that comes after 23 should be $(23 + 7) = 30$.

We can also have a number series where the difference is in decreasing order (unlike in the previous example where the difference is increasing). For example, let us find out the next term of the series 10, 15, 19, 22, 24, ...

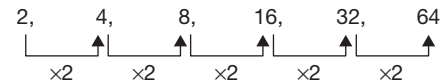


Here the differences between 1st and 2nd, 2nd and 3rd, 3rd and 4th numbers, etc., are 5, 4, 3, 2, and so on. Since the difference between 22 and 24 is 2, the next difference should be 1. So, the number that comes after 24 should be 25.

Product Series

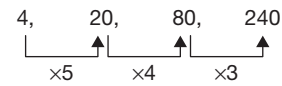
A product series is usually a number series where the terms are obtained by a process of multiplication. Here also, there can be different types of series. We will look at these through examples.

Consider the series 2, 4, 8, 16, 32, 64, ...



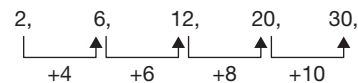
Here, each number in the series is multiplied by 2 to get the next term. So, the term that comes after 64 is 128. **So, each term is multiplied by a fixed number to get the next term.** Similarly, we can have a series where we have numbers obtained by **dividing** the previous term with a constant number. For example, in the series 64, 32, 16, 8, ..., each number is obtained by dividing the previous number by 2 (or in other words, by multiplying the previous term by $\frac{1}{2}$). So, here, the next term will be 4 (obtained by dividing 8 with 2).

Consider the series 4, 20, 80, 240, ...



Here, the first term is multiplied by 5 to get the second term; the second term is multiplied by 4 to get the third term; the third term is multiplied by 3 to get the fourth term. Hence, to get the fifth term, we have to multiply the fourth term by 2, i.e., the fifth term is 480. **So, each term is multiplied by a decreasing factor (or it could also be an increasing factor) to get the next term.** That is, with whatever number a particular term is multiplied to get the next term, this latest term is multiplied by a number different from the previous multiplying factor to get the next term of the series. All the multiplying factors follow a certain pattern (normally of increasing or decreasing order).

Consider the series 2, 6, 12, 20, 30, ...



This can be looked at a series of increasing differences. The differences of consecutive pairs of terms are 4 (between 2 and 6), 6 (between 6 and 12), 8 (between 12 and 20), 10 (between 20 and 30) and so on. Hence, the difference between 30 and the next term should be 12 and so the next term will be 42. But this series can also be looked at as a product series.

$$\begin{array}{ccccc}
 2, & 6, & 12, & 20, & 30 \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 1 \times 2 & 2 \times 3 & 3 \times 4 & 4 \times 5 & 5 \times 6
 \end{array}$$

The first term is the product of 1 and 2; the second term is the product of 2 and 3; the third term is the product of 3 and 4; the fourth term is the product of 4 and 5; the fifth term is the product of 5 and 6. Hence, the next term will be the product of 6 and 7, that is 42.

Squares/Cubes Series

There can be series where all the terms are related to the squares of numbers or cubes of numbers. With squares/cubes of numbers as the basis, there can be many variations in the pattern of the series. Let us look at the various possibilities of series based on squares/cubes.

Each term of the series may be the square of a natural number, such as 1, 4, 9, 16, ...

$$\begin{array}{cccc}
 1, & 4, & 9, & 16 \\
 \downarrow & \downarrow & \downarrow & \downarrow \\
 1^2 & 2^2 & 3^2 & 4^2
 \end{array}$$

The numbers are squares of 1, 2, 3, 4 ..., respectively. The number which follows 16 (which is the square of 4) will be 25 (which is the square of 5).

The terms of the series may be the squares of odd numbers (For example: 1, 9, 25, 49, ...) or even numbers (For example: 4, 16, 36, 64, ...).

The terms of the series could be such that a number and its square are both given one after the other and such pairs are given in some specific pattern. For example, take the series 2, 4, 3, 9, 4, 16, ...

$$\begin{array}{cccccc}
 2, & 4, & 3, & 9, & 4, & 16, \\
 \underbrace{\hspace{1cm}}_{+1} & & \uparrow & & \uparrow & \\
 & & & +1 & &
 \end{array}$$

Here, 2 is followed by its square 4; then comes the number 3 (which is one more than 2) followed by its square 9 and so on. Hence, the next number in the series is 5 and the one after that is its square, i.e., 25.

Similarly, each term could be the square root of its predecessor. For example, in the series 81, 9, 64, 8, 49, 7, 36, ..., 81 is the square of 9, 64 the square of 8, and so on. Therefore, the next number which follows in the series should be the square root of 36, i.e., 6.

The terms of the series could be the squares of natural numbers increased or reduced by certain number. For example, in the series 3, 8, 15, 24, ...

$$\begin{array}{cccc}
 3, & 8, & 15, & 24 \\
 \downarrow & \downarrow & \downarrow & \downarrow
 \end{array}$$

$$2^2 - 1 \quad 3^2 - 1 \quad 4^2 - 1 \quad 5^2 - 1$$

We have {Squares of natural numbers - 1} as the terms. The first term is $2^2 - 1$; the second term is $3^2 - 1$; the third term is $4^2 - 1$ and so on. Hence, the next term will be $6^2 - 1$, i.e., 35 [Please note that the above series can also be looked at as a series with increasing differences. The differences between the 1st and 2nd terms, the 2nd and 3rd terms, and so on are 5, 7, 9, and so on. Hence, the next difference should be 11 giving us the next term as 35]. There could also be a series with (squares of natural numbers + some constant).

Like we have seen series with squares of numbers, we can have similar series with cubes of numbers. For example, take the series 1, 8, 27, 64, ...

$$\begin{array}{cccc}
 1, & 8, & 27, & 64 \\
 \downarrow & \downarrow & \downarrow & \downarrow \\
 1^3 & 2^3 & 3^3 & 4^3
 \end{array}$$

Here, all the terms are cubes of natural numbers. So, the next term will be 5^3 , i.e., 125.

Consider the series 2, 9, 28, 65, ...

$$\begin{array}{cccc}
 2, & 9, & 28, & 65 \\
 \downarrow & \downarrow & \downarrow & \downarrow \\
 1^3 + 1 & 2^3 + 1 & 3^3 + 1 & 4^3 + 1
 \end{array}$$

Here, the terms are (Cubes of natural numbers + 1). The first term is $1^3 + 1$; the second term is $2^3 + 1$; the third term is $3^3 + 1$ and so on. Hence, the next term will be $5^3 + 1$, i.e., 126.

Miscellaneous Series

There are series that do not come under the other patterns and are of general nature but are important and are fairly common. Even here, sometimes, there can be a specific pattern in some cases.

Take the series 3, 5, 7, 11, 13, ... This is a series of consecutive PRIME NUMBERS. It is an important series and the student should look out for this as one of the patterns. The next term in this series is 17.

There can also be variations using prime numbers. Take the series 9, 25, 49, 121, In this series, the terms are squares of prime numbers. Hence, the next term is 13^2 , i.e., 169.

Take the series 15, 35, 77, The first term is 3×5 ; the second term is 5×7 ; the third term is 7×11 . Here, the terms are product of two consecutive prime numbers. So, the next term will be the product of 11 and 13, i.e., 143.



Take the series 8, 24, 48, 120, 168, Here, the 2nd term is 3 times the first term and the 3rd term is 2 times the 2nd term, but after that it does not follow this pattern any more. If you look at the terms carefully, you will find that the terms are (one less than squares of prime numbers). Hence, the next term will be $17^2 - 1$, i.e., 288.

Consider the series 1, 4, 9, 1, 6, 2, 5, 3,

At first sight there is nothing we can say about the series. This is actually a series formed by squares of natural numbers. However, if any of the squares is in two or more digits, each of the digits is written as a separate term of the series. Thus, the first terms are 1, 4 and 9, the squares of 1, 2 and 3, respectively. After this, we should get 16 (which is the square of 4). Since this has two digits 1 and 6, these two digits are written as two different terms 1 and 6 in the series. Similarly, the next square 25 is written as two different terms 2 and 5 in the series. So, the next square 36 should be written as two terms 3 and 6. Of these, 3 is already given. So, the next term of the series is 6.

Consider the series 1, 1, 2, 3, 5, 8,

$$\begin{array}{ccccccc}
 1, & 1, & 2, & 3, & 5, & 8, & \\
 & & \downarrow & \downarrow & \downarrow & \downarrow & \\
 & & 1+1 & 1+2 & 2+3 & 3+5 &
 \end{array}$$

Here, each term, starting with the third number, is the sum of the two preceding terms. After taking the first two terms as given (1 and 1), then onwards, to get any term, we need to add the two terms that come immediately before that position. Hence, to get the next term of the series, we should take the two preceding terms 5 and 8 and add them up to get 13. So, the next term of the series is 13. The term after this will be 21 ($= 8 + 13$).

Combination Series

A number series which has more than one type of (arithmetic) operation performed or more than one series combined together is a combination series. The series that are combined can be two series of the same type or could be different types of series as described above. Let us look at some examples.

First let us look at those series which are formed by more than one arithmetic operation performed on the terms to get the subsequent terms.

Consider the series: 2, 6, 10, 3, 9, 13, 4, 12, Here, the first term 2 is multiplied by 3 to get the second term, and 4 is added to get the third term. The next term is 3 (one more than the first term 2) and it is multiplied by

3 to get 9 (which is the next term) and then 4 is added to get the next term 13. The next term 4 (which is one more than 3) which is multiplied with 3 to get 12. Then 4 is added to this to get the next number 16.

Consider the series: 1, 2, 6, 21, 88, Here, we can observe that 88 is close to 4 times 21. It is in fact $21 \times 4 + 4$. So, if we now look at the previous term 21, it is related to the previous term 6 as $6 \times 3 + 3$. Now we get the general pattern, to get any term, multiply the previous term with k and then add k where k is a natural number with values in increasing order from 1. So, to get the second term, the first term has to be multiplied with 1 and then 1 is added. To get the third term, the second term is multiplied with 2 and then 2 is added and so on. Hence, after 88, the next term is $88 \times 5 + 5$, i.e., 445.

Now, let us look at a series that is formed by combining two (or more) different series. The two (or more) series can be of the same type or of different types described above.

Consider the series: 8, 12, 9, 13, 10, 14, Here the 1st, 3rd, 5th, ... terms which are 8, 9, 10, ... form one series whereas the 2nd, 4th, 6th, etc., terms which are 12, 13, 14 form another series. Here, both series that are being combined are two simple constant difference series. Therefore, the missing number will be the next term of the first series 8, 9, 10, ... which is equal to 11.

Consider the series: 0, 7, 2, 17, 6, 31, 12, 49, 20, Here, the series consisting of 1st, 3rd, 5th, ... terms (i.e., the series consisting of the odd terms) which is 0, 2, 6, 12, 20, ... is combined with another series consisting of 2nd, 4th, 6th, ... terms (i.e., the series consisting of the even terms) which is 7, 17, 31, 49, The first series has the differences in increasing order 2, 4, 6, 8, 10 and so on. The second series also has the difference in increasing order 10, 14, 18, Since, the last term 20 belongs to the first series, a number from the second series should follow next. The next term of the second series will be obtained by adding 22 to 49, i.e., 71.

Consider the series: 1, 1, 4, 8, 9, 27, Here, the series of squares of natural numbers is combined with the series of cubes of natural numbers. The next term in the series will be $4^2 = 16$.

Consider the series: 2, 4, 5, 9, 9, 16, 14, ?, 20, Here, we have to find out the term that should come in place of the question mark. The odd terms form one series 2, 5, 9, 14, 20, ... where the difference is increasing. The differences are 3, 4, 5, 6, This series is combined with the series of even terms 4, 9, 16, ... where the terms are squares of numbers 2, 3, 4, Hence, the

term that should come in place of the question mark is the next term of the second series which is 5^2 , i.e., 25.

A General Approach to Number Series

The best way of approaching the number series questions is to first observe the difference between terms. If the difference is constant, it is a constant difference series. If the difference is increasing or decreasing by a constant number, then it is a series with a constant increasing or decreasing difference. If there is no constant increasing or decreasing difference, then try out the product series approach. For this, first divide the second term with the first term, third with the second and so on. If the numbers obtained are the same, then it is a product series. Alternatively, try writing each term of the series as a product of two factors and see if there is any pattern that can be observed. If still there is no inference, but the difference is increasing or decreasing in a rapid manner, then check out the square series. If the increase is very high, and it is not a square series, then try out the cube series.

If the difference is alternately decreasing and increasing (or increasing for some time and alternately decreasing), then it should most probably be a mixed

series. Therefore, test out the series with alternate numbers. If still the series is not solved, then try out the general series.

Letter Series

The questions here are similar to the questions in Number Series Type I. Instead of numbers we have letters of the alphabet given here. We have to first identify the pattern that the series of letters follow. Then, we have to find the missing letter based on the pattern already identified. In Letter Series, in general, we have a series with constant or increasing or decreasing differences. The position of the letters in the English alphabet is considered to be the value of the alphabet in questions on Letter Series. Also, when we are counting, after we count from A to Z, we again start with A, i.e., we treat the letters as being cyclic in nature. Like in Number Series, in this type of Letter Series also, we can have a 'combination' of series, i.e., two series are combined and given. We need to identify the pattern in the two series to find out the missing letter. Sometimes, there will be some special types of series also. Let us look at a few examples to understand questions on Letter Series.

SOLVED EXAMPLES

1. Find the next letter in the series.

D, G, J, M, P, ____.

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

Sol: Three letters are added to each letter to get the next letter in the series.

$D^{+3}, G^{+3}, J^{+3}, M^{+3}, P^{+3}, \underline{S}$

$P + 3$ and $P = 16$ and $16 + 3 = 19$ and the 19th letter in the alphabet is S.

2. Find the next letter in the series.

A, B, D, H, ____.

- (A) L (B) N
(C) R (D) P

Sol: Each letter in the given series is multiplied with 2 to get the next letter in the series.

$A \times 2 \Rightarrow 1 \times 2 = 2$ and the 2nd letter is B. $B \times 2 \Rightarrow 2 \times 2 = 4$ and the 4th letter is D.

Similarly, $H \times 2 \Rightarrow 8 \times 2 = 16$ and the 16th letter is P.

3. What is the next letter in the series?

B, D, G, K, P, ____

- (A) S (B) V
(C) W (D) X

Sol: $B^{+2}, D^{+3}, G^{+4}, K^{+5}, P^{+6}, \underline{\hspace{1cm}}$

$P + 6 = 16 + 6 = 22$ and the 22nd letter is V.

4. I, X, J, W, K, V, L, ____.

- (A) M (B) U
(C) S (D) T

Sol: The given series is an alternate series.

$I^{+1}, J^{+1}, K^{+1}, L$ is one series and $X^{-1}, W^{-1}, V^{-1}, \underline{\hspace{1cm}}$ is the other series.

$X - 1 = W, W - 1 = V$ and $V - 1 = 22 - 1 = 21$ and the 21st letter is U.

EXERCISES

Directions for questions 1 to 5: Complete the following series.

1. 10, 130, 1430, 10010, 50050, ____
 (A) 100100 (B) 110100
 (C) 150150 (D) 150100
2. 361, 529, 841, 961, ____
 (A) 1249 (B) 1269
 (C) 1349 (D) 1369
3. 50, 51, 77.5, 156, 391, ____
 (A) 1173 (B) 1174
 (C) 1175 (D) 1369.5
4. 20, 35, 60, 105, 190, ____
 (A) 365 (B) 360
 (C) 355 (D) 350
5. 8, 4, 4, 6, 12, 30, ____
 (A) 75 (B) 95
 (C) 90 (D) 105

Directions for questions 6 to 10: Find the wrong number in the series.

6. 12, 33, 55, 84, 114, 147, 183
 (A) 55 (B) 84
 (C) 33 (D) 147
7. 1850, 1050, 650, 400, 350, 300, 275
 (A) 650 (B) 350
 (C) 400 (D) 275
8. 12, 31, 72, 95, 114, 131, 144
 (A) 31 (B) 12
 (C) 72 (D) 114
9. 24, 25, 29, 36, 54, 79, 115
 (A) 24 (B) 29
 (C) 79 (D) 36
10. 5, 10, 17, 33, 65, 129, 257
 (A) 5 (B) 10
 (C) 17 (D) 65

Directions for questions 11 to 15: In each of these questions a number series is given. After the series, a number is given along with (a), (b), (c), (d) and (e). You have to complete the series starting with the number given to find the values of (a), (b), (c), (d) and (e) applying the same pattern followed in the given series. Then answer the questions given below.

11. 4, 40, 89, 153, 234, 334
 20 (a) (b) (c) (d) (e)
 What is the value of (d) in the series?
 (A) 169 (B) 250
 (C) 196 (D) 269

12. 24, 12, 12, 18, 36, 90, 270
 32 (a) (b) (c) (d) (e)
 What is the value of (b) in the series?
 (A) 16 (B) 24
 (C) 75 (D) 48
13. 5, 6, 14, 45, 184, 925, 5556
 10 (a) (b) (c) (d) (e)
 What is the value of (a) in the series?
 (A) 24 (B) 75
 (C) 9 (D) 11
14. 0.75, 3, 12, 48, 192, 768, 3072
 5 (a) (b) (c) (d) (e)
 What is the value of (e) in the series?
 (A) 1280 (B) 4680
 (C) 5120 (D) 80
15. 16, 52, 84, 112, 136, 156, 72
 30 (a) (b) (c) (d) (e)
 What is the value of (c) in the series?
 (A) 66 (B) 30
 (C) 126 (D) 80

Directions for questions 16 to 20: In each of the following series two wrong numbers are given, out of which one differs by a margin of 1, i.e., + 1 or –1 and the other with a greater margin. From the given choices choose the number that differs by the greater margin. The first and the last numbers in the series are always correct.

16. 434, 629, 774, 874, 938, 972, 990
 (A) 629 (B) 774
 (C) 874 (D) 972
17. 5, 7, 18, 73, 499, 5487, 71314
 (A) 7 (B) 18
 (C) 73 (D) 499
18. 5300, 4300, 3571, 3061, 2716, 2501, 2375
 (A) 4300 (B) 3571
 (C) 3061 (D) 2716
19. 21491, 3071, 511, 102, 30, 9, 4
 (A) 9 (B) 30
 (C) 102 (D) 509
20. 201600, 100800, 33605, 8400, 1679, 28040
 (A) 280 (B) 1679
 (C) 8400 (D) 33605

Directions for questions 21 to 30: Complete the following series.

21. MTD, NSA, PVE, PVC, SXF, RYE, ____
 (A) VXY (B) VZG
 (C) UVW (D) UYW

22. ABFL, BDLX, CFRJ, DHXV, ____
 (A) EICH (B) EJDI
 (C) EJDH (D) FICH

23. DMP, IOM, ____, SSG, XUD
 (A) MPI (B) MQI
 (C) NPJ (D) NQJ

24. X, P, J, F, ____
 (A) A (B) B
 (C) C (D) D

25. IJLO, STVY, CDFI, MNPS, ____
 (A) WYAB (B) WWAC
 (C) WXZC (D) WXAC

26. EUILN, DWFPI, ____, CXEQH, GSKJP
 (A) FTJKO (B) FUJLM
 (C) EULIM (D) ETJKO

27. C1B, G12E, K3H, O26K, ____
 (A) T5O (B) U5P
 (C) S5N (D) R5M

28. $\frac{C}{12}, \frac{E}{30}, \frac{G}{56}, \dots, \frac{K}{132}, \frac{M}{182}$
 (A) $\frac{J}{80}$ (B) $\frac{I}{80}$
 (C) $\frac{J}{90}$ (D) $\frac{I}{90}$

29. XTV, UQS, RNP, OKM, ____
 (A) HLJ (B) JHL
 (C) HJL (D) LHJ

30. LMZ, NYO, XPQ, RSW, ____
 (A) TUV (B) TVU
 (C) VTU (D) SVQ

ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (C) | 6. (A) | 11. (B) | 16. (D) | 21. (B) | 26. (A) |
| 2. (D) | 7. (C) | 12. (A) | 17. (B) | 22. (C) | 27. (C) |
| 3. (B) | 8. (A) | 13. (D) | 18. (C) | 23. (D) | 28. (D) |
| 4. (C) | 9. (D) | 14. (C) | 19. (B) | 24. (D) | 29. (D) |
| 5. (C) | 10. (B) | 15. (C) | 20. (D) | 25. (C) | 30. (B) |

SOLUTIONS

Solutions for questions 1 to 5:

- The given logic is as follows.
 $10^{\times 13}, 130^{\times 11}, 1430^{\times 7}, 10010^{\times 5}, 50050^{\times 3}, \underline{150150}.$
- The given logic is as follows.
 $361, \quad 529, \quad 841, \quad 961, \quad \underline{1369}.$
 $(19)^2 \quad (23)^2 \quad (29)^2 \quad (31)^2 \quad (37)^2$
- The given logic is as follows.
 $50^{(\times 1+1)}, 51^{(\times 1.5+1)}, 77.5^{(\times 2+1)}, 156^{(\times 2.5+1)}, 391^{(\times 3+1)},$
 $\underline{1174}.$
- The given logic is as follows.
 $20^{(\times 2-5)}, 35^{(\times 2-10)}, 60^{(\times 2-15)}, 105^{(\times 2-20)}, 190^{(\times 2-25)},$
 $\underline{355}.$

- The given logic is as follows.

$$8^{\times 0.5}, 4^{\times 1}, 4^{\times 1.5}, 6^{\times 2}, 12^{\times 2.5}, 30^{\times 3}, \underline{90}.$$

Solutions for questions 6 to 10:

- The given logic is as follows.
 $12^{+21}, 33^{+24}, \underline{57}^{+27}, 84^{+30}, 114^{+33}, 147^{+36}, 183$
 Hence, the wrong number in the series is 55.
- The given logic is as follows.
 $1850^{-800}, 1050^{-400}, 650^{-200}, \underline{450}^{-100}, 350^{-50}, 300^{-25}, 275$
 Hence, the wrong number in the series is 400.
- The given logic is as follows.
 $12^{+31}, \underline{43}^{+29}, 72^{+23}, 95^{+19}, 114^{+17}, 31^{+13}, 144$
 Hence, the wrong number in the series is 31.



9. The given logic is as follows.

$$24^{(+1=1^2)}, 25^{(+4=2^2)}, 29^{(+9=3^2)}, \underline{38}^{(+16=4^2)}, 54^{(+25=5^2)}, \\ 79^{(+36=6^2)}, 115$$

Hence wrong number in the series is 36.

10. The given logic is as follows.

$$5^{(+4=2^2)}, \underline{9}^{(+8=2^3)}, 17^{(+16=2^4)}, 33^{(+32=2^5)}, 65^{(+64=2^6)}, \\ 129^{(+128=2^7)}, 257$$

Hence wrong number in the series is 10.

Solutions for questions 11 to 15:

The given logic is as follows.

$$4^{+6^2}, 40^{+7^2}, 89^{+8^2}, 153^{+9^2}, 234^{+10^2}, 334$$

11. The new series will be as follows.

20 (a) (b) (c) (d) (e)

$$20^{+6^2}, 56^{+7^2}, 105^{+8^2}, 169^{+9^2}, 250^{+10^2}, 350$$

∴ The value of (d) is 250.

12. The given logic is as follows.

$$24^{×0.5}, 2^{×1}, 12^{×1.5}, 18^{×2}, 36^{×2.5}, 90^{×3}, 270$$

The new series will be as follows.

32 (a) (b) (c) (d) (e)

$$32^{×0.5}, 16^{×1}, 16^{×1.5}, 24^{×2}, 48^{×2.5}, 120$$

∴ The value of (b) is 16.

13. The given logic is as follows.

$$5^{(×1+1)}, 6^{(×2+2)}, 14^{(×3+3)}, 45^{(×4+4)}, 184^{(×5+5)}, \\ 925^{(×6+6)}, 5556$$

The new series will be as follows.

10 (a) (b) (c) (d) (e)

$$10^{(×1+1)}, 11^{(×2+2)}, 24^{(×3+3)}, 75^{(×4+4)}, 304^{(×5+5)}, 1525$$

∴ The value of (a) is 11.

14. The given logic is as follows.

$$0.75^{×4}, 3^{×4}, 12^{×4}, 48^{×4}, 192^{×4}, 768^{×4}, 3072$$

The new series will be as follows.

5 (a) (b) (c) (d) (e)

$$5^{×4}, 20^{×4}, 80^{×4}, 320^{×4}, 1280^{×4}, 5120$$

∴ The value of (e) is 5120.

15. The given logic is as follows.

$$16^{+36}, 52^{+32}, 84^{+28}, 112^{+24}, 136^{+20}, 156^{+16}, 172$$

The new series will be as follows.

30 (a) (b) (c) (d) (e)

$$30^{+36}, 66^{+32}, 98^{+28}, 126^{+24}, 150^{+20}, 170$$

∴ The value of (c) is 126.

Solutions for questions 16 to 20:

16. The given logic is as follows.

$$434 + (14)^2 = \underline{630}.$$

$$630 + (12)^2 = 774.$$

$$774 + (10)^2 = 874.$$

$$874 + (8)^2 = 938.$$

$$938 + (6)^2 = \underline{974}.$$

$$974 + (4)^2 = 990.$$

Hence, the wrong numbers are 629 and 972, where 972 has greater difference.

17. The given logic is as follows.

$$5^{×2-3}, 7^{×3-5}, \underline{16}^{×5-7}, 73^{×7-11}, \underline{500}^{×11-13}, 5487^{×13-17}, 71314$$

Hence, the wrong numbers are 18 and 499, where 18 has greater difference.

18. The given logic is as follows.

$$5300^{-10^3}, 4300^{-9^3}, 3571^{-8^3}, \underline{3059}^{-7^3}, 2716^{-6^3}, \underline{2500}^{-5^3}, 2375$$

Hence, the wrong numbers are 3061 and 2501, where 3061 has greater difference.

19. The given logic is as follows.

$$21491^{(+6+7)}, 3071^{(-5+6)}, 511^{(+4+5)}, \underline{103}^{(-3+4)}, \underline{25}^{(+2+3)}, \\ 9^{(-1+2)}, 4$$

Hence, the wrong numbers are 102 and 30, where 30 has greater difference.

20. The given logic is as follows.

$$201600^{+2}, 100800^{+3}, \underline{33600}^{+4}, 8400^{+5}, \underline{1680}^{+6}, 280^{+7}, 40$$

Hence, the wrong numbers are 33605 and 1679, where 33605 has greater difference.

Solutions for questions 21 to 30:

21. The alternate groups are in different series.

MTD, PVE, SXF are in on series.

Pattern for the first letters:

$$M^{+3}, P^{+3}, S^{+3}, \underline{V}$$

Pattern for the second letters:

$$T^{+2}, V^{+2}, X^{+2}, \underline{Z}$$

Pattern for the third letters:

$$D^{+1}, E^{+1}, F^{+1}, \underline{G}$$

Hence, the next pair is VZG.

22. In this series the first letter in all the groups form a series of consecutive letters. Hence, the first letter in the next group is E. The other letters in each group is related as follows.

$$A^{×2} \quad B^{×3} \quad F^{×2} \quad L$$

$$B^{×2} \quad D^{×3} \quad L^{×2} \quad X$$

$$C^{×2} \quad F^{×3} \quad R^{×2} \quad \underline{J}$$

$D^{x^2} \quad H^{x^3} \quad X^{x^2} \quad V$

Hence, the next group is obtained as follows.

$E^{x^2} J^{x^3} D^{x^2} H$

Hence, the next group in the series is EJDH.

23. The given series is a mixed series.

Pattern for the first letters:

$D^{+5}, I^{+5}, N^{+5}, S^{+5}, X$

Pattern for the second letters:

$M^{+2}, O^{+2}, Q^{+2}, S^{+2}, U$

Pattern for the third letters:

$P^{-3}, M^{-3}, J^{-3}, G^{-3}, D$

Hence, the missing pair is NQJ.

24. $X^{-8}, P^{-6}, J^{-4}, F^{-2}, \underline{\quad}$

The values that are subtracted are consecutive even numbers in decreasing order starting from 8. Hence, the next letter in the series is $F - 2 = D$.

25. The given logic is as follows.

$I^{+1} J^{+2} L^{+3} O^{+4}, S^{+1} T^{+2} V^{+3} Y^{+4}, C^{+1} D^{+2} F^{+3} I^{+4},$

$M^{+1} N^{+2} P^{+3} S^{+4}, \underline{W^{+1} X^{+2} Z^{+3} C}$

Hence, WXZC is the next group in the series.

26. The given series is a mixed series.

Pattern for the first letters:

$E^{-1}, D^{+2}, F^{-3}, C^{+4}, G$

Pattern for the second letters:

$U^{+2}, W^{-3}, T^{+4}, X^{-5}, S$

Pattern for the third letters:

$I^{-3}, F^{+4}, J^{-5}, E^{+6}, K$

Pattern for the fourth letters:

$L^{+4}, P^{-5}, K^{+6}, Q^{-7}, J$

Pattern for the fifth letters:

$N^{-5}, I^{+6}, O^{-7}, H^{+8}, P$

Hence, the missing group is FTJKO.

- 27.

3	2	7	5	11	8	15	11				
C	1	B,	G	12	E,	K	3	H,	O	26	K,
$(3 - 2)$	$(7 + 5)$	$(11 - 8)$	$(15 + 11)$								

Pattern for the first letters:

$C^{+4}, G^{+4}, K^{+4}, O^{+4}, \underline{S}$

Pattern for the second letters:

$B^{+3}, E^{+3}, H^{+3}, K^{+3}, \underline{N}$

Hence, the required group is, $S(19 - 14)N \Rightarrow S5N$.

$$28. \frac{C(3)}{3x(3+1)}, \frac{E(5)}{5x(5+1)}, \frac{G(7)}{7x(7+1)},$$

$$\frac{I(9)}{9x(9+1)}, \frac{K(11)}{11x(11+1)}, \frac{M(13)}{13x(13+1)}$$

Pattern for the letters:

Letters in consecutive odd positions.

Hence, $\frac{I}{90}$ is the missing term in the series.

29. The given series is a mixed series.

Pattern for the first letters:

$X^{-3}, U^{-3}, R^{-3}, O^{-3}, \underline{L}$

Pattern for the second letters:

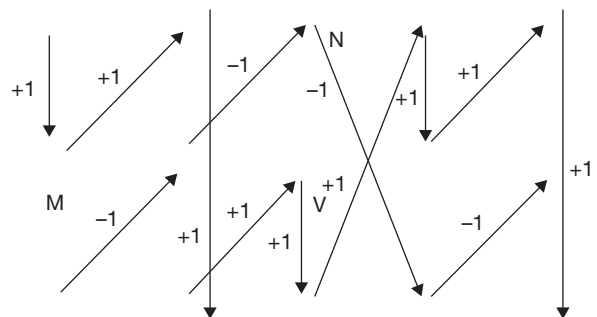
$T^{-3}, Q^{-3}, N^{-3}, K^{-3}, \underline{H}$

Pattern for the third letters:

$V^{-3}, S^{-3}, P^{-3}, M^{-3}, \underline{J}$

Hence, the next group in the series is LHJ.

30. In the given series each group is related to its previous group and the letters within the group are related to each other as follows.



Hence, the missing group in the series is TVU.

2

Analogies

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn about analogy – a similar relationship between two or more entities
- Learn about number analogies and verbal analogies
- Learn about the different kinds of relationships between elements in number analogy questions like:
 - Multiples
 - Square/square roots
 - Cube/cube roots
 - Prime numbers

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

□ ANALOGIES

Analogy means ‘similarity’ or ‘similar relationship’. In these type of questions regarding the number or letter or verbal analogies, a pair of entities that has a certain relationship is given. This number/letter/pair is followed by a third number/letter/word. The student is expected to identify the relationship between the pair given and find out a FOURTH element such that the relationship between the third and the fourth is similar to the relationship that exists between the first and the second (In some cases, it may not be the fourth one that has to be found out. The fourth one will be given and the student has to find out one of the other three, whichever is not given).

Number Analogies

Typical relationships between the numbers in a given pair can be any of the following:

- One number is a multiple of the other.
- One number is the square or square root of the other.
- One number is the cube or cube root of the other.
- The two numbers are squares of two other numbers which themselves are related. For example, the two numbers are squares of two consecutive integers or squares of two consecutive even integers or squares of two consecutive odd integers.
- The two numbers are such that they are obtained by subtracting a certain number from the squares or cubes of the two related numbers.
- The two numbers are such that they are obtained by adding a certain number to the squares or cubes of the two related numbers.
- The two numbers can be consecutive, even, odd or prime numbers.

There can be many more combinations that one can think of but the student has to note an important point in solving questions on Number Analogies. In Number Series related questions, since a series of numbers (more than two numbers) will be given, the relationship or pattern can be identified uniquely. In Number Analogies, since only two numbers are given, it may be possible to think of more than one relationship exist-

ing between the two numbers in the given pair. But, it should be kept in mind that generally, simple addition of one number or subtraction of one number is not what is given in Number Analogies. The questions try to test the insight that the student has got into the relationship between the numbers.

Let us take a few examples and understand the questions on Number Analogies.

SOLVED EXAMPLES

1. 25 is related to 36 in the same way as 49 is related to _____.

(A) 61 (B) 63
(C) 65 (D) 60

Sol: When the numbers in the question are considered the students tend to consider 25 and 36 as squares of two consecutive natural numbers. But the answer choices do not have any answer suitable to the above logic. Hence, it is important that the student keeps the answer choices in view in arriving at the logic.

$$25 + 11 = 36$$

$$\text{Similarly, } 49 + 11 = 60.$$

2. 27 is related to 51 in the same way as 83 is related to _____.

(A) 102 (B) 117
(C) 123 (D) 138

Sol: The given analogy can be written as:

$$5^2 + 2 : 7^2 + 2 :: 9^2 + 2 : \underline{\quad}.$$

5 and 7 are successive odd numbers.

Similarly, next odd number to 9 is 11 and $11^2 + 2 = 121 + 2 = 123$.

3. 11 is related to 25 in the same way as 17 is related to _____.

(A) 33 (B) 28
(C) 41 (D) 37

Sol: $11 \times 2 + 3 = 22 + 3 = 25$.

Similarly, $17 \times 2 + 3 = 34 + 3 = 37$.

Letter Analogies

The questions in this area are similar to Verbal Analogies. Here, the questions are based on the relationship between **two groups of letters** (instead of **two words** as in Verbal Analogies). Typically, three sets of letters are given followed by a question mark (where a fourth set of letters is supposed to be inserted). The student has

to find the relation or order in which the letters have been grouped together in the first two sets of letters on the left hand side of the symbol ' : ' and then find a set of letters to fit in place of the question mark so that the third and the fourth set of letters will also have the same relationship as the first and the second. The sequence or order in which the letters are grouped can be illustrated by the following examples.

SOLVED EXAMPLES

1. BDEG is related to DFGI in the same way as HKMO is related to _____.

(A) ILNP (B) JMOP
(C) JMOQ (D) JNOQ

Sol: Two letters are added to each letter to get the next letters in the analogy.

B D E G; Similarly, H K M O

+2 +2 +2 +2 +2 +2 +2 +2

D F G I J M O Q

2. ACDF is related to CGJN in the same way as BEHI is related to _____.

(A) DJNQ (B) DINQ
(C) DINR (D) DHNQ

Sol: A C D F; Similarly, B E H I

+2 +4 +6 +8 +2 +4 +6 +8

C G J N D I N Q

3. SUWY is related to LPTX in the same way as PRTV is related to _____.



- (A) INRU (B) INQU
(C) IMRU (D) IMQU

Sol: S U W Y; Similarly, P R T V
 $-7 -5 -3 -1$ $-7 -5 -3 -1$
 L P T X I M Q U

4. BCDE is related to DFHH in the same way as FGHI is related to _____.

- (A) LJPL (B) LKPL
(C) JKPJ (D) IKPL

Sol: B C D E; Similarly, F G H I
 $x2 +3$ $x2 +3$ $x2 +3$ $x2 +3$
 D F H H L J P L

Verbal Analogies:

Here, the questions are based on relationship between two words. In these kind of questions three words are followed by a blank space, which the student has to fill

up in such a way that the third and the fourth words have the same relationship between them as the first and the second words have. The following examples help in understanding the concepts.

SOLVED EXAMPLES

1. Gum is related to Stick in the same way as Needle is related to _____.

- (A) Cloth (B) Prick
(C) Taylor (D) Stitch

Sol: Gum is used to Stick and Needle is used to Stitch.

2. Socks is related to Feet in the same way as Hands is related to _____.

- (A) Arms (B) Shirt
(C) Gloves (D) Fingers

Sol: Socks are worn on Feet. Similarly, Gloves are worn on Hands.

3. Soft is related to Hard in the same way as Cold is related to _____.

- (A) Hot (B) Ice
(C) Winter (D) Snow

Sol: Soft and Hard are antonyms. Similarly, the antonym of Cold is Hot.

EXERCISES

Directions for questions 1 to 25: Find the missing term.

1. $36 : 343 :: \text{_____} : 1331$
(A) 81 (B) 121
(C) 100 (D) 144
2. $24 : 576 :: 32 : \text{_____}$
(A) 1024 (B) 992
(C) 1228 (D) 865
3. $13 : 2197 :: 16 : \text{_____}$
(A) 256 (B) 2744
(C) 4096 (D) 3378
4. $81 : 729 :: 144 : \text{_____}$
(A) 1728 (B) 1331
(C) 169 (D) 2197
5. $22 : 506 :: 27 : \text{_____}$
(A) 675 (B) 756
(C) 702 (D) 783
6. $6 : 222 :: 9 : \text{_____}$
(A) 738 (B) 767
(C) 729 (D) 744
7. $5 : 120 :: 8 : \text{_____}$
(A) 520 (B) 504
(C) 448 (D) 512
8. $5 : 150 :: 8 : \text{_____}$
(A) 520 (B) 516
(C) 512 (D) 576
9. $6 : 180 :: 9 : \text{_____}$
(A) 729 (B) 738
(C) 632 (D) 648
10. $105 : 150 :: 39 : \text{_____}$
(A) 68 (B) 64
(C) 60 (D) 72
11. $390 : 315 :: \text{_____} : 564$
(A) 663 (B) 689
(C) 653 (D) 674
12. $3864 : 5098 :: 4994 : \text{_____}$
(A) 6228 (B) 6246
(C) 6194 (D) 6286
13. $1936 : 1360 :: \text{_____} : 2142$
(A) 2746 (B) 2718
(C) 2672 (D) 2466

14. $11 : 24 :: 37 : \text{_____}$
(A) 68 (B) 92
(C) 74 (D) 78
15. $97 : 8 :: 43 : \text{_____}$
(A) 4 (B) 2
(C) 3 (D) 7
16. $PS : KH :: MT : \text{_____}$
(A) NH (B) NG
(C) LG (D) LH
17. $EOU : IUA :: AIU : \text{_____}$
(A) EIO (B) IOE
(C) EOA (D) EAO
18. $HRD : JSF :: XMP : \text{_____}$
(A) ZNQ (B) ZOR
(C) YNR (D) YNQ
19. $DATE : ECWI :: CHAIN : \text{_____}$
(A) DJDMS (B) DJELR
(C) DIFMS (D) DIELS
20. $MONTH : NMQPM :: PAPER : \text{_____}$
(A) QYTBV (B) QXSBX
(C) QYTAV (D) QYSAW
21. $6P1 : 5Y2 :: 6J3 : \text{_____}$
(A) 6L4 (B) 9K4
(C) 9W4 (D) 4L6
22. $3P2 : 2J0 :: 3R6 : \text{_____}$
(A) 2M6 (B) 2N8
(C) 1H6 (D) 2L4
23. $12L : 24X :: 5E : \text{_____}$
(A) 21U (B) 19S
(C) 10J (D) 20T
24. $2E3 : 4I5 :: 7O8 : \text{_____}$
(A) 10U11 (B) 11W12
(C) 13A14 (D) 9U12
25. $B6H : D10N :: K5P : \text{_____}$
(A) M9V (B) T72
(C) R8J (D) B6D

Directions for questions 26 to 30: Select the correct alternative from the given choices.

26. Hand is related to Elbow in the same way as Leg is related to _____.



- (A) Joint (B) Fingers
(C) Toes (D) Knee
27. Aeroplane is related to Pilot in the same way as Elephant is related to _____.
(A) Elephant Man (B) Saddle
(C) Mahout (D) Jockey
28. Bangladesh is related to Dhaka in the same way as Germany is related to _____.
(A) Paris (B) Berlin
(C) Baghdad (D) Rome
29. Spain is related to King in the same way as Brazil is related to _____.
(A) Chancellor (B) President
(C) Pope (D) Director
30. River is related to Bank in the same way as Sea is related to _____.
(A) Bank (B) Port
(C) Coast (D) Pebble

ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (C) | 6. (A) | 11. (A) | 16. (B) | 21. (C) | 26. (D) |
| 2. (A) | 7. (B) | 12. (A) | 17. (C) | 22. (D) | 27. (C) |
| 3. (C) | 8. (D) | 13. (B) | 18. (D) | 23. (C) | 28. (B) |
| 4. (A) | 9. (D) | 14. (D) | 19. (A) | 24. (A) | 29. (B) |
| 5. (B) | 10. (A) | 15. (B) | 20. (D) | 25. (A) | 30. (C) |

SOLUTIONS

Solutions for questions 1 to 25:

1. $36 : 343 :: \underline{\hspace{1cm}} : 1331$
 $(6)^2 : (7)^3 :: (10)^2 : (11)^3$
 Hence, $10^2 = 100$ is the missing number.
2. $24 : 576 :: 32 : \underline{\hspace{1cm}}$
 The given analogy is of the form $n : n^2$.
 $24 : (24)^2 :: 32 : (32)^2$
 $(32)^2 = 1024$ is the next number.
3. $13 : 2197 :: 16 : \underline{\hspace{1cm}}$
 The given analogy is of the form $n : n^3$.
 $13 : (13)^3 :: 16 : (16)^3$
 $(16)^3 = 4096$ is the missing number.
4. $81 : 729 :: 144 : \underline{\hspace{1cm}}$
 $(9)^2 : (9)^3 :: (12)^2 : (12)^3$
 $(12)^3 = 1728$ is the next number.
5. $22 : 506 :: 27 : \underline{\hspace{1cm}}$
 $22 : (22)^2 + 22 :: 27 : (27)^2 + 27$
 This is of the form $n : n^2 + n$.
 $(27)^2 + 27 = 756$ is the next number.
6. $6 : 222 : 9 : \underline{\hspace{1cm}}$
 $6 : (6)^3 + 6 :: 9 : (9)^3 + 9$
 $(9)^3 + 9 = 738$ is the next number.

7. $5 : 120 :: 8 : \underline{\hspace{1cm}}$
 $5 : (5)^3 - 5 :: 8 : (8)^3 - 8$
 $(8)^3 - 8 = 504$ is the next number.

8. $5 : 150 :: 8 : \underline{\hspace{1cm}}$
 $5 : 5^3 + 5^2 :: 8 : 8^3 + 8^2$
 This is of the form $n : n^3 + n^2$.
 $8^3 + 8^2 = 576$ is the next number.

9. $6 : 180 :: 9 : \underline{\hspace{1cm}}$
 $6 : 6^3 - 6^2 :: 9 : 9^3 - 9^2$
 This is of the form $n : n^3 - n^2$.
 $9^3 - 9^2 = 648$.

10. $105 : 150 :: 39 : \underline{\hspace{1cm}}$

$$\underbrace{(10)^2 + \frac{10}{2}}_{+2} : \underbrace{(12)^2 + \frac{12}{2}}_{+2} :: \underbrace{(6)^2 + \frac{6}{2}}_{+2} : \underbrace{(8)^2 + \frac{8}{2}}_{+2}$$

This is of the form $n^2 + \frac{n}{2}$.

$(8)^2 + \frac{8}{2} = 68$ is the next number.

11. $390 : 315 :: \underline{\hspace{1cm}} : 564$

3

Odd Man Out

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn how to pick the odd one out from the given items
- Learn about different ways of classifying elements like:
 - Number classification
 - Alphabet classification
 - Word classification

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❑ ODD MAN OUT

Finding the odd man out from the given alternatives is a very common type of questions that one comes across in different competitive examinations. In the questions on odd man out, all the items, except one follow a certain pattern (in their formation) or belong to a group. The item that does not follow the pattern or does not belong to the group has to be marked as the answer choice.

The problems of this variety often fall under the category of 'Classification'. When a given set of elements is classified under a single head, one of the items will not fall into that group to which the rest belong, i.e., it will not have the common property, which the others will have. Hence, it becomes the odd man out.

Questions on classification can be asked in any form. Some of the commonly asked ones are given below.

Number Classification

In this case, we need to choose the odd number from the given alternatives. The numbers may belong to a particular set, i.e., they may be odd, even, prime, rational, squares, cubes, etc., and only one of the choices

will not follow the rule which others do and that is our answer. A few illustrations are given below.

1. Find the odd one among the following.

- | | |
|------------|--------|
| (a) (A) 17 | (B) 27 |
| (C) 37 | (D) 47 |

- (b) (A) 441 (B) 289
(C) 361 (D) 343

Sol: (a) All the given numbers except 27 are prime numbers whereas 27 is a composite number.
(b) The given numbers can be written as $(21)^2$, $(17)^2$, $(19)^2$, $(7)^3$, $(25)^2$. All except 343 are the squares whereas 343 is a cube.

Alphabet Classification

In this type, a group of jumbled letters typically consisting of three letters (but can be four or two or just a single letter) are put together. The pattern or order in which they are grouped is to be studied and we need to find out which groups have the same pattern or relationship between the letters. There will be one choice, which will have a pattern that is different from the rest and that is our answer.

2. Find the odd one among the following.

- (A) ZW (B) TQ
(C) SP (D) NL

Sol: $Z^{-3}W$, $T^{-3}Q$, $S^{-3}P$, $N^{-2}L$, $P^{-3}M$
Hence, NL is the odd one.

3. Find the odd one among the following.

- (A) CFD (B) GJH
(C) KNM (D) JMK

Sol: $C^{+3}F^{-2}D$, $G^{+3}J^{-2}H$, $K^{+3}N^{-1}M$, $J^{+3}M^{-2}K$, $V^{+3}Y^{-2}W$
Hence, KNM is the odd one.

Word Classification

Here, different items are classified based on common properties, like names, places, professions, parts of speech, etc. A few examples are illustrated below.

4. Find the odd one among the following.

- (A) Mercury (B) Moon
(C) Jupiter (D) Saturn

Sol: All others except Moon are planets where as Moon is a satellite.

5. Find the odd one among the following.

- (A) SORE (B) SOTLU
(C) NORGAE (D) MEJNIAS

Sol: The words are jumbled. The actual words are ROSE, LOTUS, ORANGE, JASMINE and LILLY. All, except ORANGE are flowers whereas ORANGE is a fruit.



EXERCISES

Directions for questions 1 to 30: Three of the following four are alike in a particular pattern and hence, form a group. Find the one which does not belong to that group.

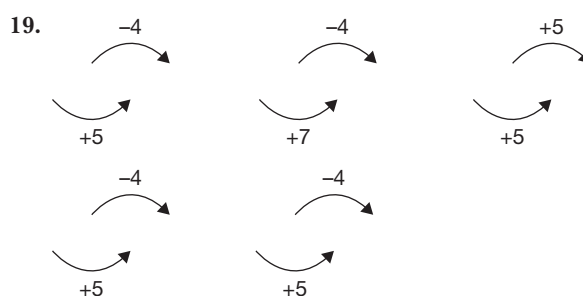
- | | | | |
|---|--|--|---|
| 1. (A) 16
(C) 49 | (B) 9
(D) 121 | 15. (A) 43
(C) 13 | (B) 59
(D) 21 |
| 2. (A) 248
(C) 236 | (B) 224
(D) 268 | 16. (A) QDW
(C) BOL | (B) UHS
(D) SGT |
| 3. (A) 1296
(C) 2704 | (B) 2304
(D) 1764 | 17. (A) 2D
(C) 4P | (B) 3I
(D) 6A |
| 4. (A) $\frac{312}{468}$
(C) $\frac{230}{345}$ | (B) $\frac{318}{477}$
(D) $\frac{354}{472}$ | 18. (A) IED
(C) IDE | (B) OCL
(D) OHK |
| 5. (A) 2
(C) 10 | (B) 5
(D) 54 | 19. (A) PQUM
(C) NOSK | (B) HIOE
(D) RSWO |
| 6. (A) 144
(C) 225 | (B) 169
(D) 196 | 20. (A) MNPL
(C) FHJE | (B) SUWR
(D) JLNI |
| 7. (A) 543
(C) 345 | (B) 435
(D) 354 | 21. (A) ABB
(C) BCE | (B) KBV
(D) EDT |
| 8. (A) 39
(C) 24 | (B) 636
(D) 37 | 22. (A) EHFC
(C) PSQN | (B) ILJG
(D) ROSU |
| 9. (A) 346
(C) 742 | (B) 469
(D) 427 | 23. (A) AZ
(C) DZYXW | (B) CZYX
(D) EZYXW |
| 10. (A) 4774
(C) 363 | (B) 4174
(D) 666 | 24. (A) $\frac{A}{BB}$
(C) $\frac{BB}{CCC}$ | (B) $\frac{CCC}{DDDD}$
(D) $\frac{DDDDD}{CCC}$ |
| 11. (A) 744
(C) 654 | (B) 852
(D) 473 | 25. (A) 2W3
(C) 1L2 | (B) 1Q7
(D) 2Z5 |
| 12. (A) 5840
(C) 7321 | (B) 6530
(D) 6422 | 26. (A) Late
(C) Rate | (B) Mate
(D) Bite |
| 13. (A) 18
(C) 72 | (B) 32
(D) 88 | 27. (A) Spider
(C) Mosquito | (B) Housefly
(D) Bee |
| 14. (A) 29
(C) 129 | (B) 341
(D) 67 | 28. (A) Pistchios
(C) Walnuts | (B) Pecans
(D) Apple |
| | | 29. (A) November
(C) June | (B) September
(D) February |
| | | 30. (A) November
(C) August | (B) March
(D) December |

ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (A) | 6. (B) | 11. (D) | 16. (D) | 21. (C) | 26. (D) |
| 2. (D) | 7. (D) | 12. (D) | 17. (D) | 22. (D) | 27. (A) |
| 3. (C) | 8. (D) | 13. (D) | 18. (D) | 23. (D) | 28. (D) |
| 4. (D) | 9. (A) | 14. (B) | 19. (B) | 24. (D) | 29. (D) |
| 5. (D) | 10. (B) | 15. (?) | 20. (A) | 25. (D) | 30. (A) |

SOLUTIONS

- Except 16, all are odd numbers.
- Except 268, in all the numbers, the last digit is the product of first two digits.
- Except 2704, all the numbers are divisible by '6'.
- Except $\frac{354}{472}$, all fractions become $\frac{2}{3}$ when simplified.
- Except 54, all the numbers can be expressed in the form $n^2 + 1$.
- Except 169, all the numbers are squares of composite numbers.
- Except 354, all the numbers are odd numbers.
- $6 \underline{62} = 636$, $2 \underline{22} = 24$, $8 \underline{82} = 864$, $33^2 = 39$.
The above pattern is not followed in 37.
- Except 346, all the numbers are divisible by 7.
- Except 4174, all the numbers are palindromes.
- Except 473, in all the numbers the sum of all the digits is 15.
- Except in '6422', in all the numbers, the last two digits are product of the first digits.
- $18 = 2 \times 3^2$, $32 = 2 \times 4^2$, $72 = 2 \times 6^2$, $98 = 2 \times 7^2$
Except 88, all the numbers follow similar pattern.
- $29 = 3^3 + 2$, $129 = 5^3 + 4$, $67 = 4^3 + 3$, $221 = 6^3 + 5$,
Except 341, all the numbers follow similar pattern.
- In all the groups, the first and last letters are corresponding and opposite letters of the 2nd letter, respectively except SGT.
- In each of the group 2D, 3I, 4P, 5Y the number is the square root of the position value of the letter. This pattern is not followed by 6A.
- In all the groups, the difference of the first letter and the last letter's place value is the place value of the second letter, except in 'OHK'.



Except HIOE, all the other groups follow the similar pattern.

- $M^{+1}N^{+2}P^{-4}L$, $S^{+2}U^{+2}W^{-5}R$, $F^{+2}H^{+2}J^{-5}E$, $J^{+2}L^{+2}N^{-5}I$, $C^{+2}E^{+2}G^{-5}B$. Except MNPL, all other groups follow the similar pattern.
- $I^{+3}L^{-2}J^{-3}G$, $P^{+3}S^{-2}Q^{-3}N$, $M^{+3}P^{-2}N^{-3}K$, $R^{-3}O^{+4}S^{+2}U$, $E^{+3}H^{-2}F^{-3}C$
Except ROSU, all follow the similar pattern.
- In all the groups the number of letters of the place value of the first letter is taken from the back side, in reverse order, except in EYZXW.
- In all the groups, the number of letters in the numerator are less than the number of letters in denominator.
Except in $\frac{DDDDD}{CCC}$.
- The digits on either side of the letter in each of the groups 2W3, 1Q7, 1L2, 1R8 indicate the place value of the letter in the alphabet. Except in 2Z5.
- Except 'Bite', all the words are rhyming words.
- Except 'Spider', all are flying insects.
- Except 'Apple', all are types of nuts.
- Except 'February', all the given months have 30 days.
- Except 'November', all the given months have 31 days.

4

Coding and Decoding

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn about coding (encrypting a message, according to a pattern or set of rules so that no one can understand the message without knowing the rule)
- Learn about decoding (decrypting a message and writing the original message so that anyone can understand it)
- Be exposed to various types of coding/decoding like:
 - Arranging in ascending/descending order
 - Adding/subtracting from each element to generate new elements
 - Coding letters as numbers and vice-versa

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

❑ CODING AND DECODING

Before looking at the different types of questions and some of the codes that can be used with the help of examples, let us first understand what we mean by coding and decoding. When we say **coding**, a particular code or pattern is used to express a word in English language as a different word or in a different form. The coded word itself does not make any sense unless we know the pattern or code that has been followed.

Decoding refers to the process of arriving at the equivalent English word from the given code word.

In the questions, a particular code is given and on the basis of this given code, we have to find out how another word (in English language) can be coded. The correct code for the given word has to be selected from the answer choices on the basis of the code given in the question.

SOLVED EXAMPLES

1. In a certain code language, if the word 'PARTNER' is coded as OZQSMDQ, then what is the code for the word 'SEGMENT' in that language?

- (A) TFHNFOU (B) RDFLDMS
(C) RDELDMS (D) RDFEDNS

Sol: Word: P A R T N E R
 Logic: -1 -1 -1 -1 -1 -1 -1
 Code: O Z Q S M D Q
 Similarly, the code for SEGMENT is
 Word: S E G M E N T
 Logic: -1 -1 -1 -1 -1 -1 -1
 Code: R D F L D M S

2. In a certain code language, if the word 'RECTANGLE' is coded as TGEVCPING, then how is the word 'RHOMBUS' coded in that language?

(A) TJQODWV (B) TJQNDWU
 (C) TJQODWU (D) TJQOEWU

Sol: Word: R E C T A N G L E
 Logic: +2 +2 +2 +2 +2 +2 +2 +2
 Code: T G E V C P I N G
 Similarly, the code for RHOMBUS is
 Word: R H O M B U S
 Logic: +2 +2 +2 +2 +2 +2 +2
 Code: T J Q O D W U

3. In a certain code language, if the word 'SPHERE' is coded as EREHPS, then how is the word 'EXHIBITION' coded in that language?

(A) NOTITBIHXE (B) NOITIDIHXE
 (C) NOITIBIHWE (D) NOITIBIHXE

Sol: Word: S P H E R E
 Logic: The letters in the given word are reversed.
 Code: E R E H P S
 Similarly, the code for EXHIBITION is
 Word: E X H I B I T I O N
 Logic: The letters in the given word are reversed.
 Code: N O I T I B I H X E

4. In a certain code language, if the word 'REJECTION' is coded as SGMIHZIPWW, then how is the word 'MECHANIC' coded in that language?

(A) NGFLFTP K (B) NGPLFTP K
 (C) NGFKFTP K (D) NGPTPKIL

Sol: Word: R E J E C T I O N
 Logic: +1 +2 +3 +4 +5 +6 +7 +8 +9
 Code: S G M I H Z P W W
 Similarly, the code for MECHANIC is
 Word: M E C H A N I C
 Logic: +1 +2 +3 +4 +5 +6 +7 +8
 Code: N G F L F T P K

5. In a certain code language, if the word 'PLAYER' is coded as AELPRY, then how is the word 'MANAGER' coded in that language?

(A) AEAGMNR (B) AAGEMNR
 (C) AAEGMNR (D) AAEGNMR

Sol: Word: P L A Y E R
 Logic: The letters in the word are arranged in the increasing order of their value as in the alphabet.

Code: A E L P R Y
 Similarly, the code for MANAGER is AAEGMNR.

6. In a certain code language, if the number 1 is assigned to all the letters in odd numbered places in the alphabet and the remaining letters are assigned the number 2, then what is the code for the word 'INDIAN'?

(A) 121212 (B) 111222
 (C) 112212 (D) 122112

Sol: The code for the word INDIAN is 122112.

7. In a certain code language, if CRICKET is coded as 3923564, ROCKET is coded as 913564 and KETTLE is coded as 564406, then how is LITTLE coded in that language?

(A) 244060 (B) 024406
 (C) 020446 (D) 200446

Sol: As we observe that the letters and their corresponding codes are given in order, i.e., the code for C is 3, R is 9, I is 2 and so on. Hence, the code for LITTLE is 024406.

Directions for questions 8 to 11: In a certain code language, the codes for some words are as follows.

WORDS	CODES
NATION	- agvnab
REMOTE	- rzgrbe
STAIR	- efgnv
FORMAL	- bensyz
COMMON	- zabzpb
FOR	- ebs

Based on the above coding pattern answer the following questions.

8. What is the code for 'SCREEN'?

(A) fepcra (B) fpersa
 (C) fpreba (D) fperra

9. What is the code for 'RATION'?

(A) ensvba (B) engvba
 (C) engrba (D) engvca



10. What is the code for 'CREATOR'?
- (A) prengbc (B) persbgc
(C) perngbe (D) pebrycn
11. What is the code for 'AMERICAN'?
- (A) nzrevpna (B) nzrespna
(C) nzlespna (D) nzreqpna

Solutions for questions 8 to 11: The given words and their codes are as follows.

WORDS		CODES	
(1) NATION	-	agvnab	
(2) REMOTE	-	rzgrbi	
(3) STAIR	-	efgnv	
(4) FORMAL	-	bensyz	
(5) COMMON	-	zabzpb	
(6) FOR	-	ebs	

In the 1st word, the letter N is repeated and the code 'a' is repeated. Hence, for N, the code is 'a'. Similarly, from the 2nd word, the code for E is 'r'. In the 1st and 6th words, the letter O is common and so is the code b. Hence, the code for O is b. In the 5th word, the letter M is repeated and so is the code z. Hence, the code for

M is Z. Similarly, the codes for the remaining letters can be determined.

The letters and their respective codes are as follows.

Letter	A	C	E	F	I	L	M	N	O	R	S	T
Code letter	n	p	R	s	v	y	z	a	b	e	f	G

8. The code for 'SCREEN' is fperra.
9. The code for 'RATION' is engvba.
10. The code for 'CREATOR' is perngbe.
11. The code for 'AMERICAN' is nzrevpna.
12. In a certain code if white is called as black, black as yellow, yellow as blue, blue as red, red as green, green as purple, then what is the colour of blood in that language?
- (A) Red (B) Green
(C) Yellow (D) Purple

Sol: The colour of blood is Red and in this code, Red is called Green. Hence, blood is green in colour in that language.

EXERCISES

Directions for questions 1 to 20: Select the correct alternative from the given choices.

- In a certain code language, if the word CLIMATE is coded as IAECMLT, then how is the word CALCULATE coded in that language?
(A) AUEACLCLT (B) AUACELCLT
(C) AUAECCLT (D) AUAELCCT
- In a certain code language, if the word SOLUTIONS is coded as SNOITULOS, then how is the word ANSWER coded in that language?
(A) RENSWA (B) RENSAW
(C) REASWN (D) REWSNA
- In a certain code language, if the word BASKET is coded as UFLTBC, then how is the word SIMPLE coded in that language?
(A) FMQNJG (B) FMQGNJ
(C) FMQNJT (D) MFNQJT
- In a certain code language, if the word SINGER is coded as XNSLJW, then how is the word DANCER coded in that language?
(A) IFSHJW (B) ISFHJW
(C) ISFJHW (D) IJWFSH
- In a certain code language, if the word PLEASE is coded as GNRGUC, then how is the word CODING coded in that language?
(A) FQIPEK (B) FPKQEI
(C) FQKPIE (D) FQEIPK
- In a certain code language, if the word KITE is coded as 4567 and the word RATE is coded as 8967, then how is the word TAKE coded in that language?
(A) 6974 (B) 6794
(C) 6947 (D) 6479
- In a certain code language, if SP is coded as UR and LO is coded as NQ then TV is coded as _____.
(A) VW (B) WV
(C) VN (D) VX
- In a certain code language, if the word ASIA is coded as 1431, the word AFRICA is coded as 125361 and the word FRANCE is coded as 251768, then how is the word ARIES coded in that language?
(A) 15348 (B) 15438
(C) 13584 (D) 15384
- In a certain code language, if the word LOCAL is coded as MPDBM, then which word is coded as DBMMFS?
(A) CARROT (B) CODING
(C) CALLER (D) CARING
- In a certain code language, if the word CREATE is coded as $\Omega\theta\#4\theta$ and the word INDIA is coded as 8768#, then how is the word ACCIDENT coded in that language?
(A) $\#\#86\theta74$ (B) $86\theta74\#\#\$
(C) $\theta\#\#86\$74$ (D) $\#\#\$86\theta74$
- In a certain code language, if the word PROGRAM is coded as RTQHTCO, then how is the word PLAYING coded in that language?
(A) RKPICZN (B) RCKPIZN
(C) RPICKZN (D) None of these
- In a certain code language, if the word DOUBLE is coded as ODBUEL, then how is the word SINGLE coded in that language?
(A) ISNGEL (B) ISGNLE
(C) SINGEL (D) ISGNEL
- In a certain code language, if the word SUMMER is coded as $\Omega\theta\#\#17$, and the word MOTION is coded as $\#\%\$2\6 , then how can the word 'SECTOR' be coded in that language?
(A) $\Omega\%\circ21\%$ (B) $\Omega21\#\theta\%$
(C) $\theta\%\Omega861$ (D) $\Omega1\circ\%\$7$
- In a certain code language, if ADC is coded as 143 and BED is coded as 254 then how is DFG coded in that language?
(A) 456 (B) 465
(C) 467 (D) 645
- In a certain code language, if sun means moon, moon means earth, earth means sky, sky mean sea, then on which of the following do we live according to that language?
(A) Sun (B) Moon
(C) Earth (D) Sea
- In a certain code language, if the word STOP is coded as PWLS, then how is the word EXIT coded in that language?
(A) ABFW (B) BWFA
(C) WBFA (D) BAFW
- In a certain code language, if the word LANGUAGE is coded as LNGGAUAE then how is the word FINANCE coded in that language?
(A) FNCNIAE (B) FNCNIEA
(C) FNNCIAE (D) FNNCAIE



18. In a certain code, if the word SOME is coded as MSEO and the word NAME is coded as MNEA, then what is the code for WARM in that language?
 (A) RAMW (B) RMAW
 (C) RWMA (D) RAWM
19. In a certain code language, if the word LETTER is coded as MUFFUS, then how is the word DECIDE coded in that language?
 (A) EDFEEJ (B) EEFJJD
 (C) FFEEDJ (D) EDEFJF
20. In a certain code language, if the word CORRECT is coded as ORCCRET, then what is the code for the word KINGDOM?
 (A) IGOKNDM (B) HFNMJCL
 (C) HFJNMCL (D) HFNCLMJ

Directions for questions 21 to 25: In a certain code language, the codes for the sentences in Column I are given in Column II. Each word has a unique code. Answer the questions based on these codes.

Column I	Column II
1. kite night right might	sap tap map cap
2. might weight sight eight	zap cap wap yap
3. night eight boat right	yup tap sap zap
4. boat not weight night	wap sap yup lap

21. What is the code for the word 'not'?
 (A) lap (B) map
 (C) nap (D) zap
22. Which word is coded as 'cap'?
 (A) weight (B) might
 (C) night (D) not
23. What is the code for the word 'right'?
 (A) yup (B) sap
 (C) map (D) tap
24. What can be the code for 'might right boat correct'?
 (A) cap fap tap yup (B) tap yap sap map
 (C) wap yup lap cap (D) cap zap tap sap

25. What can be coded as 'sap tap map pop'?
 (A) might right boat eight
 (B) boat sight might weight
 (C) right night site kite
 (D) might not boat kite

Directions for questions 26 to 30: Given below are the codes for the digits/symbols. Study the conditions given below and answer the questions that follow.

Digit/ Symbol	5	2	©	#	4	@	8	Ω	7	\$	3	9	®	*	1
Letter code	C	G	R	L	B	T	H	M	D	X	W	O	P	K	N

Conditions:

- If both the first and the last elements are odd digits, then code both of them as 'A'.
- If both the first and the last elements are even digits, then code both of them as 'E'.
- If the first element is an even digit and the last element is a symbol, then the codes for the first and the last elements get interchanged.
- If both the first and the last elements are symbols, then reverse the code for the entire group.

What will be the codes for the following group of elements?

26. 25\$391@4
 (A) GCXWONTE (B) ECXWONTE
 (C) ECWVOTNE (D) GWXCONTE
27. 1\$Ω4925
 (A) AXKPMGA (B) BPKXMGB
 (C) BXKPMBA (D) None of these
28. \$4@Ω2*5
 (A) XTBMGKC (B) XBTMGKC
 (C) XBTGMCK (D) CBTMGKX
29. *87\$Ω2\$
 (A) KHDXMGX (B) HKXDGMO
 (C) DXGKDHM (D) XGMXDHK
30. 872Ω@9®
 (A) HDGMTOP (B) HGD MOTP
 (C) PDGMT OH (D) PGMDOTH

ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (C) | 6. (C) | 11. (D) | 16. (D) | 21. (A) | 26. (B) |
| 2. (D) | 7. (D) | 12. (D) | 17. (C) | 22. (B) | 27. (D) |
| 3. (C) | 8. (D) | 13. (D) | 18. (C) | 23. (D) | 28. (B) |
| 4. (A) | 9. (C) | 14. (C) | 19. (D) | 24. (A) | 29. (D) |
| 5. (D) | 10. (D) | 15. (B) | 20. (A) | 25. (C) | 30. (C) |

SOLUTIONS

Solutions for questions 1 to 20:

1. Word: CLIMATE

Logic: Letters in the word are arranged as all vowels come together first and then consonants.

Code: IAECLMT

Similarly, the code for CALCULATE is AUAECLCLT.

2. Word: SOLUTIONS

Logic: The letters in the given word are reversed.

Code: SNOITULOS

Similarly, the code for ANSWER is REWSNA.

3.	Word:	B	A	S	K	E	T
	Logic:	+1	+1	+1	+1	+1	+1
	Code:	C	B	T	L	F	U

and then the code is reversed, i.e., UFLTBC.

Similarly,

Word:	S	I	M	P	L	E
Logic:	+1	+1	+1	+1	+1	+1
Code:	T	J	N	Q	M	F

and then the code is reversed, i.e., FMQNJT.

4.	Word:	S	I	N	G	E	R
	Logic:	+5	+5	+5	+5	+5	+5
	Code:	X	N	S	L	J	W

Similarly,

Word:	D	A	N	C	E	R
Logic:	+5	+5	+5	+5	+5	+5
Code:	I	F	S	H	J	W

∴ IFSHJW is the code for DANCER.

5.	Word:	P	L	E	A	S	E
	Logic1:	+2	+2	+2	+2	+2	+2
	Logic2:	R	N	G	C	U	G

Half coded and then reversed.

Code: GNRGUC.

Similarly,

Word:	C	O	D	I	N	G
Logic1:	+2	+2	+2	+2	+2	+2
Logic2:	E	Q	F	K	P	I

Half coded and then reversed.

Code: FQEIPK.

∴ FQEIPK is the code for CODING.

6.	WORD	CODE				
	KITE	4567	→ (I)			
	RATE	8967	→ (II)			

By comparing the positions of the letters T and E, in both the words with respective codes it can be identified that the code for each letter is in the corresponding position in the code.

Hence, the code for the word TAKE is 6947.

7.	Word1:	S	P	Word2:	L	O	
	Logic:	+2	+2	Logic:	+2	+2	
	Code:	U	R	Code:	N	Q	

Similarly,

Word:	T	V				
Logic:	+2	+2				
Code:	V	X				

∴ VX is the code for TV.



8. As we observe that the letters and their corresponding codes are given in order, i.e., the code for A is 1, S is 4 and so on. Hence, the code for ARIES is 15384.

9.

Word:	L	O	C	A	L	
Logic:	+1	+1	+1	+1	+1	
Code:	M	P	D	B	M	

Similarly,

Word:	C	A	L	L	E	R
Logic:	+1	+1	+1	+1	+1	+1
Code:	D	B	M	M	F	S

∴ CALLER is coded as DBMMFS.

10. As we observe that the letters and their corresponding codes are given in order, i.e., the code for C is \$, R is Ω and so on. Hence, the code for ACCIDENT is '\$\$\$86074'.

11.

Word:	P	R	O	G	R	A
M						
Logic:	+2	+2	+2	+1	+2	+2
+2						
Code:	R	T	Q	H	T	C
O						

Similarly,

Word:	P	L	A	Y	I	N
G						
Logic:	+2	+2	+2	+1	+2	+2
+2						
Code:	R	N	C	Z	K	P
I						

∴ RNCZKPI is the code for PLAYING.

12.

Word:	D	O	U	B	L	E
Logic:						
Code:	O	D	B	U	E	L
Similarly,						
Word:	S	I	N	G	L	E
Logic:						
Code:	I	S	G	N	E	L

∴ ISGNEL is the code for SINGLE.

13. As we observe that the letters and their corresponding codes are given in the following order, i.e., the code for S is Ω, U is θ and so on. Hence, the code for SECTOR is 'Ω1©%\$7'.

14. As we observe that the alphabets are coded with their place values according to the alphabetical order, i.e., the code for A is 1, B is 2 and so on. Hence, the code for DFG is 467.

15. We live on the earth and earth is called moon in the given code language.

16.

Word:	S	T	O	P		
Logic:	-3	+3	-3	+3		
Code:	P	W	L	S		

Similarly,

Word:	E	X	I	T		
Logic:	-3	+3	-3	+3		
Code:	B	A	F	W		

∴ BAFW is the code for EXIT.

17. As we observe that consonants come first, followed by vowels in the corresponding code. Hence, the code for the word FINANCE is FNNCIAE.

18.

Word:	S	O	M	E
Logic:				
Code:	M	S	E	O
Word:	N	A	M	E
Logic:				
Code:	M	N	E	A

Similarly,

Word:	W	A	R	M
Logic:				
Code:	R	W	M	A

∴ RWMA is coded for WARM.

19. First write the odd-positioned letters of the word and then even-positioned ones one after the other.

Word:	L	E	T	T	E	R
Logic:	L	T	E	E	T	R
+1	+1	+1	+1	+1	+1	
Code:	M	U	F	F	U	S

Similarly,

Word:	D	E	C	I	D	E
Logic:	D	C	D	E	I	E
+1	+1	+1	+1	+1	+1	
Code:	E	D	E	F	J	F

∴ EDEFJF is code for DECIDE.

20. Write the even-positioned letters of the word first and then the odd-positioned ones one after the other.

Word:	C	O	R	R	E	C
T						
Code:	O	R	C	C	R	E
T						

Similarly,

Word:	K	I	N	G	D	O
M						
Code:	I	G	O	K	N	D
M						

∴ IGOKNDM is the code for KINGDOM.

Solutions for questions 21 to 25:

From (1) and (2), the code for 'might' is 'cap'.
 From (2) and (3), the code for 'eight' is 'zap'.
 From (1) and (4), the code for 'night' is 'sap'.
 From (3) and (4), the code for 'boat' is 'yup'.
 From (3), the code for 'right' is 'tap' and from (1), the code for 'kite' is 'map'.

From (2) and (4), the code for 'weight' is 'wap' and from (2), the code for 'sight' is 'yap' and from (4), the code for 'not' is lap.

Hence, the codes are as follows:

Word	kite	night	right	might	weight	sight	Eight	boat	not
Code	map	sap	tap	cap	wap	yap	Zap	yup	lap

21. The code for 'not' is 'lap'.
 22. 'might' is coded as 'cap'.
 23. The code for 'right' is 'tap'.
 24. The code for 'might right boat correct' can be 'cap tap yup fap'.
 25. 'right night site kite' can be coded as 'sap tap map pop'.

Solutions for questions 26 to 30:

26. The given group of elements is 25\$391@4.
 This group follows condition (ii).
 Hence, the code is ECXWONTE.
 27. The given group of elements is 1\$Q4925.
 This group follows condition (i).
 Hence, the code is AXMBOGA.
 28. The given group of elements is \$4@Q2*5.
 This group does not follow any condition.
 Hence, the code is XBTMGKC.
 29. The given group of elements is *87\$Q2\$.
 This group follows condition (iv).
 Hence, the code is XGMXDHK.
 30. The given group of elements is 872Q@9@.
 This group follows condition (iii).
 Hence, the code is PDGMTOH.

5

Symbols and Notations

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn about symbols and notations as an extension of coding-decoding
- Learn how to draw conclusions, find the values or compare two or more quantities after understanding the notations/relations given

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

□ SYMBOLS AND NOTATIONS

The basic approach for the questions of this chapter is more or less similar to that of coding and decoding. As in the questions of coding and decoding, a basic word is coded in a particular way and the candidate is asked to code another word using the same logic.

Similarly, in 'Symbols and Notations', one has to study the symbols and their meanings carefully which are given against them. Then, the meanings given are to be used in place of those symbols in answering the questions. The word 'Notation' basically stands for the meaning which each symbol will be assigned.

SOLVED EXAMPLES

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

$a + b$ means a is greater than b .

$a - b$ means a is less than or equal to b .

$a \times b$ means a is greater than or equal to b .

$a \div b$ means a is less than b .

$a \# b$ means a is equal to b .

Each of the following questions consists of some statements followed by two conclusions.

Give your answer as:

- (A) If only conclusion (I) follows.
- (B) If only conclusion (II) follows.
- (C) If both conclusions (I) and (II) follow.
- (D) If neither (I) nor (II) follows.

1. Statements: $m - n, n \div o, o \# q.$
 Conclusions: I. $q \times m$
 II. $q + m$

Sol: The given statements are (i) $m \leq n, n < o$ and $o = q$, i.e., $m \leq n < o = q$.

Conclusion I: $q \times m \Rightarrow q \geq m$ does not follow.

Hence, conclusion I does not follow.

Conclusion II: $q + m \Rightarrow q > m$ follows.

Hence, only conclusion II follows.

2. Statements: $l \div m, o \# q, m + o$
 Conclusions: I. $m + q$
 II. $l \times o$

Sol: The given statements are $l < m, o = q$ and $m > o$, i.e., $m > l, m > o = q$.

Conclusion I: $m + q \Rightarrow m > q$ follows.

Conclusion II: $l \times o \Rightarrow l \geq o$ does not follow.

\therefore Only conclusion I follows

3. Statements: $x \div y, y - z, z \div a$
 Conclusions: I. $x - a$
 II. $z - x$

Sol: By combining the statements, we get $x < y \leq z < a$.

Conclusion I: $x - a \Rightarrow x \leq a$ does not follow.

Conclusion I does not follow.

Conclusion II: $z - x \Rightarrow z \leq x$ does not follow.

Conclusion II does not follow

\therefore Neither I nor II follows.

4. Statements: $e \# f, f + g, g \div h$
 Conclusions: I. $e + g$
 II. $g + f$

Sol: By combining all the statements, we get:

$e = f > g; g < h$

Conclusion I: $e + g \Rightarrow e > g$ follows.

Conclusion I follows.

Conclusion II: $g + f \Rightarrow g > f$ does not follow.

Conclusion II does not follow.

\therefore Only I follows.

5. Statements: $a + b, c - d, d \div b$
 Conclusions: I. $a + c$
 II. $c \div b$

Sol: By combining all the statements, we get:

$a > b, c \leq b, d < b$

$\Rightarrow a > b > d \geq c$

Conclusion I: $a + c \Rightarrow a > c$ follows.

Conclusion I follows.

Conclusion II: $c \div b \Rightarrow c < b$ follows.

Conclusions II follows.

\therefore Both I and II follow.

6. If ' Δ ' means 'is less than', ' $\$$ ' means 'is greater than' and ' \pounds ' means 'is equal to' and given that $a \Delta b, c \pounds d$ and $c \$ b$, then which of the following is true?

(A) $d \Delta a$

(B) $b \$ d$

(C) $a \pounds c$

(D) $a \Delta b \Delta c$

Sol: $a \Delta b \Rightarrow a < b$

$c \$ b \Rightarrow c > b \Rightarrow b < c$

$c \pounds d \Rightarrow c = d$

$\therefore a < b < c = d$

(A) $d \Delta a \Rightarrow d < a \rightarrow$ does not follow

(B) $b \$ d \Rightarrow b > d \rightarrow$ does not follow

(C) $a \pounds c \Rightarrow a = c \rightarrow$ does not follow

(D) $a \Delta b \Delta c \Rightarrow a < b < c \rightarrow$ follows

EXERCISES

Directions for questions 1 to 5: In a certain code language, '+' means '×', '×' means '−', '−' means '÷' and '÷' means '+'. Simplify the following expressions using the above directions, in which the mathematical operators are written according to the code language.

- $9 + 4 - 6 \times 6 \div 8$
(A) 8.5 (B) 8
(C) 5.25 (D) 0
- $10 + 10 \times 10 - 10 \div 10$
(A) 109 (B) 10
(C) 19 (D) 11
- $16 \times 4 \div 4 + 14 - 2$
(A) 56 (B) 28
(C) 40 (D) 112
- $16 - 2 + 4 \div 16 - 8 \times 2$
(A) −15 (B) 2
(C) 4 (D) 32
- $2 \div 4 + 8 - 16 \times 32 \div 64 \times 128 \div 256$
(A) 4.5 (B) 164
(C) 4 (D) 163

Directions for questions 6 to 10: These questions are based on the following information.

In the following questions certain symbols are used to represent relations as given below.

$A \phi B$ means A is greater than B.

$A \delta B$ means A is greater than or equal to B.

$A \Omega B$ means A is equal to B.

$A \int B$ means A is not greater than B.

$A \lambda B$ means A is neither greater nor equal to B.

In each of the following questions four statements followed by four conclusions marked I, II, III, IV are given. Assuming that the statements to be true, find which of the four conclusions follows the given statements.

- Statements: $P \Omega R, Q \int S, R \delta S, P \lambda T$.
Conclusions:
I. $P \phi S$,
II. $P \Omega Q$
III. $P \Omega S$
IV. $Q \lambda P$
(A) Either I or III follows.
(B) Either II or IV follows.
(C) Either I or III and either II or IV follow.
(D) All follow
- Statements: $J \phi H, J \lambda G, I \delta K, G \int K$.
Conclusions:
I. $I \phi G$
II. $J \phi I$

III. $G \Omega I$

IV. $H \lambda K$

- (A) Only IV follows. (B) Either I or III follows.
(C) Only II follows. (D) Both (A) and (B).

8. Statements: $W \Omega Z, Z \delta X, W \int V, Y \phi V$.

Conclusions:

I. $V \delta X$

II. $Y \int X$

III. $Y \phi Z$

IV. $V \lambda X$

- (A) Only I follows. (B) Only III follows.
(C) Only II follows. (D) Both (A) and (B).

9. Statements: $P \phi F, U \lambda W, R \int F, R \delta U$.

Conclusions:

I. $P \delta W$

II. $W \Omega F$

III. $W \lambda F$

IV. $P \lambda W$

- (A) Only I and III follow.
(B) Only II and IV follow.
(C) Either III or IV follows.
(D) None follows

10. Statements: $A \lambda B, B \int C, C \delta E, E \phi D$.

Conclusions:

I. $A \lambda C$

II. $B \phi E$

III. $C \phi D$

IV. $E \Omega A$

- (A) Only I follows.
(B) Only III follows.
(C) Only II and III follows.
(D) Only I and III follows.

Directions for questions 11 to 15: Select the correct alternative from the given choices.

11. Which of the following symbols should replace the question marks in that order in the given expression, in order to make the expression ' $A > J$ ' definitely true?

$A ? X ? E ? U ? J ? S$

- (A) $=, \geq, =, =, >$ (B) $>, \geq, =, <, >$
(C) $=, >, =, >, \geq$ (D) $<, =, \leq, <, >$

12. Which of the following elements should replace the question marks in that order in the given expression, in order to make the expression ' $L > P$ ' definitely true?

$? > ? = ? > ? = ? < ?$

- (A) L, O, N, M, Q, P (B) L, M, N, O, P, Q
(C) P, O, N, Q, M, L (D) L, M, O, N, Q, P

13. Which of the following expressions is true if the given expressions 'B > K' as well as 'T < D' are true?
 (A) $T < B \leq G < D = K$ (B) $B < T = G \leq D > K$
 (C) $D < K > G = T \geq B$ (D) $B > D = G \geq K > T$

14. Which of the following expressions is not true if the given expression 'L < F' as well as 'H ≥ Q' are definitely true?
 (A) $L < M \leq H = F \geq Q$ (B) $L < M \leq Q = F \leq H$
 (C) $L < Q = M \geq H \leq F$ (D) $H \geq F = M \geq Q > L$

15. Which of the following symbols should replace the question mark in the given expression in order to make the expressions 'C < V' and 'Y < Q' definitely true?

$$C < J \leq Q ? V \geq W > Y$$

- (A) = (B) <
 (C) ≤ (D) >

Directions for questions 16 to 20: Study the following sequence carefully and answer the questions given below.

R K 5 9 # B 2 % * E ? A 8 L \$ I 4 S V 7 ! C 6 N @ H 1 3 & D

16. Four of the following are alike. Find the odd one.
 (A) RKB (B) ALI
 (C) SVC (D) BLI
17. How many consonants are there, which are immediately followed by a digit but not immediately preceded by a consonant?
 (A) 3 (B) 2
 (C) 1 (D) 0
18. Find the next term in the following series.
 5#2, *?8, \$4V, ____
 (A) LIS (B) !6@
 (C) I4S (D) 13\$
19. Which is the 9th element to the right of the 19th element from the left end?
 (A) 7 (B) 3
 (C) V (D) H
20. How many letters are there, each of which are immediately followed and immediately preceded by a symbol?
 (A) One (B) Three
 (C) Two (D) More than three

Directions for questions 21 to 25: Select the correct alternative from the given choices.

21. If $a \Delta b = a + b + ab$ and $a \$ b = a^2 + b^2$, then $(3 \Delta 4) \$ 5 =$
 (A) 386 (B) 1625
 (C) 336 (D) 436
22. If $p > q = p^2 + q^3$ and $p < q = p^3 - q^2$ then $(1 > 2) < 3 =$
 (A) 503 (B) 720
 (C) 648 (D) 960

23. If $x > y = x^3 + y^3$ and $x @ y = x^3 - y^3$ then $3 > (2 @ 1) =$
 (A) 756 (B) 702
 (C) 440 (D) 370

24. If $E \downarrow F = (E + F)^2 + (E - F)^2$ and $E \uparrow F = (E + F)^2 - (E - F)^2$, then $(2 \downarrow 5) \uparrow (4 \downarrow 3) =$
 (A) 7808 (B) 15616
 (C) 11600 (D) 23200

25. If $m \neq n = m^2 - mn + n^2$ and $m ? n = (m + n)^2 - mn$, then $(2 ? 3) \neq (5 \neq 3) =$
 (A) 900 (B) 361
 (C) 642 (D) 729

Directions for questions 26 to 30: In a certain instruction system the different computation processes are written as follows.

- (a) 'A % B ! C' means 'A is added to the product of B and C'.
 (b) 'A © B * C' means 'the product of B and C is subtracted from A'.
 (c) 'A # B @ C' means 'the product of A and B is divided by C'.
 (d) 'A • B \$ C' means 'C is multiplied by the sum of A and B'.

You have to find out what will come in the place of question mark (?) in each question following the computation processes.

26. $100 © 20 * 3 = a$
 $a \% 40 ! 5 = ?$
 (A) 140 (B) 240
 (C) 340 (D) 360

27. $16 • 14 \$ 4 = t$
 $t \# 10 @ 12 = ?$
 (A) 700 (B) 300
 (C) 400 (D) 100

28. $100 © 5 * 16 = q$
 $q \% 4 ! 12 = ?$
 (A) 140 (B) 68
 (C) 98 (D) 102

29. $50 \# 40 @ 200 = p$
 $16 \% 12 ! p = ?$
 (A) 112 (B) 136
 (C) 126 (D) 226

30. $12 • 13 \$ 5 = r$
 $10 © 4 * r = ?$
 (A) 120 (B) -430
 (C) -490 (D) 720



ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (B) | 6. (C) | 11. (C) | 16. (D) | 21. (A) | 26. (B) |
| 2. (A) | 7. (D) | 12. (B) | 17. (A) | 22. (B) | 27. (D) |
| 3. (C) | 8. (D) | 13. (D) | 18. (B) | 23. (D) | 28. (B) |
| 4. (D) | 9. (D) | 14. (C) | 19. (B) | 24. (C) | 29. (B) |
| 5. (B) | 10. (D) | 15. (A) | 20. (A) | 25. (B) | 30. (C) |

SOLUTIONS

Solutions for questions 1 to 5:

- '+' means '×', '×' means '−', '−' means '÷' and '÷' means '+'.
The given expression is $9 + 4 - 6 \times 6 \div 8$.
On converting this expression as per the directions, we get the expression $9 \times 4 \div 6 - 6 + 8$.
Let us simplify this expression using BODMAS rule, where
'B' stands for 'Brackets',
'O' stands for 'of',
'D' stands for 'Division',
'M' stands for 'Multiplication',
'A' stands for 'Addition' and
'S' stands for 'subtraction'.
 $\therefore 9 \times 4 \div 6 - 6 + 8 = 36 \div 6 - 6 + 8 = 6 - 6 + 8 = 8$
- The given expression is $10 + 10 \times 10 - 10 \div 10$.
As per the directions, it becomes $10 \times 10 - 10 \div 10 + 10$.
Using BODMAS rule, we get:
 $10 \times 10 - 10 \div 10 + 10 = 100 - 1 + 10 = 109$.
- The given expression $16 \times 4 \div 4 + 14 - 2$ becomes $16 - 4 + 4 \times 14 \div 2$ as per the given directions.
Using BODMAS rule, we get:
 $16 - 4 + 4 \times 14 \div 2 = 12 + 56 \div 2 = 12 + 28 = 40$.
- As per the given directions, the given expression $16 - 2 + 4 \div 16 - 8 \times 2$ becomes
 $16 \div 2 \times 4 + 16 \div 8 - 2$.
Using BODMAS rule, we get:
 $16 \div 2 \times 4 + 16 \div 8 - 2 = 8 \times 4 + 2 - 2 = 32 + 0 = 32$.
- $2 \div 4 + 8 - 16 \times 32 \div 64 \times 128 \div 256$ becomes
 $2 + 4 \times 8 \div 16 - 32 \div 64 - 128 + 256$.
Using BODMAS rule, we get:
 $2 + 4 \times 8 \div 16 - 32 \div 64 - 128 + 256$
 $= 2 + 32 \div 16 + 32 \div 128$
 $= 2 + 2 + 160 = 164$

Solutions for questions 6 to 10:

- A ϕ B means A is greater than B $\Rightarrow A > B$.
A δ B means A is greater than or equal to B $\Rightarrow A \geq B$.
A Ω B means A is equal to B $\Rightarrow A = B$.
A \int B means A is not greater than B $\Rightarrow A \leq B$.

A λ B means A is neither greater nor equal to B $\Rightarrow A < B$.

- Given statements are:
P Ω R $\Rightarrow P = R$
Q \int S $\Rightarrow Q \leq S$
R δ S $\Rightarrow R \geq S$
P λ T $\Rightarrow P < T$
By combining all the statements, we get:
T $> P = R \geq S \geq Q$
Conclusion I: P ϕ S $\Rightarrow P > S$ does not follow.
Conclusion II: P Ω Q $\Rightarrow P = Q$ does not follow.
Conclusion III: P Ω S $\Rightarrow P = S$, does not follow.
Conclusion IV: Q λ P $\Rightarrow Q < P$ does not follow.
But either I or III and either II or IV follows.
- Given statements are:
J ϕ H $\Rightarrow J > H$
J λ G $\Rightarrow J < G$
I δ K $\Rightarrow I \geq K$
G \int K $\Rightarrow G \leq K$
By combining all the statements, we get:
H $< J < G \leq K \leq I$
Conclusion I: I ϕ G $\Rightarrow I > G$ does not follow.
Conclusion II: J ϕ I $\Rightarrow J > I$ does not follow.
Conclusion III: G Ω I $\Rightarrow G = I$ does not follow.
Conclusion IV: H λ K $\Rightarrow H < K$ follows.
 \therefore Only IV and either I or III follow.
- Given statements are:
W Ω Z $\Rightarrow W = Z$; Z δ X $\Rightarrow Z \geq X$
W \int V $\Rightarrow W \leq V$; Y ϕ V $\Rightarrow Y > V$
By combining all the statements, we get:
Y $> V \geq W = Z \geq X$
Conclusion I: V δ X $\Rightarrow V \geq X$ follows.
Conclusion II: Y \int X $\Rightarrow Y \leq X$ does not follow.
Conclusion III: Y ϕ Z $\Rightarrow Y > Z$ follows.
Conclusion IV: V λ X $\Rightarrow V < X$ does not follow.
 \therefore Only I and III follow.
- Given statements are:
P ϕ F $\Rightarrow P > F$; U λ W $\Rightarrow U < W$
R \int F $\Rightarrow R \leq F$; R δ U $\Rightarrow R \geq U$
By combining all the statements, we get:
P $> F \geq R \geq U < W$

- Conclusion I: $P \delta W \Rightarrow P \geq W$ does not follow.
 Conclusion II: $W \Omega F \Rightarrow W = F$ does not follow.
 Conclusion III: $W \lambda F \Rightarrow W < F$ does not follow.
 Conclusion IV: $P \lambda W \Rightarrow P < W$ does not follow.
 \therefore None follows.

10. Given statements are:

$$A \lambda B \Rightarrow A < B$$

$$B \int C \Rightarrow B \leq C; C \delta E \Rightarrow C \geq E; E \phi D \Rightarrow E > D$$

By combining all the statements, we get:

$$A < B \leq C \geq E > D$$

Conclusion I: $A \lambda C \Rightarrow A < C$ follows.

Conclusion II: $B \phi E \Rightarrow B > E$, does not follow.

Conclusion III: $C \phi D \Rightarrow C > D$, follows.

Conclusion IV: $E \Omega A \Rightarrow E = A$ does not follow.

\therefore Only I and III follow.

Solutions for questions 11 to 15:

11. In order to make the given expression 'A > J' true, the symbols which are to be placed in the place of question mark are =, >, =, >, \geq . Then the expression becomes $A = X > E = U > J \geq S$.
12. In order to make the given expression 'L > P' true, the elements which are to be placed in the place of question mark are L, M, N, O, P and Q. Then the expression becomes $L > M = N > O = P < Q$.
13. In the expression $B > D = G \geq K > T$, the given expression 'B > K' as well as 'T < D' are true.
14. In all the other expressions except in $L < Q = M \geq H < F$ the expressions 'L < F' and 'H \geq Q' are definitely true.
15. In the given expression the question mark should be replaced with '=' in order to make the expressions 'C < V' and 'Y < Q' definitely true. Then the expression becomes $C < J \leq Q = V \geq W > Y$.

Solutions for questions 16 to 20:

16. The given sequence is:
 R K 5 9 # B 2 % * E ? A 8 L \$ I 4 S V 7 ! C 6 N @ H 1 3 & D
 Except BLI, in all others, the three letters are consecutive alphabets in the given sequence.
17. B, C and H are the three letters which are followed by a digit but not immediately preceded by a consonant.
18. The sequence is:
 5 # 2, * ? 8, \$ 4 V _____
 The logic is as follows:
 $5^{+2} \#^{+2} 2^{+2}, *^{+2} ?^{+2} 8^{+2}, \$^{+2} 4^{+2} V^{+2}, !^{+2} 6^{+2} @$
19. The 9th element to the right of the 19th element from the left end is (9 + 19)th = 28th from the left end, that is 3.
20. There is only one letter, i.e., E, which is immediately followed and immediately preceded by symbol.

Solutions for questions 21 to 25:

21. $3 \Delta 4 = 3 + 4 + 3 \times 4 = 7 + 12 = 19$
 $(3 \Delta 4) \$ 5 = 19 \$ 5 = 19^2 + 5^2$
 $= 361 + 25 = 386$
22. $1 > 2 = 1^2 + 2^3 = 1 + 8 = 9$
 $(1 > 2) < 3 = 9 < 3 = 9^3 - 3^2$
 $= 729 - 9 = 720$
23. $2 @ 1 \Rightarrow 2^3 - 1^3 = 8 - 1 = 7$
 $3 > (2 @ 1) = 3 > 7 = 3^3 + 7^3$
 $\Rightarrow 27 + 343 = 370$
24. $E \downarrow F = (E + F)^2 + (E - F)^2 = 2(E^2 + F^2)$
 $E \uparrow F = (E + F)^2 - (E - F)^2 = 4 E F$
 $2 \downarrow 5 = 2(2^2 + 5^2) = 2(4 + 25) = 58$
 $4 \downarrow 3 = 2(4^2 + 3^2) = 2(16 + 9) = 50$
 $\therefore (2 \downarrow 5) \uparrow (4 \downarrow 3) = 58 \uparrow 50$
 $= 58 \uparrow 50$
 $\Rightarrow 4 \times 58 \times 50 = 11600$
25. $2 ? 3 = (2 + 3)^2 - 2 \times 3 = 25 - 6 = 19$
 $5 \neq 3 = 5^2 - 5 \times 3 + 3^2 = 25 - 15 + 9 = 19$
 $(2 ? 3) \neq (5 \neq 3) = 19 \neq 19$
 $= 19^2 - 19 \times 19 + 19^2 = 19^2 = 361$

Solutions for questions 26 to 30:

- (a) 'A % B ! C' means 'A is added to the product of B and C'.
- (b) 'A @ B * C' means 'the product of B and C is subtracted from A'.
- (c) 'A # B @ C' means 'the product of A and B is divided by C'.
- (d) 'A • B \$ C' means 'C is multiplied by the sum of A and B'.
26. Given, $100 @ 20 * 3 = a$
 The value $a = 100 - (20 \times 3) = 40$
 Then $40 \% 40 ! 5 = 40 + 40 \times 5 = 240$.
27. Given, $16 \bullet 14 \$ 4 = q$
 The value of $q = (16 + 14) \times 4 = 120$
 Then $120 \# 10 @ 12$
 $= \frac{120 \times 10}{12} = 10 \times 10 = 100$.
28. Given, $100 @ 5 * 16 = t$
 $\therefore t = 100 - (5 \times 16) = 20$
 Then $20 \% 4 ! 12 = 20 + 4 \times 12 = 20 + 48 = 68$.
29. Given, $50 \# 40 @ 200 = p$
 $\Rightarrow p = \frac{50 \times 40}{200} = 10$
 Then $16 \% 12 ! 10 = 16 + 12 \times 10 = 16 + 120 = 136$.
30. Given, $12 \bullet 13 \$ 5 = r$
 $\Rightarrow r = (12 + 13) \times 5 = 125$
 $10 @ 4 * 125 = 10 - (4 \times 125) = -490$.

6

Blood Relations

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn about different types of blood relations
- Learn how to draw a family tree
- Learn to differentiate between different stages/levels of the family tree
- Learn how to represent the gender of each person and the relationship between two persons

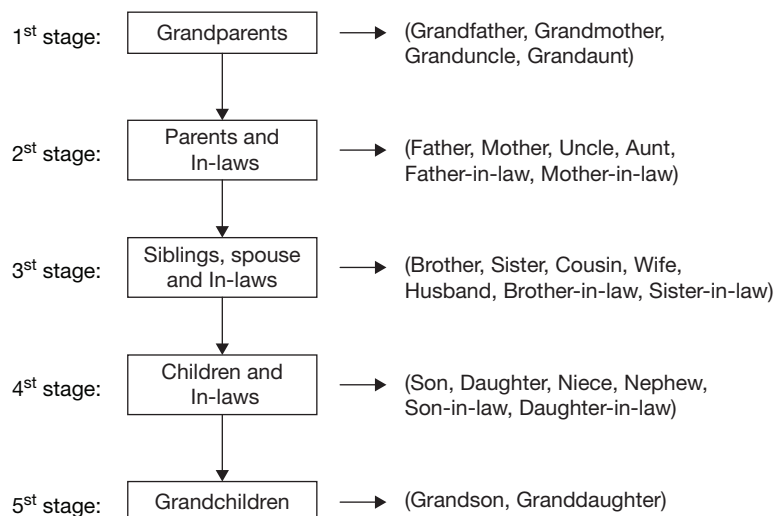
The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

□ BLOOD RELATIONS

There are two types of questions based on blood relations that are given in different competitive examinations. For the sake of convenience, we will refer to the two types of questions as Type I and Type II. (Please note that the questions on blood relationships are not categorized as above in the actual exam papers. It is being done purely from the point of better understanding).

In the exams, the success of a candidate in the questions on blood relations depends upon his knowledge about various blood relations. Some of the relationships given below help in solving the problems.

The easiest and non-confusing way to solve these types of problems would be to draw a family tree diagram and increase the levels in the hierarchy as shown in the next page:



Mother's or Father's son	:	Brother
Mother's or Father's daughter	:	Sister
Mother's or Father's brother	:	Uncle
Mother's or Father's sister	:	Aunt
Mother's or Father's mother	:	Grandmother
Mother's or Father's father	:	Grandfather
Grandmother's brother	:	Granduncle
Grandmother's sister	:	Grandaunt
Grandfather's brother	:	Granduncle
Grandfather's sister	:	Grandaunt
Sister's or Brother's son	:	Nephew
Sister's or Brother's daughter	:	Niece
Uncle or Aunt's (Son or Daughter)	:	Cousin
Son's wife	:	Daughter-in-law
Daughter's husband	:	Son-in-law
Husband's or Wife's sister	:	Sister-in-law
Husband's or Wife's brother	:	Brother-in-law
Sister's husband	:	Brother-in-law
Brother's wife	:	Sister-in-law
Children of same parents	:	Siblings (could be all brothers, all sisters or some brothers and some sisters)
Children	:	Son, Daughter
Children's Children	:	Grandchildren (Grandson, Granddaughter)

In addition, remember the word spouse which means either husband or wife.

Grandfather and grandmother will come in the first stage; mother, father, uncle and aunt will come in the second stage; sister, brother and cousin will come at the third stage; son, daughter, niece and nephew will come in the fourth stage and finally, granddaughters and grandsons will come. The above stages are made from the point of view of an individual.

In **Type – I questions**, the relationship between two people is given through a roundabout way of relating them through other people. We have to go through the series of relationships and finally determine the relationship between the two people given in the question. The relationship can be given as a simple statement or as a statement made by a person. In the first example given below, a person is involved in making a statement whereas in the **Type – II question**, there is no person involved in making a statement.

SOLVED EXAMPLES

1. A's father's mother-in-law's only daughter's son is B. How is A related to B?

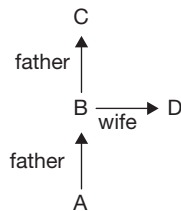
(A) Brother
(B) Sister
(C) Nephew
(D) Cannot be determined

Sol: A's father's mother-in-law's only daughter is A's mother. A's mother's son is A's brother. But A can be either brother or sister to B.

2. If A's father is B, C is the father of B and D is A's mother, then how is C related to D?

(A) Father
(B) Grandfather
(C) Father-in-law
(D) Uncle

Sol: A's father is B and mother is D. Therefore, D is B's wife and C is the father of B. Hence, C is D's father-in-law.



3. $A + B$ means A is the son of B.
 $A - B$ means A is the daughter of B.
 $A \times B$ means A is the father of B.
 $A \div B$ means A is the mother of B.

If $M \times N + O - P \div Q$, then how is M related to Q?

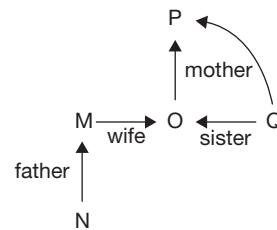
(A) Husband
(B) Cousin
(C) Brother-in-law
(D) Uncle

Sol: $M \times N + O - P \div Q$ means M is the father of N, N is the son of O, O is the daughter of P, P is the mother of Q.

M is the father of N and N is the son of O means M is the husband of O.

O is the daughter of P and P is the mother of Q means O is the sister of Q.

M is the husband of O and O is the sister of Q means M is the brother-in-law of Q.



4. $A + B$ means A is the son of B.
 $A - B$ means A is the daughter of B.
 $A \times B$ means A is the father of B.
 $A \div B$ means A is the mother of B.

Which of the following means S is the son-in-law of P?

(A) $P + Q \div R \times S - T$ (B) $P \times Q \div R - S + T$
 (C) $P + Q \times R - S \div T$ (D) $P \times Q - R \div S \times T$

Sol: $P + Q \div R \times S - T$ means P is the son of Q, Q is the mother of R, R is the father of S and S is the daughter of T. Hence, S is the nephew of P.

$P \times Q \div R - S + T$ means P is the father of Q, Q is the mother of R, R is the daughter of S and S is the son of T. Hence, S is the son-in-law of P.

$R + Q \times R - S \div T$ means P is the son of Q, Q is the father of R, R is the daughter of S and S is the mother of T. Hence, S is the mother of P.

$P \times Q - R \div S \times T$ means P is the father of Q, Q is the daughter of R, R is the mother of S and S is the father of T. Hence, S is the son of P.

5. Pointing to a person, Raju said, 'He is the only brother of my father's mother's daughter'. How is the person related to Raju?

(A) Brother (B) Father
(C) Uncle (D) Nephew

Sol: Raju's father's mother's daughter is Raju's father's sister. Raju's father's sister's only brother is Raju's father. Hence, the person is Raju's father.

6. A's mother's father is the husband of B's mother. How is A related to B, if A and B are males?

(A) Uncle (B) Father
(C) Nephew (D) Son

Sol: A's mother's father is the husband of B's mother. That means A's mother is the sister of B. Hence, A is the nephew of B.

EXERCISES

Directions for questions 1 to 15: Select the correct alternate from the given choices.

- How is my mother's daughter's only sister-in-law related to me if my father has only one child?
(A) Cousin (B) Sister
(C) Sister-in-law (D) Niece
- A person who is my wife's mother's only son is my _____.
(A) Brother-in-law (B) Sister-in-law
(C) Cousin (D) Mother-in-law
- How is my father's daughter's mother's only daughter-in-law related to my wife's son?
(A) Mother (B) Father
(C) Brother (D) Sister
- How is my brother's son's sister related to my mother's husband?
(A) Son (B) Daughter
(C) Grandson (D) Granddaughter
- A is the sister of B's wife's brother-in-law's father. If B's father-in-law has only one child, B is A's _____.
(A) Nephew (B) Niece
(C) Aunt (D) Daughter
- Mr Rakesh's father-in-law's only child's sister-in-law's father is Rakesh's _____.
(A) Uncle (B) Father
(C) Brother (D) Grandfather
- How is my mother's sister's only sibling's father related to me?
(A) Father (B) Uncle
(C) Father-in-law (D) Grandfather
- How is my father's wife's son's daughter's brother related to me?
(A) Son (B) Nephew
(C) Niece (D) Cannot be determined
- How is my son's daughter's sibling's mother related to my wife's only son?
(A) Sister (B) Sister-in-law
(C) Wife (D) Aunt
- How is Mr Harry's son's paternal grandmother related to Harry's father-in-law's only daughter?
(A) Mother-in-law (B) Aunt
(C) Mother (D) Wife
- How is my father's son's sister's mother related to me?

- (A) Grandmother (B) Aunt
(C) Sister (D) Mother
- C is the brother of D. A is the husband of B. B is the mother of C. E is the wife of D. How is B related to E?
(A) Mother (B) Father
(C) Mother-in-law (D) Father-in-law
- How is my father's brother's wife's daughter related to me?
(A) Brother (B) Cousin
(C) Sister (D) Aunt
- Ms Ritu's only brother's son's maternal grandmother is Sita. How is Sita's husband related to Ritu's brother's sister-in-law?
(A) Father (B) Uncle
(C) Grandfather (D) Brother
- Ms Sneha introduced a person to Deepti and said, 'He is your sister's paternal grandfather and also my only brother's father'. How is Sneha related to Deepti?
(A) Mother (B) Sister
(C) Grandmother (D) Aunt

Directions for questions 16 to 20: Use the relationship given below and answer the following questions.

$P @ Q$ means P is the father of Q.

$P \Rightarrow Q$ means P is the mother of Q.

$P * Q$ means P is the son of Q.

$P \# Q$ means P is the daughter of Q.

$P \$ Q$ means P is the brother of Q.

$P \% Q$ means P is the sister of Q.

- Which of the following means A is the grandson of B?
(A) $A \Rightarrow R * S * B$ (B) $A \$ R \# S @ B$
(C) $A \$ R \# S * B$ (D) $A \$ R \Rightarrow S * B$
- Which of the following means W is the mother of Z?
(A) $W * X * Y @ Z$ (B) $W \Rightarrow X \# Y @ Z$
(C) $W \Rightarrow X * Y @ Z$ (D) Both (B) and (C)
- Which of the following means E is the nephew of G?
(A) $E \# F \$ G$ (B) $E * F \$ G$
(C) $E * F \% G$ (D) Both (B) and (C)
- Which of the following means H is the father of L?
(A) $H @ I \% J \# K \Rightarrow L$ (B) $H \Rightarrow I \% J \# K @ L$
(C) $H @ I \% J \% K \# L$ (D) $H \Rightarrow I \# J @ K \$ L$
- Which of the following means M is the aunt of S?
(A) $M \$ N @ R \$ S$ (B) $M \% N @ R \$ S$
(C) $M \% N \Rightarrow R @ S$ (D) $M @ N \Rightarrow R \% S$



Directions for questions 21 to 25: These questions are based on the following information.

P, Q, R, S, T, U, V and W are eight members of a family. W is T's only brother. S's son is U and S is P's son. R is T's brother-in-law and his mother is Q. V is not Q's husband. R is not S's son. W has a niece.

21. Who is Q's daughter-in-law?
(A) S (B) T
(C) U (D) V
22. What is the ratio of males to females in the family?
(A) 1 : 1 (B) 3 : 5
(C) 5 : 3 (D) 3 : 1
23. How is R related to V?
(A) Brother (B) Father
(C) Daughter (D) Uncle
24. Which of the following statements is true?
(A) U is R's Son (B) V is W's daughter
(C) P is Q's brother (D) None of these
25. How is P's grandson related to T's brother?
(A) Nephew (B) Niece
(C) Son (D) Daughter

Directions for questions 26 to 30: These questions are based on the following information.

In a family of three generations there are six members A, B, C, D, E and F. All of them are from different professions. E is the son of a Teacher. The Architect is married to the Manager. C is an Engineer and his daughter is a Doctor. D is the wife of an Engineer. A is not C's father and C's mother is B. A's grandfather is a Manager. One of them is a Student, who is not F.

26. Which of the following pair represents a couple?
(A) FD (B) AB
(C) CD (D) AE
27. Who is a Student?
(A) A (B) B
(C) C (D) E
28. What is the profession of D's daughter?
(A) Doctor (B) Student
(C) Engineer (D) Manager
29. How is the Engineer related to the Student?
(A) Son (B) Daughter
(C) Father (D) Brother
30. Who is Teacher's father-in-law?
(A) A (B) B
(C) C (D) None of these

ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (C) | 6. (B) | 11. (D) | 16. (C) | 21. (B) | 26. (C) |
| 2. (A) | 7. (D) | 12. (C) | 17. (D) | 22. (C) | 27. (D) |
| 3. (A) | 8. (D) | 13. (B) | 18. (D) | 23. (D) | 28. (A) |
| 4. (D) | 9. (C) | 14. (A) | 19. (A) | 24. (D) | 29. (C) |
| 5. (A) | 10. (A) | 15. (D) | 20. (B) | 25. (A) | 30. (D) |

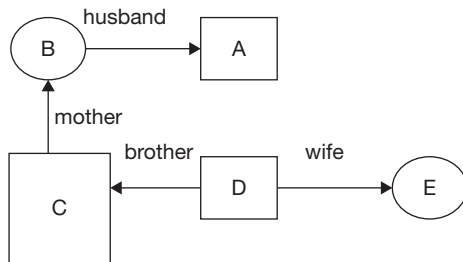
SOLUTIONS

Solutions for questions 1 to 15:

1. Note: For all the diagram, □ represent males and ○ represent females.
My mother's daughter is myself. As my father has only one child, my only sister-in-law is my sister-in-law.
2. My wife's mother's only son is my wife's brother. Hence, he is my brother-in-law.
3. My father's daughter's mother is my mother. My mother's only daughter-in-law is my wife. My wife is the mother of her son.

4. My brother's son's sister is my brother's daughter. My mother's husband is my father. therefore, he is my brother's father. My brother's daughter is my father's granddaughter.
5. B's wife's brother-in-law is B's brother as B's father-in-law has only one child. B's brother's father's sister is B's aunt. Thus, B is A's nephew.
6. Mr Rakesh's father-in-law's only child is Rakesh's wife. Rakesh's wife's sister-in-law is Rakesh's sister, whose father is Rakesh's father.

7. My mother's sister's only sibling is my mother. My mother's father is my grandfather.
8. My father's wife's son can be me or my brother. Thus, the person here can be my son or my nephew. Hence, it cannot be determined.
9. My son's daughter's sibling's mother is my daughter-in-law. My wife's only son is my son. My daughter-in-law is my son's wife.
10. Harry's son's paternal grandmother is Harry's mother. Harry's father-in-law's only daughter is Harry's Wife. Harry's mother is Harry's wife's mother-in-law.
11. My father's son's sister's mother is my mother.
12. As A is the husband of B, B is the mother of C and C is the brother of D, we can say that C and D are children of A and B. Now, E is the wife of D. Thus, B is the mother-in-law of E.



13. My father's brother's wife's daughter is my cousin.
14. Ms. Ritu's only brother's son's maternal grandmother is Ritu's brother's mother-in-law, i.e., Sita. Ritu's brother's sister-in-law is Sita's daughter. Sita's husband is the father of Sita's daughter.
15. He is your sister's paternal grandfather means he is Deepti's paternal grandfather. He is my only brother's father means he is Sneha's father. Thus, Sneha is the aunt of Deepti.

Solutions for questions 16 to 20:

16. Choice (A):
 $A \Rightarrow R * S * B$ means A is the mother of R, R is the son of S, S is the son of B. Hence, A is the daughter-in-law of B.
 Choice (B):
 $A \$ R \# S @ B$ means A is the brother of R, R is the daughter of S, S is the father of B.
 \therefore A is the brother of B.
 Choice (C):
 $A \$ R \# S * B$ means A is the brother of R, R is the daughter of S, S is the son of B.
 \therefore A is the grandson of B.
17. From (A), W is a male. Hence, he cannot be a mother. Choice (B):

$W \Rightarrow X \# Y @ Z$ means W is the mother of X, X is the daughter of Y and Y is the father of Z. Hence, W is the mother of Z.

Choice (C):

$W \Rightarrow X * Y @ Z$ means W is the mother of X, X is the son of Y and Y is the father of Z. Thus, W is the mother of Z. Hence, (B) and (C) are correct.

18. Choice (A):

$E \# F$ means, E is the daughter of F. Thus, E is a female and hence, she cannot be a nephew.

Choice (B):

$E * F$ means, E is the son of F. $F \$ G$ means F is the brother of G. Hence, E is the nephew of G.

Choice (C):

$E * F$ means, E is the son of F. $F \% G$ means F is the sister of G. Hence, E is the nephew of G.

\therefore Both (B) and (C) are correct.

19. Choice (A):

$H @ I$ means H is the father of I. $I \% J$ means I is the sister of J. $J \# K$ means J is the daughter of K and $K \Rightarrow L$ means K is the mother of L. Hence, H is the father of L.

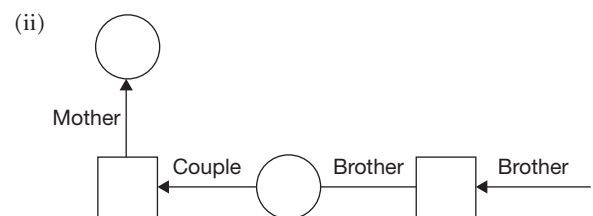
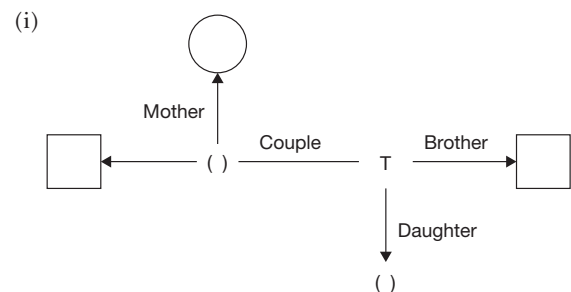
20. Choice (A):

$M \$ N$ means M is the brother of N. Thus, M is a male. Hence, he cannot be the aunt.

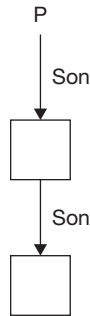
Choice (B):

$M \% N$ means M is the sister of N, $N @ R$ means N is the father of R. $R \$ S$ means R is the brother of S. Thus, M is the aunt of S.

Solutions for questions 21 to 25: From the information, W is T's brother, R is T's brother-in-law and R's mother is Q and W has a niece. We get the following relationship diagram.



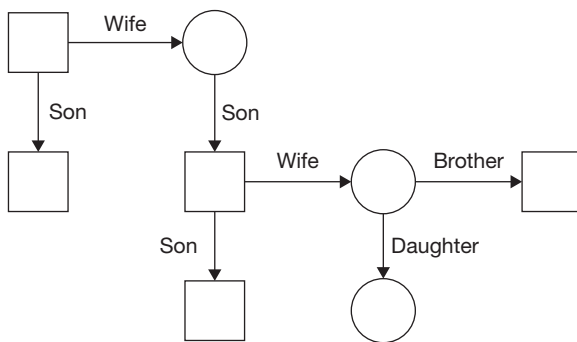
Now, S is P's son and U is S's son.



Now, Q's husband is not V (given) and not S (R is not S's son).

Thus, Q's husband is either P or U. But U can be Q's husband because then there is no way to find out R's sibling and T's daughter.

Thus, P is Q's husband and V is T's daughter. Case (ii) is not possible as S is a male. Thus, we get following relationship diagram.



21. Q's daughter-in-law is T.
22. P, R, S, W and U are males and Q, T and V are females. Hence, the ratio is 5 : 3.
23. R is V's uncle.
24. None of the statements is true.
25. P's grandson is U. T's brother is W. U is W's nephew.

Solutions for questions 26 to 30: It is given that C is an Engineer. Also, D is the wife of an Engineer, i.e., D is C's wife. Also, C's mother is B and C has a daughter. And from the information that F is not C's father. Thus, we get the following relationship diagram.

Now, we have got at least one person from each of the three generations of the family.

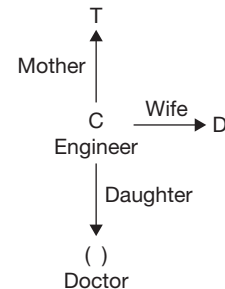
Now, E is the son of a Teacher and A's grandfather is a Manager. Also, Manager is married to an Architect.

Now, comparing the above three figures, there is only one way to combine them. C's father is a Manager. C's mother is an Architect. D is a Teacher. So, A and E are C's children. Now, as E is a male, E cannot be the Doctor.

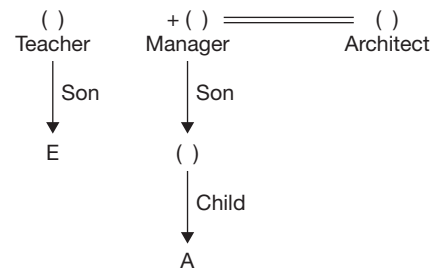
Hence, E is a Student. Thus, A is the Doctor. Finally, F is the Manager and is C's father.

∴ The family tree is represented as shown below.

It is given that C is an Engineer. Also D is the wife of an Engineer i.e., D is C's wife. Also, C's mother is B and C has a daughter. And from the information that F is not C's Father. Thus, we get the following relationship.



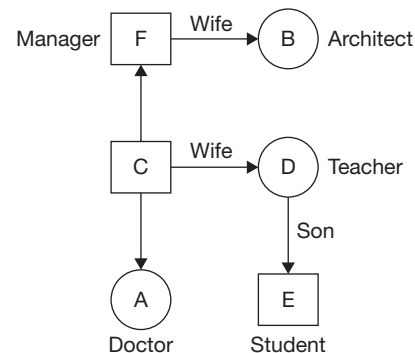
Now, we have got at least one person from each of the three generations of the family. Now E is the son of a Teacher. And, A's grandfather is a Manager. Also, Manager is married to an Architect.



Now, comparing the above three figures, there is only one way to combine them. C's father is a manager. C's Mother is an Architect. D is a Teacher. So, A and E are C's children. Now, as E is a Male, E cannot be the Doctor.

Hence, E is a Student. Thus, A is the Doctor. Finally, F is the Manager and is C's father.

∴ The family tree is represented as shown below.



26. CD represents a couple.
27. E is a Student.
28. D's daughter is A. A is a Doctor.
29. C is the Engineer and E is the Student, C is E's father.
30. D is the Teacher. D's father-in-law is F.

7

Direction Sense

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

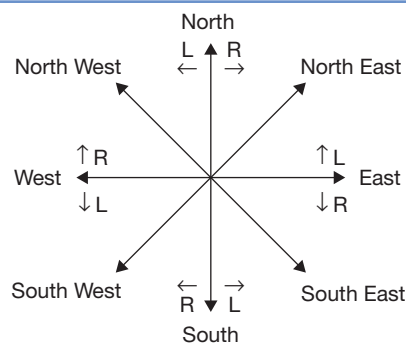
- Revisit the cardinal directions (North, South, East and West) and the intermediate directions (northeast, southeast, northwest and southwest)
- Become familiar with spatial visualization, and draw figures tracing the journey of a person/moving body
- Learn to apply Pythagoras theorem to find the distance between two points in a plane

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

□ DIRECTION SENSE

The questions on direction sense typically involve a person moving certain distances in specified directions. Then, the student is asked to find out the distance between the initial and the final points. The easiest way of solving these problems is to draw a diagram as you read the information given in the problem and ensure that the diagram reflects all the information given in the problem.

To solve these types of problems, the student should be aware of the directions. The student should also recognize the left and right of a person walking in a particular direction. The following diagram shows all the directions and left (L) and right (R) of a person walking in that direction and the student should memorize the diagram.



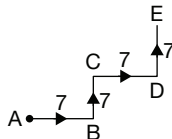
NOTE

The distance from a particular point after travelling a distance of x metres in the horizontal direction and a distance of y metres in the vertical direction is equal to $\sqrt{x^2 + y^2}$. (Please note that in common usage, North-South direction is referred to as 'vertical' direction and the East-West direction is referred to as the 'horizontal' direction).

SOLVED EXAMPLES

1. A person travels a distance of 7 km towards east from his house, then travels 7 km towards north and then a distance of 7 km towards east and finally 7 km towards north. What is the vertical distance travelled by him?

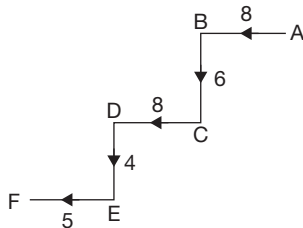
Sol:



Let A and E be the initial and the final positions. The vertical distance travelled = $BC + ED = (7 + 7) \text{ km} = 14 \text{ km}$.

2. A person starts from his house and travels 8 m towards west; then he travels 6 m towards his left, then 8 m towards west and then 4 m towards south. Finally, he turns right and travels 5 m. What is the horizontal distance travelled by him?

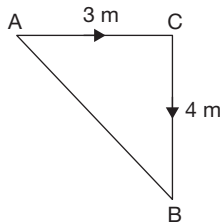
Sol:



Let A and F be the initial and the final positions. \therefore Horizontal distance travelled = $FE + DC + BA = 5 + 8 + 8 = 21 \text{ m}$.

3. Surya travels 3 m towards east and then turns right and travels 4 m. What is the distance between the initial and the final positions of Surya?

Sol:

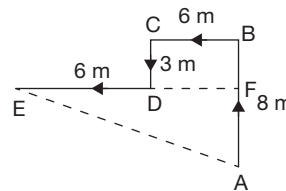


Let A and B be the initial and the final positions of Surya.

$$AB = \sqrt{AC^2 + BC^2} = \sqrt{3^2 + 4^2} = 5 \text{ m}.$$

4. Starting from his house, Sachin walks a distance of 8 m towards north, then he turns left and walks 6 m, then he walks 3 m towards south and finally travels 6 m towards west to reach his office. What is the distance between his house and office and also find in which direction is his office situated with respect to his house?

Sol:



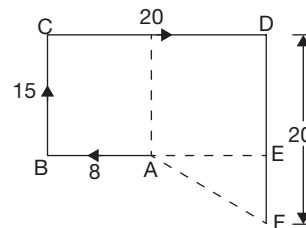
Let A be Sachin's house and E his office. The distance between A and E

$$\begin{aligned} &= \sqrt{(EF)^2 + (AF)^2} = \sqrt{(ED + CB)^2 + (AB - FB)^2} \\ &= \sqrt{(ED + CB)^2 + (AB - FB)^2} = \sqrt{12^2 + 5^2} \\ &= 13 \text{ m}. \end{aligned}$$

His office is towards north-west of his house.

5. Starting from her house, Nisha travelled 8 m towards west, then turned right and travelled 15 m. She then travelled 20 m towards east, followed by another 20 m towards south to reach a hostel. How far is her house from the hostel and in which direction?

Sol:



Let A and F be the initial and final positions.

$$\text{Now } AF = \sqrt{AE^2 + EF^2}$$

$$\begin{aligned} AE &= CD - BA \\ &= 20 - 8 = 12 \text{ m} \end{aligned}$$

$$\begin{aligned} EF &= DF - DE = DF - CB \\ &= 20 - 15 = 5 \text{ m} \end{aligned}$$

$$\begin{aligned} \therefore AF &= \sqrt{144 + 25} \\ &= \sqrt{169} = 13 \text{ m} \end{aligned}$$

Her house is towards north-west from the hostel.

EXERCISES

Directions for questions 1 to 20: Select the correct alternative from the given choices.

- A boy walks 7 km towards the north, then turns to his right to travel 13 km then he turns to his left and travels 11 km. What is the vertical distance between the starting point and end point (in km)?
(A) 11 (B) 18
(C) 21 (D) 13
- Shyam travels 8 km towards the east, then turns right and travels 4 km, then turns right and travels 18 km and then turns left and travels 17 km. What is the vertical distance between his starting and end points?
(A) 21 km (B) 26 km
(C) 47 km (D) 20 km
- Akash travels 8 km towards the east then turns right and travels 9 km. After he travels 6 km towards east, he turns left and travels 5 km, then he travels 13 km towards the east and stops. How far is he from the starting point, in horizontal direction (in km)?
(A) 41 (B) 14
(C) 26 (D) 27
- Mahesh runs 20 m towards the west, turns left and runs 10 m, again turns left and runs 8 m. Then he runs 25 m towards the north, turns left and runs 17 m and stops. In which direction is he from the starting point?
(A) South-west (B) South-east
(C) North-west (D) North-east
- A person travels 2 km towards the south, turns left and travels 10 km, again turns left and travels 14 km and then turns right and travels 5 km. In which direction is he from the starting point?
(A) South-west (B) South
(C) North-west (D) North-east
- A person travels 8 km, turns right and travels 5 km. Then, he turns right again and travels 8 km. Finally, he turns left and travels 17 km towards south. In which direction is his starting point with respect to his end point?
(A) North (B) South
(C) North-east (D) South-west
- Sonal went for a walk from her house to the park. She walked for 100 m then turned right to walk 200 m towards south. Then she turned right and walked 50 m, then turned left and walked 20 m. Finally, she turned left and walked 250 m to reach the park. In which direction is her home with respect to the park?
(A) East (B) West
(C) North (D) North-west
- Harilal travels 4 km towards east, turns left and travels 2 km and then travels another 6 km towards the north. He then turns right and travels 2 km to reach a temple. How far is the temple from his starting point (in km)?
(A) 6 (B) 8
(C) 10 (D) 12
- Pooja starts from her house and travels 7 km towards the north. Then she turns left, travels 3 km, then turns left again and travels 4 km and then travels 2 km towards the west. Finally, she turns right and travels 9 km. How far is she from the starting point (in km)?
(A) 10 (B) 12
(C) 0 (D) 13
- Kapil travelled 7 km towards the north-east followed by 12 km towards the south, then 7 km towards the south-west followed by 5 km towards the west. How far is he from the starting point (in km)?
(A) 13 (B) 12
(C) 5 (D) 14
- Sunil travelled 15 km towards the east, then he took a left turn and travelled 4 km, then he turned right and travelled 9 km followed by 11 km after taking a right turn. How far is he from the starting point (in km)?
(A) 24 (B) 25
(C) 20 (D) 5
- Pramod went to visit his friend Malik's home. He travelled 10 km towards the north, then turned right and travelled 6 km. Then he took a left turn and travelled 4 km, then took right and travelled 9 km, then again, he took right and travelled 6 km to reach Malik's home. Malik told him that there is a shortcut road which is of the shortest possible distance between their homes. How many kilometers less Pramod can travel if he follows the shortcut for returning back to his home?
(A) 17 (B) 35
(C) 15 (D) 18
- Lokesh travelled 7 km towards the east. Then he turned left and travelled 4 km then he travelled 3 km towards the west, then he turned right and travelled 5 km. How far is he from the starting point?
(A) $13\sqrt{2}$ (B) $\sqrt{97}$
(C) $2\sqrt{13}$ (D) 13
- Ramesh and Suresh started their journey from a common point. Ramesh travelled 7 km towards the north, then turned left and travelled 23 km, then he turned left again and travelled 15 km and Suresh travelled 2 km towards the south, then he turned left and travelled 12 km,



then he turned left again and travelled 6 km stopped. How far they are from each other (in km)?

- (A) 35 (B) 37
(C) 12 (D) 38

15. Pallavi and Jessica decided to meet at a theatre. Pallavi travelled 9 km from her house towards the west. Then she took a right turn and travelled 10 km, then 7 km towards her right to reach the theatre. Jessica travelled 5 km from her house, then 7 km towards her right then 5 km towards her left. Then she took a left turn and travelled 12 km towards south and reached the theatre. How far is Pallavi's home from Jessica's home (in km)?

- (A) 14 (B) 15
(C) 16 (D) 17

16. A person walks 4 km towards the east, then turns to his left to travel 7 km, then turns towards the west and travels 10 km, finally he travels 15 km towards the south. How far and in which direction is he from the starting point?

- (A) 10 km, South-west
(B) 12 km, South-east
(C) 12 km, North-east
(D) 10 km, North-east

17. A person started travelling from place A towards the east. After travelling 9 km he took a right turn and travelled 5 km, then he took a right turn and travelled 4 km, then again right and travelled for 6 km, then he travelled 10 km towards the east, then took a left turn and travelled 7 km to reach place B. How far and in which direction is B with respect to A?

- (A) 17 km, South-west
(B) 15 km, North-east
(C) 17 km, North-east
(D) 25 km, North-west

18. A defective compass points towards the north when it should point towards the south-west. If a person is holding that compass facing north-east, then in which direction that defective compass will indicate?

- (A) South (B) East
(C) South-west (D) North-west

19. Sujay walked 9 m facing towards the west, then took a left turn and walked a distance of 6 m. He then took a right turn and walked a distance of 9 m. Approximately, how far is he from the starting point?

- (A) 18 m (B) 20 m
(C) 19 m (D) 21 m

20. Anil started walking towards the east. After walking 8 km, he took a left turn and walked for 4 km then again took a left turn and walked for 2 km. Further, he took a right turn and walked for 6 km then again took a right turn and walked for 2 km then took a left turn before taking

another left turn and walked for 2 km and 8 km, respectively and stopped. In which direction is he from the starting point?

- (A) North-east (B) South
(C) North-west (D) North

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

A person starts from place A and goes upto place J through B, C, D, E, F, G, H and I in that order. From A he travels 7 km towards the north to reach B, then he takes a right turn and travels 6 km to reach C, from C he travels 11 km towards the south to reach D, then he turned left and travelled 12 km to reach E, then he again turned left and travelled for 5 km to reach F. From F he travelled 9 km towards west to reach G, then he took a left turn and travelled 15 km to reach H, then he took a left turn, travelled 15 km to reach I, then again turned left and travelled 7 km to reach J.

21. How far and in which direction is A with respect to J?

- (A) 29 km, North-west
(B) 25 km, North-west
(C) 29 km, South-west
(D) 25 km, South-east

22. H is in which direction from F?

- (A) South-west (B) South-east
(C) South (D) North-east

23. How far is F from D (in km)?

- (A) 10 (B) 17
(C) 15 (D) 13

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

Point A is 8 m towards the south of point E. Point C is 4 m towards the north of point B, which is 5 m towards the west of point D. Point C is 7 m towards the east of point E. Point I is 6 m towards the east of point F, which is 9 m towards the north of point H. Point D is 11 m towards the south of point G, which is 8 m towards the east of point H.

24. In which direction is point I with respect to point A?

- (A) South-west (B) North-east
(C) South-east (D) North-west

25. If point K is 2 m towards the east of point I, then what is the distance between the points D and K?

- (A) 19 m (B) 21 m
(C) 22 m (D) 20 m

26. Approximately how far and in which direction is point E with respect to point G?

- (A) 14 m, South-west (B) 15 m, North-west
(C) 13 m, South-west (D) 14 m, South

Directions for questions 27 and 28: These questions are based on the following information.

S, T, U, V, W, X, Y and Z are the eight class rooms in a college. Z is 10 km towards the south of X and is 2 km towards the east of U, which is 3 km towards the south of T. S is 5 km towards the west of T and is 6 km towards the south of V. W is 1 km towards the north of Y, which is 5 km towards the east of V.

27. How far and in which direction is X with respect to W?

- (A) 2 km, West (B) 2 km, East
(C) 1 km, East (D) 2 km, North

28. If classroom R is constructed exactly between X and Z, then approximately how far is T with respect to R?

- (A) 9 km (B) 8 km
(C) 3 km (D) 4 km

Directions for questions 29 and 30: These questions are based on the following information.

Eight cities $T_1, T_2, T_3, T_4, T_5, T_6, T_7$ and T_8 in a state are in different directions as given below.

T_6 is towards the south of T_4 , which is towards the south-west of T_3 . T_8 is towards the north of T_2 and is west of T_5 . T_1 is towards the west of T_2 . T_7 is towards the west of T_6 and is towards the south of T_5 .

29. If the distance between the cities (T_8, T_2) , (T_8, T_5) and (T_5, T_7) are equal, then in which direction is T_2 with respect to T_7 ?

- (A) East (B) West
(C) North-east (D) South-west

30. In which direction is T_4 with respect to T_5 ?

- (A) East (B) North-east
(C) South-east (D) North

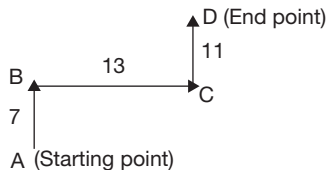
ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (B) | 6. (A) | 11. (B) | 16. (A) | 21. (B) | 26. (A) |
| 2. (A) | 7. (D) | 12. (D) | 17. (C) | 22. (A) | 27. (B) |
| 3. (D) | 8. (C) | 13. (B) | 18. (A) | 23. (D) | 28. (C) |
| 4. (C) | 9. (D) | 14. (B) | 19. (C) | 24. (B) | 29. (B) |
| 5. (D) | 10. (A) | 15. (D) | 20. (D) | 25. (D) | 30. (A) |

SOLUTIONS

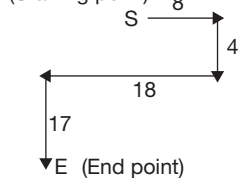
Solutions for questions 1 to 20:

1.



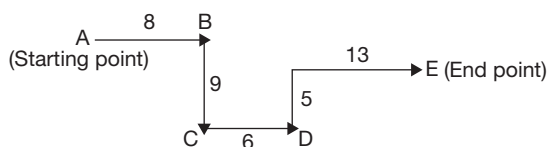
Vertical distance between A and D = $7 + 11 = 18$ km.

2. (Starting point)



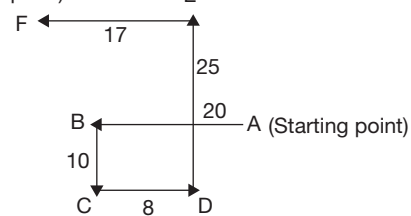
Vertical distance between S and E is $4 + 17 = 21$ km.

3.



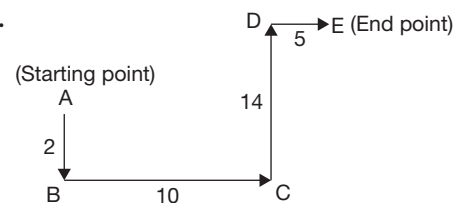
\therefore Total distance in horizontal direction = $AB + CD + DE$
 $= 8 + 6 + 13 = 27$ km.

4. (End point)

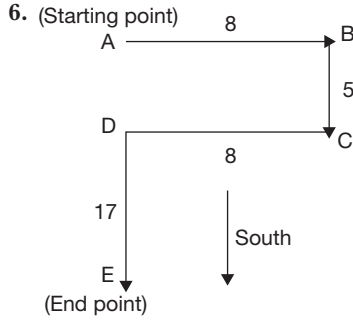


F is towards the north-west of A.

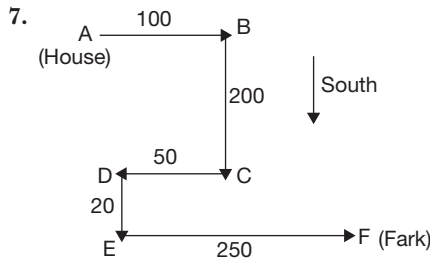
5.



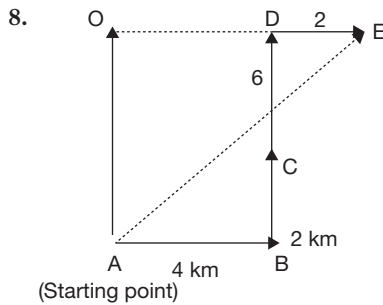
E is towards the north-east of A.



Hence, A (starting point) is towards the north of E (end point).



Hence, her home (A) is towards the north-west of park (F).



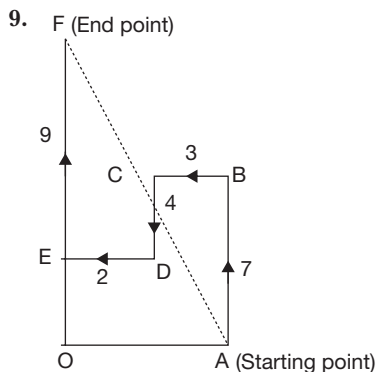
We have to find AE:

$$\text{In } \triangle AOE, AE = \sqrt{AO^2 + OE^2}$$

$$AO = BC + CD = 8 \text{ km}$$

$$OE = AB + DE = 6 \text{ km}$$

$$\therefore AE = \sqrt{8^2 + 6^2} = 10 \text{ km}$$



We have to find AF.

In $\triangle AOF$,

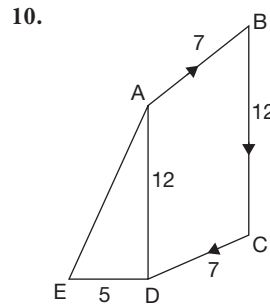
$$AF^2 = \sqrt{AO^2 + OF^2}$$

$$AO = BC + DE = 5 \text{ km.}$$

$$OF = AB - CD + EF = 12 \text{ km.}$$

$$AF = \sqrt{25 + 144} = \sqrt{169}.$$

$$AF = 13 \text{ km}$$



We have to find AE.

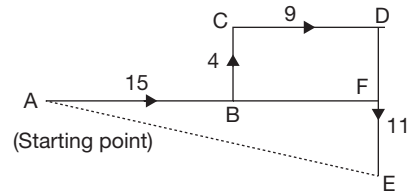
In $\triangle ADE$,

$$AE^2 = AD^2 + DE^2$$

$$AD = BC = 12$$

$$\therefore AD = \sqrt{12^2 + 5^2} = 13 \text{ km}$$

11. We have to find AE.



In $\triangle AEF$,

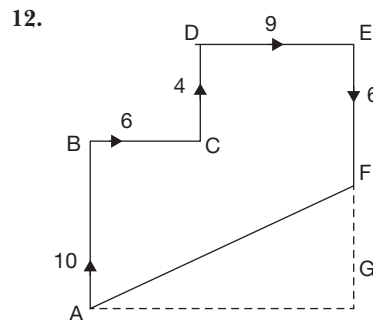
$$AE^2 = AF^2 + EF^2$$

$$AF = 15 + 9 = 24$$

$$EF = 11 - 4 = 7$$

$$\therefore AE = \sqrt{24^2 + 7^2}$$

$$= 25 \text{ km}$$



A is Pramod's home and F is Malik's home.

Total distance travelled by Pramod from A to F is
 $= 10 + 6 + 4 + 9 + 6 = 35$ km

AF represents the shortcut road.

In $\triangle AGE$,

$$AF^2 = AG^2 + GF^2$$

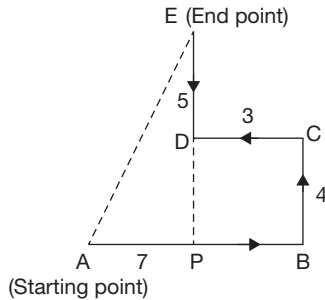
$$AG = BC + DE = 15.$$

$$GF = AB + CD - EF = 10 + 4 - 6 = -8$$

$$\therefore AF^2 = \sqrt{15^2 + 8^2} = 17 \text{ km}$$

Hence, Pramod can travel $(35 - 17)$ km = 18 km less if he follows the shortcut for returning to his home.

13. We have to find AE.



In $\triangle APE$,

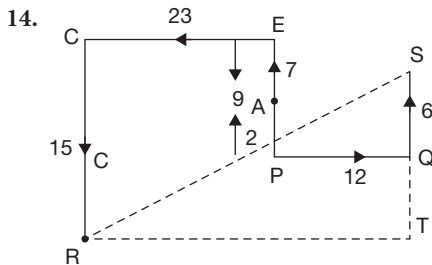
$$AE^2 = AP^2 + EP^2$$

$$AP = AB - CD = 4$$

$$EP = DE + BC = 9$$

$$AE = \sqrt{4^2 + 9^2}$$

$$\Rightarrow AE = \sqrt{97} \text{ km}$$



Here, A is the common point from where Ramesh and Suresh start. R is the final position of Ramesh and S is the final position of Suresh. We have to find RS.

$$\text{Now, } RT = 23 + 12 = 35$$

$$QS = 6 + (15 - 9) = 12$$

$$\therefore \text{In } \triangle RTS,$$

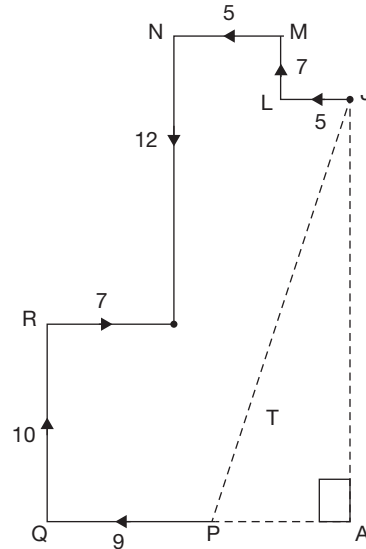
$$RS^2 = RT^2 + TS^2$$

$$TS = QS + (RC - PE)$$

$$\therefore RS = \sqrt{35^2 + 12^2}$$

$$RS = 37 \text{ km}$$

15. Let P represents Pallavi's home. J represents Jessica's home and T represents the theatre where they meet.



We have to find PJ.

In $\triangle PAJ$,

$$PJ^2 = PA^2 + JA^2$$

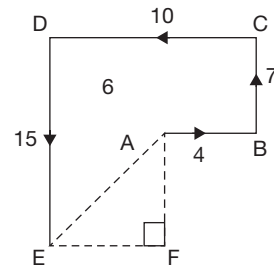
$$PA = 7 + 5 + 5 - 9 = 8$$

$$JA = 10 + 12 - 7 = 15$$

$$\therefore PJ = \sqrt{8^2 + 15^2}$$

$$PJ = 17 \text{ km}$$

16. In $\triangle AEF$, $AF = 15 - 7 = 8$.



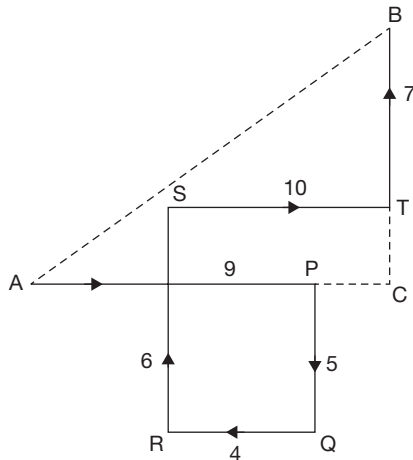
$$EF = 10 - 4 = 6$$

$$\therefore AE = \sqrt{8^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100}$$

$$AE = 10 \text{ km}$$

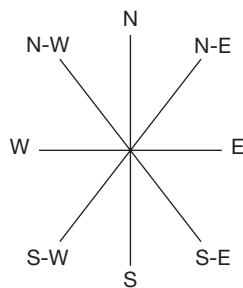
E is towards the south-west of A.

17.

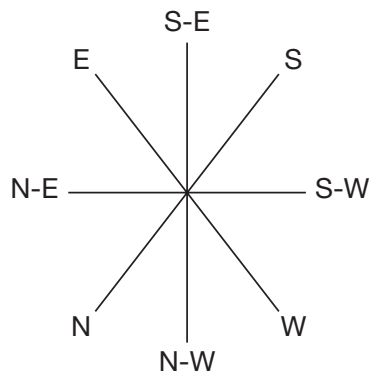


In $\triangle ACB$,
 $AB^2 = BC^2 + AC^2$
 $BC = BT + RS - PQ$
 $= 6 + 7 - 5 = 8$.
 $AC = AP + ST - RQ$
 $= 9 + 10 - 4 = 15$
 $\therefore AB = \sqrt{8^2 + 15^2}$
 $AB = 17 \text{ km}$.
 B is towards the north-east of A.

18. Actual direction:

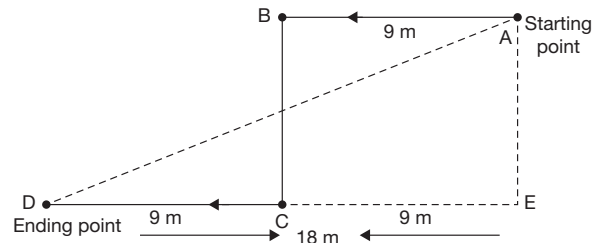


Damaged compass:



By comparing the two diagrams it is clear that, the pointer which was showing north-east is directed towards the south by damaged compass.

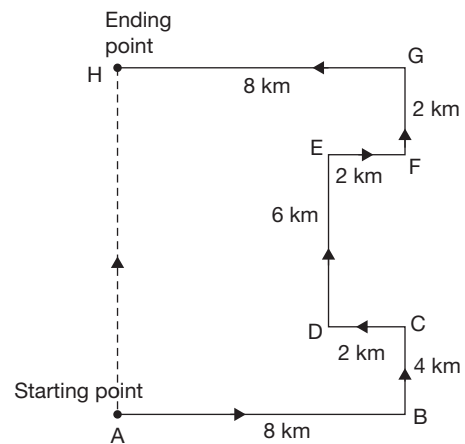
19. The path traced by Sujay is as shown below.



$$AD^2 = DE^2 + AE^2$$

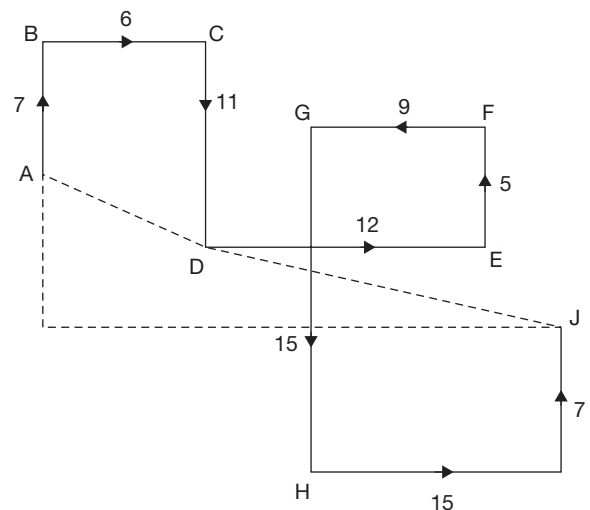
$$AD = \sqrt{18^2 + 6^2} = \sqrt{360} \approx 19 \text{ m}$$

20. The path traced by Anil is as shown below.



\therefore He is towards the north of the starting point.

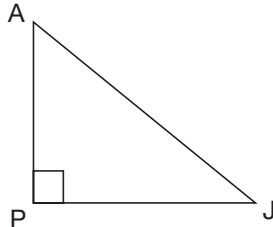
Solutions for questions 21 to 23:



21. In ΔAPJ , $AJ^2 = AP^2 + PJ^2$

$$\begin{aligned} AP &= (CD - AB) + (GH - FE - JI) \\ &= (11 - 7) + (15 - 5 - 7) \\ &= 4 + 3 = 7 \end{aligned}$$

$$\begin{aligned} PJ &= BC + HI + (DE - GF) \\ &= 6 + 15 + 12 - 9 = 24 \end{aligned}$$



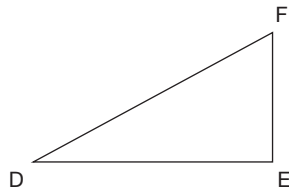
$$AJ = \sqrt{7^2 + 24^2} = \sqrt{625}$$

$$AJ = 25$$

A is towards the north-west of J.

22. H is towards the south-west of F.

23.



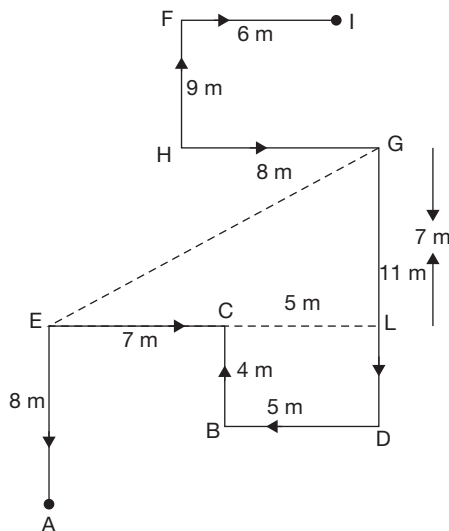
$$FD^2 = EF^2 + DE^2$$

$$FD^2 = 5^2 + 12^2$$

$$FD = \sqrt{169} = 13 \text{ km}$$

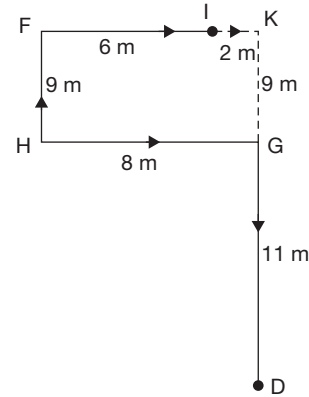
Solutions for questions 24 to 26:

24. The given data can be represented as shown below.



Point I is towards the north-east of point A.

25. If point K is 2 m towards the east of point I, then we shall draw the following route.



\therefore The distance between D and K is

$$DK = DG + GK = 11 + 9 = 20 \text{ m.}$$

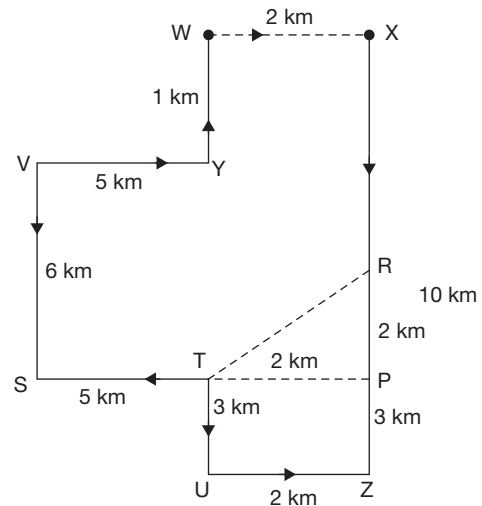
26. $GE = \sqrt{EL^2 + LG^2}$

$$= \sqrt{(7+5)^2 + 7^2} = \sqrt{193} \approx 14 \text{ m}$$

\therefore Point E is 14 m towards the south-west of point G.

Solutions for questions 27 and 28:

27. The given data can be represented as shown below.

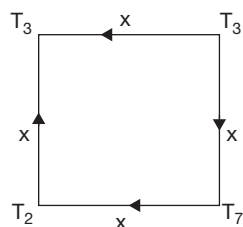


X is 2 km towards the east of W.

28. $TR = \sqrt{TP^2 + RP^2} = \sqrt{2^2 + 2^2} \approx 3 \text{ km}$

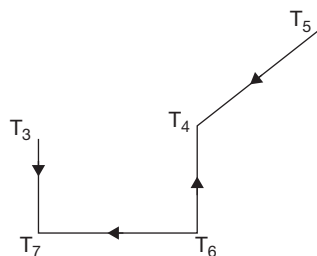
Solutions for questions 29 and 30:

29. From the given information, the path can be represented as shown below.

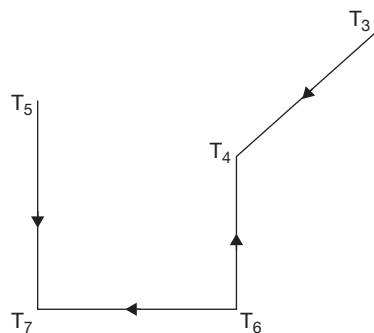


$\therefore T_2$ is towards the west of T_7 .

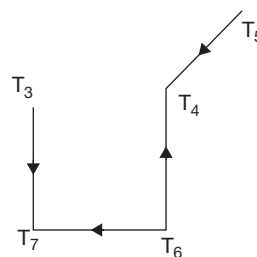
30. From the given information, we have the following possibilities.



Hence, T_4 is towards the north-east of T_5 .



Hence, T_4 is towards the south-east of T_5 .



Hence, T_4 is towards the east of T_5 .

8

Clocks

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Calculate the angular speed at which the minute hand and the hour hand of a clock move
- Learn to apply relative velocity concept to clocks
- Learn how many times in a day the hands of a clock coincide
- Learn how to find the angle between the hands of a clock at any time of the day

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

CLOCKS

The hour hand and the minute hand of a clock move in relation to each other continuously and at any given point of time, they make an angle between 0° and 180° with each other.

If the time shown by the clock is known, then the angle between the hands can be calculated. Similarly, if the angle between two hands is known, then the time shown by the clock can be found out.

When we say angle between the hands, we normally refer to the acute/obtuse angles (upto 180°) between the two hands and not the reflex angle ($>180^\circ$).

For solving the problems on clocks, the following points will be helpful.

1. Minute hand covers 360° in 1 hour, i.e., in 60 minutes. Hence, MINUTE HAND COVERS 6° PER MINUTE.
2. Hour hand covers 360° in 12 hours. Hence, hour hand covers 30° per hour. Hence, HOUR HAND COVERS $1/2^\circ$ PER MINUTE.

The following additional points also should be remembered. In a period of 12 hours, the hands make an angle as follows.

1. 0° with each other (i.e., they coincide with each other), 11 times.
2. 180° with each other (i.e., they lie on the same straight line), 11 times.
3. 90° or any other angle with each other, 22 times.



NOTE

We can also solve the problems on clocks using the method of 'Relative Velocity'.

In 1 minute, minute hand covers 6° and hour hand covers $1/2^\circ$.

Therefore, relative velocity = $6 - 1/2 = 5\frac{1}{2}^\circ$ per minute. Alternately, in 1 hour, the minute hand covers 60 minute divisions whereas the hour hand covers 5 minute divisions.

\therefore Relative speed = $60 - 5 = 55$ minutes per hour.



However, adopting the approach of actual angles covered is by far the simplest and does not create any confusion.

Important points to remember

1. Any angle is made 22 times in a period of 12 hours.
2. In a period of 12 hours, there are 11 coincidences of the two hands, when the two hands are in a straight line facing opposite directions.
3. The time gap between any two coincidences is $12/11$ hours or $65\frac{5}{11}$ minutes.
4. If the hands of a clock (which do not show the correct time) coincide every p minutes, then

If $p > 65\frac{5}{11}$, then the watch is going slow or losing time. If $p < 65\frac{5}{11}$, then the watch is going fast or gaining time.

To calculate the angle ' θ ' between the hands of a clock, we use the following formula (where m = minutes and h = hours).

1. $\theta = \frac{11}{2}m - 30h$ (when $\frac{11}{2}m > 30h$)
2. $\theta = 30h - \frac{11}{2}m$ (when $30h > \frac{11}{2}m$)

SOLVED EXAMPLES

1. What is the angle between the minute hand and the hour hand of a clock at 3 hours 40 minutes?
(A) 20° (B) 70°
(C) 90° (D) 130°

Sol: The angle between the hands can be calculated

by $\theta = \left| \frac{11}{2}m - 30h \right|$, where m is minutes and h is hours. Here, $m = 40$ and $h = 3$.

$$\therefore \theta = \left| \frac{11}{2} \times 40 - 30 \times 3 \right| = |220 - 90| = 130^\circ$$

The angle between the two hands is 130° .

2. Find the time between 2 and 3 p.m. at which the minute hand and the hour hand
 - (i) make an angle of 60° with each other.
 - (ii) overlap
 - (iii) are perpendicular to each other.
 - (iv) are on the same straight line but are facing opposite directions.

Sol: (i) In the formula $\theta = \left| \frac{11}{2}m - 30h \right|$,

$$\theta = 60^\circ \text{ and } h = 2$$

$$\therefore 60 = \frac{11}{2}m - 30 \times 2$$

$$\frac{11}{2}m = 120$$

$$m = \frac{240}{11} = 21\frac{9}{11} \text{ minutes past 2}$$

or

$$60 = 30 \times 2 - \frac{11}{2}m$$

$$\therefore \frac{11}{2}m = 0$$

$$m = 0$$

Therefore, the angle between the hour hand and the minute hand is 60° at 2 p.m.

and at $21\frac{9}{11}$ minutes past 2 p.m..

- (ii) When the two hands overlap, the angle between them is 0° .

$$\theta = \left| \frac{11}{2}m - 30h \right|$$

$$\therefore \theta = 0^\circ \text{ and } h = 2$$

$$\frac{11}{2}m = 30 \times 2$$

$$m = \frac{120}{11} = 10\frac{10}{11} \text{ minutes past 2.}$$

- (iii) When two hands are perpendicular: $\theta = 90^\circ$ and $h = 2$

$$\therefore \theta = \left(\frac{11}{2}m - 30h \right) \text{ or } \left(30h - \frac{11}{2}m \right)$$

$$90 = \frac{11}{2}m - 30 \times 2$$

$$\frac{11}{2}m = 150$$

$$m = \frac{300}{11} = 27\frac{3}{11} \text{ minutes past 2.}$$

or

$$90 = 30 \times 2 - \frac{11}{2}m$$

$$\frac{11}{2}m = -30$$

As m cannot be negative, this case is not possible.

So, the hands are perpendicular to each other only once, i.e., at $27\frac{3}{11}$ minutes past 2 p.m.

- (iv) When two hands are pointing opposite directions and are on a straight line the angle between them would be 180° , i.e., $\theta = 180^\circ$ and $h = 2$.

$$180^\circ = \frac{11}{2}m - 30h$$

$$\frac{11}{2}m = 180 + 60 = 240$$

$$m = \frac{480}{11} = 43\frac{7}{11}$$

So, at $43\frac{7}{11}$ minutes past 2 p.m. the hands will be at 180° .



EXERCISES

Directions for questions 1 to 30: Select the correct alternative from the given choices.

- What is the angle covered by the minute hand in 22 minutes?
(A) 66° (B) 110°
(C) 121° (D) 132°
- By how many degrees does an hour hand move in one quarter of an hour?
(A) 5° (B) 7.5°
(C) 10° (D) 12.5°
- By how many degrees will the minute hand move in the same time, in which the hour hand moves 6° ?
(A) 54° (B) 84°
(C) 72° (D) 60°
- What is the angle between the hands of the clock, when it shows 40 minutes past 6?
(A) 40° (B) 70°
(C) 80° (D) 90°
- When the clock shows 3 hours 14 minutes, then what is the angle between the hands of the clock?
(A) 10° (B) 12°
(C) 13° (D) 14°
- What is the angle between the two hands of a clock when the time is 25 minutes past 7 p.m.?
(A) $62\frac{1}{2}^\circ$ (B) $66\frac{1}{2}^\circ$
(C) $72\frac{1}{2}^\circ$ (D) $69\frac{1}{2}^\circ$
- When the clock shows 20 minutes past 11 p.m., then what is the angle between the two hands of the clock?
(A) 110° (B) 120°
(C) 130° (D) 140°
- At what time between 9 and 10 p.m., will both the two hands of the clock coincide?
(A) $43\frac{3}{11}$ minutes past 9 p.m.
(B) $45\frac{6}{11}$ minutes past 9 p.m.
(C) $49\frac{1}{11}$ minutes past 9 p.m.
(D) $49\frac{6}{11}$ minutes past 9 p.m.
- At what time between 4 and 5 p.m. are the hands of a clock in the opposite directions?
(A) $52\frac{3}{11}$ minutes past 4 p.m.
(B) $54\frac{6}{11}$ minutes past 4 p.m.
(C) $51\frac{7}{11}$ minutes past 4 p.m.
(D) $53\frac{9}{11}$ minutes past 4 p.m.
- The angle between the hands of a clock is 20° and the hour hand is in between 2 and 3. What is the time shown by the clock?
(A) 2 hours $7\frac{3}{11}$ minutes
(B) 2 hours $14\frac{6}{11}$ minutes
(C) 2 hours $15\frac{5}{11}$ minutes
(D) Both (A) and (B)
- Which of the following can be the time shown by the clock, when the hour hand is in between 4 and 5 and the angle between the two hands of the clock is 60° ?
(A) $16\frac{4}{11}$ min past 4 (B) $18\frac{9}{11}$ min past 4
(C) $32\frac{8}{11}$ min past 4 (D) $36\frac{5}{11}$ min past 4
- Which of the following can be the time shown by the clock, when the hour hand is in between 2 and 3 and the angle between the two hands of the clock is 50° ?
(A) 25 min past 2 (B) $11\frac{9}{11}$ min past 2
(C) $1\frac{9}{11}$ min past 2 (D) $2\frac{8}{11}$ min past 2
- How many times the hands of a clock will be at 30° with each other in a day?
(A) 36 (B) 40
(C) 44 (D) 48
- How many times the minute hand of a clock overlaps with the hour hand from 9 a.m. to 4 p.m. in a day?
(A) 5 (B) 6
(C) 7 (D) 8
- A watch which gains uniformly was observed to be 1 minute slow at 8 a.m. on a day. At 6 p.m. on the same day it was 1 minute fast. At what time did the watch show the correct time?
(A) 12 p.m. (B) 1 p.m.
(C) 2 p.m. (D) 3 p.m.
- A watch, which gains uniformly was observed to be 6 minutes slow at 9 a.m. on a Tuesday and 3 minutes fast at 12 p.m. on the subsequent Wednesday. When did the watch show the correct time?
(A) 9 p.m. on Tuesday
(B) 12 a.m. on Wednesday
(C) 3 a.m. on Wednesday
(D) 6 a.m. on Wednesday
- A watch which gains uniformly was observed to be 3 minutes slow at 7 a.m. on a day. At 5 p.m. on the same day, it was 3 minutes fast. At what time did the watch show the correct time?

- (A) 1 p.m. (B) 12 p.m.
(C) 11 a.m. (D) 2 p.m.
18. A watch showed 10 minutes past 6 a.m. on Thursday morning when the correct time was 6 a.m. It loses uniformly and was observed to be 15 minutes slow at 8 a.m. on Saturday morning. When did the watch show the correct time?
(A) 1 p.m. on Friday afternoon
(B) 12 p.m. noon on Friday
(C) 4 p.m. on Friday evening
(D) 2 a.m. on Friday morning
19. The minute hand of a clock overtakes the hour hand at intervals of 60 minutes of correct time. How much time does the clock gain or lose in one hour of correct time?
(A) Gains $5\frac{5}{11}$ minutes
(B) Loses $5\frac{5}{11}$ minutes
(C) Gains $5\frac{5}{11}$ minutes
(D) Loses $5\frac{5}{11}$ minutes
20. The minute hand of a clock overtakes the hour hand after every 70 minutes of correct time. How much time does the clock lose or gain in a day of normal time?
(A) $93\frac{39}{77}$ minutes
(B) $91\frac{31}{77}$ minutes
(C) $92\frac{24}{77}$ minutes
(D) $94\frac{56}{77}$ minutes
21. Two clocks are showing correct time at 4 p.m. One clock loses 3.5 minutes in an hour, while the other gains 2.5 minutes in one hour. At 10 p.m. on the same day, by how much time will the two clocks differ?
(A) 12 minutes (B) 36 minutes
(C) 24 minutes (D) 30 minutes
22. A watch which gains uniformly was observed to be three minutes slow at 8 a.m. on a particular day. At 8 p.m. on the same day it was three minutes fast. At what time did the watch show the correct time?
(A) 1 p.m. (B) 3 p.m.
(C) 2 p.m. (D) 6 p.m.
23. A watch which loses uniformly was observed to be two minutes fast at 6 p.m. on a Wednesday and four minutes slow at 3 p.m. on the next day, i.e., Thursday. When did the watch show the correct time?
(A) 2 a.m. on Thursday
(B) 12 p.m. on Thursday
(C) 1 a.m. on Wednesday
(D) 1 a.m. on Thursday
24. There are two clocks on a wall, both set to show the correct time at 5 p.m. The clocks lose 2 minutes and 3 minutes, respectively in an hour. If the clock which loses 2 minutes in one hour shows the time as 9.50 p.m. on the same day, then what time does the other clock show?
(A) 9.30 p.m. (B) 9.40 p.m.
(C) 9.45 p.m. (D) 10.15 p.m.
25. If the time in a clock is 10 hours 40 minutes, then what time does its mirror image show?
(A) 1 hour 25 minutes (B) 1 hour 15 minutes
(C) 1 hour 10 minutes (D) 1 hour 20 minutes
26. The reflection of a wall clock in a mirror shows the time as 3 hours 40 minutes. What is the actual time?
(A) 8 hours 20 minutes
(B) 8 hours 15 minutes
(C) 8 hours 45 minutes
(D) 8 hours 35 minutes
27. If the seconds hand moves by 240° , then by how many degrees does the minute hand move in the same time?
(A) 1° (B) 2°
(C) 3° (D) 4°
28. When the time is 10.30, if the minute hand points towards south, the hour hand will point towards
(A) North-east (B) North-west
(C) South-east (D) South-west
29. A clock strikes once at 1 p.m., twice at 2 p.m., three times at 3 p.m. and so on. If it takes 10 seconds to strike at 6 p.m., find the time taken by it to strike at 12 p.m.
(A) 18 seconds (B) 22 seconds
(C) 24 seconds (D) 26 seconds
30. At a particular point of time, the number of hours to 12 p.m. from that particular time is twice the number of hours to 12 p.m. after five hours from that particular time. Find the time.
(A) 2.30 p.m. (B) 4 p.m.
(C) 2 p.m. (D) None of these



ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (D) | 6. (C) | 11. (C) | 16. (C) | 21. (B) | 26. (A) |
| 2. (B) | 7. (D) | 12. (C) | 17. (B) | 22. (C) | 27. (D) |
| 3. (C) | 8. (C) | 13. (C) | 18. (D) | 23. (D) | 28. (B) |
| 4. (A) | 9. (B) | 14. (B) | 19. (A) | 24. (C) | 29. (B) |
| 5. (C) | 10. (D) | 15. (B) | 20. (A) | 25. (D) | 30. (C) |

SOLUTIONS

Solutions for questions 1 to 30:

- The angle covered by the minute hand in 22 minutes is $22 \times 6 = 132^\circ$.
- The hour hand covers 360° in 12 hours.
 \therefore It covers $\frac{1^\circ}{2}$ in one minute. In quarter of an hour, i.e., in 15 minutes the hour hand will move $15 \times \frac{1^\circ}{2} = 7.5^\circ$.
- The hour hand will move by 6° in 12 minutes. So, minutes hand will move $12 \times 6^\circ = 72^\circ$ in 12 minutes, as the minute hand moves by 6° in one minute.

4. Angle will be $\theta = \left(\frac{11}{2}m - 30h \right)$

$$\left(\frac{11}{2} \times 20 - 30 \times 6 \right) = 40^\circ.$$

5. The angle between the hands will be:

$$\theta = \left| \frac{11}{2}m - 30h \right|$$

here, $h = 3$ and $m = 14$

$$\theta = \frac{11}{2} \times 14 - 30 \times 3$$

$$\theta = |77 - 90| = 13^\circ.$$

6. Angle between two hands is given by:

$$\theta = \left| \frac{11}{2}m - 30h \right|$$

Here, $h = 7$ and $m = 25$

$$\therefore \theta = \left| \frac{11}{2} \times 25 - 30 \times 7 \right|$$

$$= \frac{275 - 210}{2} = \frac{145^\circ}{2} = 72\frac{1}{2}$$

7. Angle between the two hands is given by:

$$\theta = \left| \frac{11}{2}m - 30h \right|, \text{ here } m = 20 \text{ and } h = 11$$

$$\Rightarrow \theta = \left| \frac{11}{2} \times 20 - 30 \times 11 \right| = 220$$

As the angle is more than 180° , the angle must be $360^\circ - 220^\circ = 140^\circ$.

8. When the hands coincide with each other the angle between them is 0. Therefore, the angle between two hands is given by:

$$\theta = 30h - \frac{11}{2}m \quad \left(\because 30h > \frac{11}{2}m \right)$$

Here, $h = 9$

$$0 = 30 \times 9 - \frac{11}{2}m$$

$$270 \times \frac{2}{11} = m$$

$$\therefore m = 49\frac{1}{11} \text{ minutes}$$

So, the hands coincide at $49\frac{1}{11}$ minutes past 9 hours.

9. When the hands of a clock are in opposite direction the angle between them is 180° .

Therefore, $\theta = \left| \frac{11}{2}m - 30h \right|$

Where $\theta = 180^\circ$ and $h = 4$

$$180 = \frac{11}{2}m - 120$$

$$\frac{11}{2}m = 300$$

$$m = \frac{600}{11} = 54\frac{6}{11} \text{ minutes}$$

So, at $54\frac{6}{11}$ minutes past 4 hours, the hands are in opposite direction.

10. Given $\theta = 20^\circ$ and $h = 2$

$$\theta = \frac{11}{2}m - 30h \text{ or } 30h - \frac{11}{2}m$$

$$20 = \frac{11}{2}m - 30 \times 2$$

$$\frac{11}{2}m = 80$$

$$m = \frac{160}{11} = 14 \frac{6}{11} \text{ minutes (or) } 20 = 30 \times 2 - \frac{11}{2}m$$

$$\frac{11}{2}m = 40$$

$$m = \frac{80}{11} = 7 \frac{3}{11} \text{ minutes}$$

Therefore, the angle between the hands will be 20° at hours $14 \frac{6}{11}$ minutes past 2 and $7 \frac{3}{11}$ minutes past 2.

11. Given $\theta = 60^\circ$ and $h = 4$

$$\theta = \frac{11}{2}m - 30h \text{ or } \theta = 30h - \frac{11}{2}m$$

$$60 = \frac{11}{2}m - 30 \times 4 \text{ or } 60 = 120 - \frac{11}{2}m$$

$$\frac{11}{2}m = 180 \text{ or}$$

$$\frac{11}{2}m = 60 \therefore m = \frac{2 \times 60}{11} = 10 \frac{10}{11} \text{ minutes}$$

$$m = \frac{360}{11} = 32 \frac{8}{11} \text{ minutes}$$

Hence, the angle between the hands will be 60° at $32 \frac{8}{11}$ min past 4.

12. In the formula, $\theta = \left| \frac{11}{2}m - 30h \right|$

$$\theta = 50^\circ, h = 2$$

$$\therefore 50 = -\frac{11}{2}m - 30 \times 2$$

$$\frac{11}{2}m = 110$$

$$m = 20 \text{ minutes past 2 p.m.}$$

or

$$50 = 30 \times 2 - \frac{11}{2}m \Rightarrow \frac{11}{2}m = 10$$

$$m = \frac{20}{11} = 1 \frac{9}{11} \text{ minutes past 2 p.m.}$$

13. In 12 hours the clock will be at 30° with each other for 22 times. So, they will be at 30° with each other for 44 times in a day.
14. The minute hand overlaps with the hour hand once between 9 and 10, 10 and 11, 1 and 2, 2 and 3, 3 and 4.

But between 11 and 1, the overlap happens for only one time, i.e., a total of 6 times.

15. From 8 a.m. to 6 p.m., i.e., in 10 hours the clock gained 2 minutes.
So, it gains 1 minute in 5 hours.
So, it shows correct time at 1 p.m. on the same day.
16. The watch which was 6 minutes slow at 9 a.m. on a Tuesday and 3 minutes fast at 12 p.m. on Wednesday.
 \therefore The watch gained 9 minutes in 27 hours.
So, it gains 6 minutes in $\frac{6 \times 27}{9} = 18$ hours.
 \therefore It shows correct time after 18 hours, i.e., at 3 a.m. on Wednesday.
17. The duration from 7 a.m. to 5 p.m. on a day is 10 hours. The total number of minutes gained by the clock in these 10 hours is given as 6 (3 + 3) minutes. If the clock gains 3 minutes, then it shows the correct time. The time taken by the clock to gain 3 minutes is $\frac{3}{6} \times 10 = 5$ hours. 5 hours after 7 a.m., i.e., 12 p.m. Therefore, the clock shows the correct time.
18. The watch lost 25 minutes in 50 hours, i.e., 6 a.m. on Thursday to 8 a.m. on Saturday. So, it will lose 10 minutes in 20 hours. So, it will show correct time at 2 a.m. on Friday morning.
19. The minute hand gains $65 \frac{5}{11} - 60 = 5 \frac{5}{11}$ minutes in one hour.
20. In a normal clock, the minute hand overtakes the hour hand 11 times in 12 hours (i.e., 720 minutes). Hence, it takes $\frac{720}{11} = 65 \frac{5}{11}$ minutes to overtake once. But in the given clock the minute hand overtakes the hour hand in 70 minutes. Minute hand loses $70 - 65 \frac{5}{11}$, i.e., $4 \frac{6}{11}$ in 70 minutes.
So, it loses $\frac{50}{11} \times \frac{24 \times 60}{70}$ minutes in 24 hours,
i.e., $\frac{7200}{77} = 93 \frac{39}{77}$ minutes.
21. After 1 hour, the two clocks differ by $3.5 + 2.5 = 6$ minutes. So, after 6 hours the two clocks differ by 36 minutes.
22. The duration from 8 a.m. to 8 p.m. is 12 hours. Total number of minutes gained by the clock in these 12 hours is given as 6 (3 + 3) minutes. If the clock gains three minutes, then it shows the correct time, the time taken by the clock to gain three $\frac{3}{6} \times 12 = 6$ hours.
6 hours after 8 a.m., i.e., at 2 p.m. the clock shows the correct time.



23. The duration from 6 pm on Wednesday to 3 p.m. on Thursday is 21 hours. The total number of minutes by the clock in this 21 hours is 6 minutes.
The clock shows correct time when it covers the initial 2 minutes.
The time taken by the clock to lose 2 minutes is $\frac{2}{6} \times 21 = 7$ hours.
 \therefore After 7 hours, i.e., at 1 a.m. on Thursday, the clock shows the correct time.
24. After 5 hours, i.e., at 10 p.m. the clock, which loses 2 minutes will lose 10 minutes and shows 9.50 p.m. So, the other clock will lose $3 \times 5 = 15$ minutes and show 9.45 p.m.
25. Mirror time = 12 – Actual time = 12 – 10.40 = 1.20.
26. When the time is 3 hours 40 minutes the hour hand will be between 3 and 4 and the minutes hand will be at 8. So, in the reflection, the hour hand will be between 8 and 9 and the minute hand will be at 4. So, the time is 8 hours 20 minutes.
Mirror time = 12 – Actual time = 12 – 3:40 = 8:20.
27. When the seconds hand moves by 360° (i.e., 1 minute) the minute hand moves by 6° . So when the seconds hand moves by 240° , the minute hand moves by $\frac{240 \times 6}{360} = 4^\circ$.
28. At 10.30 the angle between minute hand and hour hand will be $\theta = \left| \frac{11}{2} \times 30 - 30 \times 10 \right|$
when the minute hand points towards south, the hour hand will be to the right of the minute hand which is north-west.
29. The clock strikes for 6 times at 6 p.m. Let the gap between two consecutive strikes be x .
Now, the total gap between 1st strike and 6th strike is $5x$.
Now $5x = 10 \Rightarrow x = 2$
Now, the gap between 1st strike and 12th strike at 12 p.m. is $11x$, i.e., 22 seconds.
30. Let the present time be x p.m.
 $\therefore 2(12 - (x + 5)) = 12 - x$
 $2(7 - x) = 12 - x$
 $14 - 2x = 12 - x$
 $x = 2$
 \therefore The present time is 2 p.m.

9

Calendars

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn concepts of calendars like:
 - Leap and non-leap years
 - Odd days
- Learn how to calculate the number of odd days when two dates are given
- Learn how to find the day of the week when a date is given
- Learn how to find the day of the week when two reference dates are given

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as SNAP, XAT, IIFT, MH-CET, MAT, etc.

□ CALENDARS

Suppose you are asked to find the day of the week on 30 June 1974, it would be a tough job to find it if you do not know the method. The method of finding the day of the week lies in the number of 'odd days'.



NOTE

Every 7th day will be the same day count wise, i.e., if today is Monday, then the 7th day counting from Tuesday onwards will once again be Monday. Odd day is the days remaining after completion of an exact number of weeks. Odd day is the remainder obtained on dividing the total number of days with seven.

Example: $52 \text{ days} \div 7 = 3 \text{ odd days}$.

Leap and Non-leap Year

A non-leap year has 365 days whereas a leap year has one extra day because of 29 days in the month of February. Every year which is divisible by 4 is called a

leap year. Leap year consists of 366 days, (52 complete weeks + 2 days), the extra two days are the odd days. So, a leap year has two odd days.

A non-leap year consists of 365 days (52 complete weeks + 1 day). The extra one day is the odd day.



NOTE

For every century, the year which is a multiple of 400 is a leap year. A century year which is not divisible by 400 is a non-leap year.

Example: 400, 800, 1200, 1600 are leap years. 500, 700, 900, 1900 ... are non-leap years.

Counting the Number of Odd Days

100 years consist of 24 leap years + 76 ordinary years. (100 years when divided by 4, we get 25. But at the



100th year is not a leap year, hence, only 24 leap years).
 $= 2 \times 24 \text{ odd days} + 1 \times 76 \text{ odd days}$
 $= 124 \text{ days}$
 $= 17 \text{ weeks} + 5 \text{ days}$

The extra 5 days are the odd days.

So, 100 years contain 5 odd days.

Similarly, for 200 years we have 10 extra days
 (1 week + 3 days).

\therefore 200 years contains 3 odd days.

Similarly, 300 years contain 1 odd day and 400 years contain 0 odd days.

Counting of Number of Odd Days, When Only One Date is Given

Here, we take January 1st 1 AD as the earlier date and we assume that this day is a Monday. We take its previous day, i.e., Sunday as the reference day. After this

the above-mentioned method is applied to count the number of odd days and find the day of the week for the given date.

Counting Number of Odd Days, When Two Dates Are Given

Any month which has 31 days has 3 odd days.

($\therefore 31 \div 7$ leaves 3 as remainder) and any month which has 30 days has 2 odd days ($30 \div 7$ leaves 2 as remainder).

Then, the total number of odd days are calculated by adding the odd days for each month. The value so obtained is again divided by 7 to get the final number of odd days. The day of the week of the second date is obtained by adding the odd days to the day of the week of the earlier date.

SOLVED EXAMPLES

1. If you were born on 14th April 1992, which was a Sunday, then on which day of the week does your birthday fall in 1993?

(A) Monday (B) Tuesday
 (C) Wednesday (D) Friday

Sol: 14th April 1992 to 14th April 1993 is a complete year, which has 365 days. Hence, the number of odd days from 14th April 1992 to 14th April 1993 is 1. Hence, 14th April 1993 is one day after Sunday, i.e., Monday.

2. If 1st January 1992 is a Tuesday then on which day of the week will 1st January 1993 fall?

(A) Wednesday (B) Thursday
 (C) Friday (D) Saturday

Sol: Since 1992 is a leap year there are 2 odd days. Hence, 1st January 1992 is two days after Tuesday, i.e., Thursday.

3. If 1st April 2003 was Monday, then which day of the week will 25th December of the same year be?

(A) Tuesday (B) Wednesday
 (C) Thursday (D) Friday

Sol: The number of days from 1st April to 25th December
 $(29 + 31 + 30 + 31 + 31 + 30 + 31 + 30 + 25) \text{ days}$
 $= 268 \text{ days}$

$$= \frac{268}{7} = 38 + 2 \text{ odd days.}$$

Hence, 25th December is two days after Monday, i.e., Wednesday.

4. On which day of the week does 4th June 2001 fall?

(A) Monday (B) Tuesday
 (C) Wednesday (D) Thursday

Sol: 4th June 2001 \Rightarrow (2000) years + 1st January to 4th June 2001.

We know that 2000 years have zero odd days. The number of odd days from 1st January to 4th June 2001.

Month: Jan + Feb + Mar + Apr + May + June

Odd day: $3 + 0 + 3 + 2 + 3 + 4$

$$\frac{15}{7} = 1 \text{ odd day.}$$

Hence, 4th June 2001 was a Monday.

5. Which year will have the same calendar as that of 2005?

(A) 2006 (B) 2007
 (C) 2008 (D) 2011

Sol: Year: $2005 + 2006 + 2007 + 2008 + 2009 + 2010$

Odd days: $1 + 1 + 1 + 2 + 1 + 1$

Total number of odd days from 2005 to 2010 are $7 \equiv 0$ odd days.

Hence, 2011 will have the same calendar as that of 2005.

6. What day of the week was 18th April 1901?

- (A) Monday (B) Tuesday
(C) Wednesday (D) Thursday

Sol: 18th April 1901 \Rightarrow (1600 + 300) years + 1st January to 18th April 1901.

1600 years have $- 0$ odd days

300 years have $- 1$ odd day

The number of days from 1st January 1901 to 18th April 1901 is $(31 + 28 + 31 + 18)$ days

$108 \text{ days} \equiv 3$ odd days

\therefore Total number of odd days $= 3 + 1 = 4$

Hence, 18th April 1901 is Thursday.

EXERCISES

Directions for questions 1 to 30: Select the correct alternative from the given choices.

- If 8th February 1995 was a Wednesday, then 8th February 1994 was on which day?
(A) Wednesday (B) Thursday
(C) Tuesday (D) Monday
- If 17th September 1993 was a Friday, then which day of the week was 30th June 1989?
(A) Wednesday (B) Thursday
(C) Friday (D) Saturday
- If 11th August 1985 was a Sunday, then which day of the week was 13th August 1986?
(A) Tuesday (B) Monday
(C) Thursday (D) Wednesday
- How many odd days are there in 352 days?
(A) One (B) Two
(C) Three (D) zero
- Which among the following years is a leap year?
(A) 3000 (B) 3100
(C) 3200 (D) 3300
- If 1st January 2012 is a Sunday, then which day of the week will the new year be celebrated in 2016?
(A) Friday (B) Sunday
(C) Wednesday (D) Saturday
- If 1st April 1963 was a Monday, then which day of the week will be 1st August 1959?
(A) Saturday (B) Monday
(C) Tuesday (D) Thursday
- On which dates of October 1994 did Monday fall?
(A) 4, 11, 18, 25 (B) 2, 9, 16, 23
(C) 1, 8, 15, 22 (D) 3, 10, 17, 24, 31

9. Which year will have same calendar as 2002?

- (A) 2008 (B) 2011
(C) 2009 (D) 2013

10. The calendar for year 2005 is the same as that for which of the following years?

- (A) 2010 (B) 2012
(C) 2011 (D) 2009

11. Which of the following years will have the same calendar as that of 2020?

- (A) 2050 (B) 2048
(C) 2046 (D) 2052

12. What will be the next leap year after 2096?

- (A) 2100 (B) 2101
(C) 2104 (D) 2108

13. If in a calendar year, there are 541 days and 10 days a week, then how many odd days will be there in that year?

- (A) One (B) Two
(C) Three (D) Four

14. The last day of a century cannot be

- (A) Friday (B) Wednesday
(C) Monday (D) Tuesday

15. Which day of the week was 25th December 1995?

- (A) Sunday (B) Monday
(C) Tuesday (D) Wednesday

16. Which day of the week was 23rd July 1776?

- (A) Sunday (B) Wednesday
(C) Thursday (D) Tuesday

17. If holidays are declared only on Sundays and in a particular year 12th March is a Sunday, is 23rd September in that year a holiday?



- (A) Yes
(B) No
(C) Yes, if it is a leap year.
(D) No, if it is a leap year.
18. Which day of the week was 15th January 1601?
(A) Monday (B) Tuesday
(C) Wednesday (D) Thursday
19. The first Republic day was celebrated on 26th January 1950 and it was on which day?
(A) Thursday (B) Friday
(C) Monday (D) Tuesday
20. If 23rd April 2006 is a Sunday, then 23rd April 2106 will be a
(A) Wednesday (B) Thursday
(C) Friday (D) Saturday
21. If the first day of the years 2012 and 2023 are Mondays, then which day of the week will be the last days of years respectively?
(A) Tuesday, Tuesday (B) Tuesday, Monday
(C) Monday, Tuesday (D) Sunday, Monday
22. If 14th November 2006 is a Sunday, then 14th November 2706 is a
(A) Sunday (B) Friday
(C) Tuesday (D) Monday
23. In a year, if 23rd November is a Friday then 14th March in that year is on which day of the week?
(A) Monday
(B) Wednesday
(C) Sunday
(D) Tuesday
24. In a leap year, which month will have the same calendar as that of January in that year?
(A) April (B) July
(C) October (D) March
25. What is the next leap year after 2396?
(A) 2398 (B) 2408
(C) 2404 (D) 2400
26. Which day of the week is 21st April 2006?
(A) Tuesday (B) Wednesday
(C) Thursday (D) Friday
27. What was the day of the week on 5th May 1938?
(A) Friday (B) Sunday
(C) Thursday (D) Saturday
28. What day of the week was the Indian Independence Day in 2001?
(A) Monday (B) Wednesday
(C) Tuesday (D) Thursday
29. If a year starts on Saturday but does not end on Saturday, then what is the day of the week on 13th June in that year?
(A) Monday (B) Tuesday
(C) Sunday (D) Saturday
30. If a year starts on a Friday, then what is the maximum possible number of Tuesdays in that year?
(A) 58 (B) 52
(C) 51 (D) 49

ANSWER KEYS

- | | | | | | |
|--------|---------|---------|---------|---------|---------|
| 1. (C) | 6. (A) | 11. (B) | 16. (D) | 21. (B) | 26. (D) |
| 2. (C) | 7. (A) | 12. (C) | 17. (B) | 22. (D) | 27. (C) |
| 3. (D) | 8. (D) | 13. (A) | 18. (A) | 23. (B) | 28. (B) |
| 4. (B) | 9. (D) | 14. (D) | 19. (A) | 24. (B) | 29. (B) |
| 5. (C) | 10. (C) | 15. (B) | 20. (C) | 25. (D) | 30. (B) |

SOLUTIONS

Solutions for questions 1 to 30:

- 1994 is not a leap year.
 \therefore It has only 1 odd day.
 8th February 1995 is one day before Wednesday.
 Hence, 8th February 1994 is a Tuesday.
- The number of odd days from 17th September 1993 to 30th June 1993 is as follows.
 Month: Sep + Aug + Jul + Jun
 Odd days: $2 + 3 + 3 + 1 = 2$ odd days.
 Hence, 30th June 1993 was two days back to Friday, i.e., Wednesday.
 The number of years from 1993 to 1989 is 4 years out of which there is one leap year and 3 non-leap years.
 \therefore The number of odd days = $2 \times 1 + 3 = 5$ odd days.
 Therefore, it is the same day, i.e., Friday.
- It is given that 11th August 1985 was Sunday then 13th August 1985 is Tuesday.
 1985 is not a leap year, hence, it has only one odd day.
 So, 13th August 1986 is one day to Tuesday, i.e., Wednesday.
- The number of odd days in 352 days

$$= \frac{352}{7} = 50 + 2 \text{ odd days}$$
 Hence, the total number of odd days is 2.
- Century years which are divisible by 400 are leap years.
 As 3000, 3100 and 3300 are not divisible by 400, they are not leap years. But, 3200 is a leap year.
- The total number of years from 2012 to 2016 is four out of which 2013, 2014 and 2015 are non-leap years. Hence, there is 1 odd day in each of these years, 2012 is a leap year, therefore, it has 2 odd days.
 \therefore The total number of odd days in these four years is 5.
 Here, 1st Jan 2016 is five days to Sunday, i.e., Friday.
- The total number of years from 1963 to 1959 is 4 years out of which 1959, 1961 and 1962 are ordinary years. Hence, they have 3 odd days and 1960 is leap year which has 2 odd days.
 The total number of odd days in these 4 years is 5. Hence, 1st April 1959 is 5 days back to Monday, i.e., Wednesday.
 Now, the number of odd days from 1st April to 1st August in 1959 is as follows.
 Month: Apr + May + Jun + Jul + Aug
 Odd days: $1 + 3 + 2 + 3 + 1$
 The total number of odd days is 3.
 Hence, 1st August 1959 is 3 days to Wednesday, i.e., Saturday.

- 1600 years contain zero odd days.
 300 years contain 1 odd day.
 93 years = (23 leap + 70 non-leap years)
 Total number of odd days in 93 years = $(23 \times 2 + 70 \times 1)$
 $= 116$ odd days $\Rightarrow 4$ odd days.
 Number of odd days from 1st January to 1st October in 1994
 Month: J + F + M + A + M + J + J + A + S + O
 Odd days: $3 + 0 + 3 + 2 + 3 + 2 + 3 + 3 + 2 + 1$
 $= 22$ odd days $\Rightarrow 1$ odd day.
 The total number of odd days = $1 + 4 + 1 = 6$ odd days
 \therefore 1st October 1994 is Saturday.
 Therefore, first Monday is on 3rd October.
 So, 3, 10, 17, 24 and 31 are Mondays in October.

- The number of odd days should be zero to have same calendar.

Years	Odd day
2002	— 1
2003	— 1
2004	— 2
2005	— 1
2006	— 1
2007	— 1
2008	— 2
2009	— 1
2010	— 1
2011	— 1
2012	— 2
2013	— 1

After the completion of 2013 we get 14 odd days.

Hence, the number of odd days is zero. So, 2013 will have the same calendar as that of 2002.

- Year: 2005 2006 2007 2008 2009 2010
 Odd days: $1 + 1 + 1 + 2 + 1 + 1$
 As the number of odd days from 2005 to 2010 is $7 \Rightarrow \frac{7}{7}$
 $= 0$ odd days.
 Hence, 2011 had the same calendar as did 2005.
- 2020 is a leap year. In the next 28 years we have 21 non-leap years and 7 leap years, which result in 35 odd days, i.e., effectively zero odd days.
 Hence, $2020 + 28 = 2048$ will have the same calendar as will 2020.
- For a century year to be a leap year, it should be divisible by 400. As 2100 is not divided by 400 it is not a leap year.
 The next leap year is 2104.
- To find the number of odd days, we have to find the remainder of $541/10$. The remainder is one.
 Hence, there is one odd day.



14. 100 years contain 5 odd days.
 \therefore The last day of the first century is Friday.
 200 years contain 10 odd days, i.e., 3 odd days.
 \therefore The last day of the second century is Wednesday.
 300 years contain 15 odd days, i.e., 1 odd day.
 \therefore The last day the third century is Monday.
 400 years contain 20 odd days and the 400th year itself is a leap year. Hence, there is no odd day.
 \therefore The last day is Sunday. The last day of a century cannot be Tuesday, Thursday or Saturday.
15. The total number of odd days up to 25th December, 1995 is obtained as follows.
 For 1600 years – zero odd days
 For 300 years – 1 odd day
 In 94 years there are 23 leap years and 71 non-leap years.
 The total number of odd days in these 94 years is $(23 \times 2 + 71 \times 1) = (46 + 71) = 117$.
 $\Rightarrow 5$ odd days
 The number of odd days from 1st January to 25th December 1995 is as follows.
 Month: J + F + M + A + M + J + J + A + S + O + N + D
 Odd days: $3 + 0 + 3 + 2 + 3 + 2 + 3 + 3 + 2 + 3 + 2 + 4 = 2$ odd days.
 The total number of odd days = $1 + 5 + 2 = 1$, i.e., Monday.
 Hence, 25th December 1995 is Monday.
16. 1600 years – 0 odd days
 100 years – 5 odd days
 75 years = $(18L + 57NL)$
 $= 36 + 57 = 93$ odd days $\Rightarrow 2$ odd days
 Now 1st January – 24th July 1776
 $= 205$ days $\Rightarrow 2$ odd days
 Total number of odd days = 2
 \therefore 23rd July 1776 was Tuesday.
17. The total number of odd days from 12th March to 23rd September is as follows.
 Month: M + A + M + J + J + A + S
 Odd days: $5 + 2 + 3 + 2 + 3 + 3 + 2 = 20$ days.
 $\frac{20}{7} = 6$ odd days.
 Hence, 23rd September is 6 days to Sunday, i.e., Saturday.
 So, 23rd September is not a holiday.
18. The number of odd days upto 15th January 1601 is as follows.
 $1600 + (1\text{st January to } 15\text{th January } 1601)$
 1600 years have zero odd days and there is one odd day in 15 days.
 Hence, 15th January 1601 is a Monday.
19. The number of odd days upto 26th January 1950.
 1600 years = odd days
 300 years = 1 odd day
 In 49 years these are 12 leap years and 37 non-leap years.
 Number of odd days in these 49 years is 61.
 $= 61$ odd days $\Rightarrow 5$ odd days.
- 26th January = 26 days = 5 odd days
 Total odd days 11 odd days = 4 odd days
 Therefore, the answer is Thursday.
20. Number of years from 2006 to 2106 is 100 years.
 We know that 100 years have 5 odd days. Hence, 23rd April 2106 will be 5 days after Sunday, i.e., Friday.
21. 2012 is leap year, so it will have two odd days.
 Hence, 1st January 2013 is two days after Monday, i.e., Wednesday.
 So, 31st December 2012 is a Tuesday. 2023 is a non-leap year and have 1 odd day.
 So, 1st January 2024 is Tuesday. Hence, 31st December 2023 is Monday.
22. Number of years from 2006 to 2706 is 700 years.
 700 year $(400 + 300)$ have 1 odd day.
 Hence, 14th November 2706 is one day after Sunday, i.e., Monday.
23. The number of odd days from 23rd November to 14th March in that year.
 Month: N + O + S + A + J + J + M + A + M
 Odd days: $2 + 3 + 2 + 3 + 3 + 2 + 3 + 2 + 3$
 23 odd days $\Rightarrow \frac{23}{7} = 2$ odd days.
 Hence, it is two days before Friday, i.e., Wednesday.
24. In order to have the same calendar between these two months the number of odd days should be zero.
 Month: Jan + Feb + Mar + Apr + May + Jun + Jul
 Odd days: $3 + 1 + 3 + 2 + 3 + 2$
 At the completion of June, the number of odd days is zero. Hence, January and July will have the same calendar.
25. A century year which is divisible by 400 is a leap year and a leap year comes for every 4 years.
 Hence, $2396 + 4 = 2400$ is a leap year.
26. The number of odd days upto 21st April 2006 is as follows.
 (200) years + 5 years + (1st January 2006 to 21st April 2006)
 2000 years have 0 odd days.
 In these 5 years there is a leap year and 4 non-leap years.
 Odd days = $1 \times 2 + 4 \times 1 = 6$ odd days.
 The number of odd days from 1st January 2006 to 21st April 2006.
 Month: Jan + Feb + Mar + Apr
 Odd days: $3 + 0 + 3 + 0 = 6$ days
 The total, number of odd days = $6 + 6 = 12$
 $\Rightarrow 5$ odd days
 Hence, 21st April 2006 is Friday.
27. 5th May 1938 = $1600 + 300 + 37 + (1\text{st January } 1937 \text{ to } 5\text{th May } 1937)$
 1600 years have 0 odd days.
 300 years have 1 odd day.

37 years contain 9 leap years + 28 non-leap year.

One leap year contains 2 odd days.

One non-leap year contains 1 odd day.

In 37 years number of odd days = $9 \times 2 + 28 = 46$ odd days.

Number of odd days from 1st January 1938 to 5th May 1938 is as follows.

Month	Jan	Feb	March	Apr	May	Total
Odd day	3	0	3	2	5	13

\therefore The total number of odd days = $0 + 1 + 46 + 13 = 60$ odd days.

4 odd days means thus = 4 odd days ($60 \div 4$)

\therefore 5th May 1938 is Thursday.

28. 15th August 2001 = 2000 + (1st January 2001 to 15th August 2001)

Century year contains '0' odd days.

The number of odd days from 1st January to 15th August is as follows.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Odd day	3	0	3	2	3	2	3	1

\therefore The total number of odd days = $\frac{17}{7} = 3$ odd days.

3 odd days means = Wednesday

\therefore 15th August 2001 is Wednesday.

29. As the year is starting and ending on two different days, it is a leap year.

It is given that 1st January is Saturday.

The number of odd days from 1st of January to 13th June is

= 2 (Excluding 1st January) + 1 + 3 + 2 + 3 + 6

= 17 = 3 odd days.

\therefore The 3rd day after Saturday is Tuesday.

30. If the year is a leap year, it will have 53 Fridays as well as 53 Saturdays. Each of the remaining days of week occurs only 52 times. Similarly, if it is a non-leap year, it will have 53 Fridays and all the other days of the week occur only 52 times.

\therefore The number of Tuesday is 52.

10

Decision Making

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Practise how to take decisions subject to the given constraints
- Learn to sift through conditions and data to arrive at an actionable conclusion
- Learn to identify sufficiency or inadequacy of data to take a decision

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as, XAT, IIFT, MH-CET, MAT, etc.

□ INTRODUCTION

In Decision Making, a situation/ circumstance or a caselet is provided, based on it students are generally asked two types of questions, such as:

What would be the best course of action to take in such circumstances? And, What lead to such a conclusion/situation?

These kinds of questions require a logical approach and a clear understanding of the case. It often requires careful reading of complete paragraphs and then logically inferring the information presented.

EXERCISES

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

A device classifies numbers according to the following criteria. The number must have

- (1) Seven digits
- (2) At least two prime digits.
- (3) Perfect squares as the first and the last digits.
- (4) An even digit as the middle digit.

If the number satisfies criteria (1), (2), (3) and (4), then the number is classified as a superior number.

- (5) If the number is a superior number and the digits are in increasing order from left to right according to the value, then the number is classified as an impressive number.
- (6) If the number satisfies criteria (1), (2) and (4) but not (3), but the first and last digits are even, then the number is classified as a mutual number.
- (7) If the number satisfies criteria (1) (2) and (3) but not (4) but all the digits are odd, then the number is classified as a classic number.

- (8) If the number does not fall under any of the above-mentioned classification, then the number is classified as a garbage number.

Based on the above criteria, decide which number should be classified in which of the above-mentioned classification. Mark your answer choice as follows.

- (A) If the number is classified as superior number.
 (B) If the number is classified as impressive number.
 (C) If the number is classified as mutual number.
 (D) If the number is classified as classic number (or) garbage number.

Classify the following number as mentioned above.

1. 1778459
2. 4276891
3. 1367574
4. 9632578
5. 4556666

Directions for questions 6 to 11: Study the following information carefully and answer the questions given below.

Following are the criteria required to be fulfilled, to gain admission into any intermediate college in Andhra Pradesh (AP):

- (a) The candidate should have scored at least 80% marks in SSC or 70% marks in CBSE.
- (b) The candidate should have scored at least 60% marks in the entrance exam.
- (c) The candidate should be a male and must be at least 16 years old, as on 1st June 2000.
- (d) The candidate should be a resident of Andhra Pradesh (AP), i.e., should have been born and brought up in AP.

In case a condition given above is not satisfied, an alternate condition for the same is given as below:

- (e) If condition (d) is violated, but at least one relative of the candidate is presently staying in Andhra Pradesh, for the last 5 years, then the candidate can be admitted.
- (f) If condition (b) or (c) is violated, but not both and the student has a good sports record, then he/she should be advised to approach the Principal.
- (g) If both conditions (a) and (b) are violated, but the candidate is ready to donate ₹1,00,000 to the college, then he is advised to approach the Secretary.

Now mark your answer as

- (A) If admission can be granted.
- (B) If admission cannot be granted.
- (C) If the Principal (or) the Secretary of the school is to be approached.
- (D) If data is inadequate.

The following cases are given to you as on 1st June 2000.

6. Jahangir has applied for a college in AP. He was born and brought up in Kerala. He was born in 1980 and has an excellent percentage of 95 in his SSC. He has done pretty well in the entrance test scoring 65%, and has a close relative working in AP for the past 10 years.
7. Rita was born in 1981 and has a very good academic record with 90% in her CBSE. She has done her entrance test well by scoring 80% and she is a resident of AP, where the college is also situated. She is a very good sports person and has represented the state for basketball.
8. Prakash is 17 years old and is a resident of AP where the college is located. He has scored 90% in the entrance test and 69% in SSC.
9. Ranga, a resident of state of AP is a gold medallist in swimming at National games in the junior's category. He has applied with a percentage of 75% in the SSC and a score of 55% in the entrance exam. The college is in the same locality as his residence is. He was born on 16th July 1981. He is ready to give a donation of ₹1,00,000.
10. Ram was born in 1980 and is a resident of AP. He is the present TT Champion of India. He was presented a gold medal by the President of India in the National Games. He scored below 40% of marks in both SSC and the entrance exam. He is ready to give a donation upto ₹2 lakhs.
11. Rahim, applying for a college in the same state as he is in has a bad academic record of 40% and 35% in CBSE and entrance exam, respectively. He is able to pay a donation of ₹1,00,000 to the college.

Directions for questions 12 to 17: Study the following information carefully. Answer the questions given below:

Following conditions are to be fulfilled in order to become the hero of a film:

- (a) The person should have a good track record, i.e., the rate of success of that particular person as a hero should be at least 70%.
- (b) The person should have been in the industry for at least 5 years.
- (c) The person should ask for a remuneration of less than ₹10,00,000 per film.
- (d) The person should be able to give dates continuously for at least one week.

In case a condition given above is not satisfied, the following alternate condition should be applied:

- (e) If condition (a) is violated and the hero has a success rate of greater than 50% in films and recognized as a hit pair with the heroine he is going to work with in the film, then take the suggestion of the heroine; (OR)

If condition (a) is violated and the hero has acted in more than six films with that producer, then take the advice of the Producer.



- (f) If condition (c) is violated, but the hero demands a remuneration of less than ₹50 lakhs, then he can be selected.
- (g) If condition (d) is violated, but the hero can work for at least 15 days in a month, may not be continuous then the hero can be selected.

Now mark your answers as

- (A) If the person is to be selected as a hero.
 - (B) If the person is not to be selected as a hero.
 - (C) If the heroine or the producer is to be consulted regarding the decision.
 - (D) If the data is insufficient.
12. Romeo has been in the film industry for the past 7 years and asks for a remuneration of ₹7,00,000. He is ready to give dates continuously for 10 days. As a hero he has 30 hits out of the 40 films that he has acted in for the last 7 years.
 13. Chris has a very good reputation as an actor and has 80% hits in his career. He is famous for the kind of films the producer of this film is presently making and is considered as an ideal combination with the heroine of the film. However, he charges ₹40,00,000 per film.
 14. Ritesh is a hero, who has 65% hits in his career and charges ₹8,00,000 per film. He has been in the film industry for the past 7 years and has acted in nine films with the producer of that movie. He is ready to give dates continuously for ten days.
 15. Rajesh is a hero in the film industry for the past 10 years, having 85% hits and demands a remuneration of ₹9,00,000. He acted in 10 for the kind of films of that producer. He can give dates for 18 days in a month, but continuously for only 6 days at a stretch.
 16. Hasmukh has been in the industry for the past 6 years and has 68% hits in his career. He demands a remuneration of ₹8,00,000 and is ready to give dates continuously for at least one week. The heroine and he are considered to be the hit pair of the industry.
 17. Roopesh is a successful hero for the last 8 years in action films, delivering around 85% in that line. But the trend has changed for the past 5 years. Therefore, Roopesh had to act in romantic films, where he was a misfit. Because of his failure as a romantic hero, he reduced his remuneration to ₹5,00,000. The producer now wants to make an action movie.

Directions for questions 18 to 23: Study the following information carefully and answer the questions which follow:

The following are the conditions/criteria for a group of college students to watch a movie at a theatre.

- (a) Every student in the group should have attended all their lectures, i.e., no student should miss any lecture for watching the movie.

- (b) No student in the group should have watched the movie earlier.
- (c) The movie should be screened at a theatre, which is not more than 3 kms away from their college.
- (d) Every student of the group should agree to watch the same movie.

In case a condition given above is not satisfied, an alternate condition for the same is given below:

- (e) If condition (a) alone is violated and less than half of the total number of students have to miss their lectures, then these students attend their lectures and others can proceed to watch the movie.
- (f) If condition (b) alone is violated but the movie is a hit and more than half of the total number of students of the group have not watched the movie before, then all of them go to watch the movie.
- (g) If condition (c) alone is violated but at least two seniors are accompanying them to watch the movie, then all of them go to watch the movie.
- (h) If condition (d) alone is violated and more than one-fourth of the total number of students in the group are not willing to watch the movie, then all the members of the group should meet and take a decision.

Based on the above criteria and the information given in each of the following questions, you have to take decision with regard to each case. You should not assume anything beyond what is given in the question.

Now mark your answer as:

- (A), If the group decides to watch the movie.
 - (B) If the decision is not to watch the movie.
 - (C) If the data is inadequate.
 - (D) If a meeting is to be held to take a decision. (or)
- If only a few attends the classes and remaining go to watch the movie.
18. A group of students, having attended all of their lectures plan to watch a particular movie. The movie has been released for the first time in the city and is being screened in a theatre, which is 2 kms away from their college. None of them has watched the movie earlier. All of them agree to watch the movie.
 19. A group of 10 students plans to watch a particular movie in a theatre, which is 3 kms away from their college. None of them has watched the movie earlier. Everybody agrees to watch this movie. Only 3 students out of the group have not attended their classes.
 20. A group of students has plans to watch a particular movie, along with three senior students. The movie is being screened in a theatre, which is 5 kms away from their college. None of them has seen this movie earlier. Everyone in the group has attended all their lectures. All of them agree to watch this movie.

21. A group of students has planned to watch a particular movie. They attended all the lectures but only 8 out of 10 students in the group have not watched this movie earlier. The movie is being screened in a theatre, which is just 1 km away from their college. The movie is a hit. All of them agree to watch this movie.
22. A group of students plans to watch a particular movie, which has been watched before by less than half of the group. The movie is a hit. The movie is running in a theatre, which is 2 kms away from their college. All of the students in the group have attended all their lectures. All of them agree to watch this movie.
23. A group of students having attended all of their lectures, plan to watch a particular movie. The theatre in which the movie is being screened is just 2.5 km away from their college. Less than 20% of students of the group have already watched the movie and every one in the group wants to see the movie as it was a big hit.

Directions for questions 24 to 30: Study the following information and answer the questions that follow:

The following are the conditions for constructing a house.

- The cost of land should be less than ₹20,00,000.
- The estimated cost of construction should be less than ₹30,00,000.
- The land/house to be bought should be in a posh locality.
- A loan worth at least ₹20,00,000 should be available at an interest rate of not more than 18% per annum. If a condition given above is not satisfied, then an alternate condition for the same is given below.
- If condition (d) is violated, but the interest rate is less than 12% per annum, and the amount of loan that can be availed is at least ₹10,00,000, then the matter should be discussed with the family members.
- If condition (b) is violated, then a decision is made to buy a flat on the ground floor in that location, subject to availability.
- If condition (c) is violated, but all the basic amenities are available in the vicinity nearby, then the matter should be discussed with the family members.

Now mark your answer as:

- If the decision is to buy a flat (or) to construct a house.
 - If the data is inadequate.
 - If a discussion is to be held with the family members.
 - If the house cannot be constructed.
24. The cost of a piece of land is ₹12,00,000 and the cost of construction is ₹38,00,000. The land is located in a posh locality. A loan of ₹30,00,000 can be availed at an interest rate of 15% per annum. There are flats available in that locality on the ground floor.

25. The cost of a piece of land would be around ₹15,00,000 and the cost of construction of a house would be around ₹20,00,000. Loan can be availed at a rate of 15% per annum. The land is located in a posh locality where every facility is available.
26. Land is available for ₹30,00,000 and the cost of construction is ₹20,00,000. Land is available in a very posh locality and a loan worth ₹20,00,000 can be availed at an interest rate of 16% per annum.
27. Land is available in a posh locality at ₹20,00,000 and the cost of construction is around ₹25,00,000. A loan worth ₹15,00,000 can be availed at an interest rate of 10% per annum.
28. Cost of a land in a locality is ₹10,00,000 and the cost of construction is ₹20,00,000. A loan can be availed at an interest rate of 20%.
29. Land is available in a posh locality of the city at ₹19,00,000 and the cost of construction is around ₹28,00,000. A loan of ₹15,00,000 can be availed at the rate of 10% per annum.
30. Mr Ravi has seen a piece of land costing ₹14,00,000 and the cost of construction of house is ₹28,00,000. A loan of ₹20,00,000 can be availed at the annual interest rate of a maximum of 18% per annum. The land is not located in a posh locality but has all basic amenities available in the vicinity.

Directions for questions 31 to 36: Read the following passage and answer the questions that follow it.

In May 1993, the Swedish automobile major, Volvo AB (Volvo) announced the closure of its car manufacturing facility at Uddevalla, Sweden, barely five years since its launch in 1989. A year later, the company had to shutdown yet another world-famous facility, the car assembly plant at Kalmar, which is also in Sweden.

Reacting to the two closures within a year's gap, analysts said Volvo's human centric approach towards automobile manufacturing was no longer feasible in the fiercely competitive scenario of the 1990's with most companies striving hard to improve production efficiency. Volvo was well recognized in the industry for its employee-friendly policies ever since its inception.

Guided by the 'Volvo Way,' the company had made conscious efforts to implement job enrichment concepts such as job rotation, job enlargement and employee work groups in its manufacturing facilities. In the late 1960s and early 1970s, when the company faced the problem of increasing employee turnover and absenteeism, it introduced these concepts and obtained positive results.

Volvo was inspired to build a new facility keeping this work design as a basis. This reiterated the company's belief that the industry needed to adapt itself to the people's requirements and not vice versa. This concept was imple-



mented successfully in other plants of the company too in the 1970s. The best practices in Human Relations (HR) tried and tested in these plants were passed on to new plants established in the 1980s. While investing heavily in developing new plants like Kalmar and Uddevalla, where new work design concepts were implemented, Volvo was conscious of the risks involved and the possible effect on the company's financial performance if the experiments failed.

Acknowledging this, Gyllenhammar, in Harvard Business Review wrote, 'Volvo's Kalmar plant, for example, is designed for a specific purpose: car assembly in working groups of about 20 people. If it didn't work, it would be a costly and visible failure, in both financial and social terms. We would lose credibility with our people and those who are watching from outside'.

Gyllenhammar's apprehensions proved correct when Volvo closed down the Kalmar plant in 1994. However, Volvo's efforts in bringing changes in work design offered valuable lessons to both the academic and corporate community.

Analysts appreciated Volvo for its constant emphasis on learning from experiences and implementing the lessons so learnt in its new initiatives. This contributed significantly to the development of human centric production systems. These systems brought to life several theories and concepts, which had earlier only been enunciated in textbooks but rarely practised with the kind of seriousness with which Volvo did.

31. Which of the following best captures Volvo's philosophy of work?
 - (A) Employees should update their skills according to the changing needs of the company.
 - (B) Industry needs to adapt itself to the employee's requirements.
 - (C) In order to maximize profits more emphasis should be laid on employee welfare.
 - (D) A company can gain recognition only through its pro-employee policies.
 - (E) Lavish financial incentives given to employees go a long way in keeping afloat employee morale.
32. Which of the following is perceived to be the main reason for the closure of Volvo's manufacturing facility?
 - (A) The so-called employee friendly policies which did more harm than good to the employees.
 - (B) The aggressively competitive scenario of the 90s.
 - (C) The incongruity between Volvo's human-centric work philosophy and the aggressively competitive atmosphere of the 90s.
 - (D) The mismatch between the number of workers and the work involved.
 - (E) Increasing absenteeism among the employees.
33. Which of the following can be inferred from the failure of the policies implemented by Volvo at Uddevalla and Kalmar?
 - (A) Policies should be designed according to the needs of the time.
 - (B) The policies which had positive results in the past need not necessarily have positive results in the present also.
 - (C) 'Employee-friendly' policies seldom improve production efficiency.
 - (D) Failure of policies implemented by the company will have a bearing on the company's financial performance.
 - (E) Policies introduced on an experimental basis will most often end in a fiasco.

- | | |
|---------------|---------------|
| (A) A + B + C | (B) B + C + D |
| (C) C + D + E | (D) A + B + D |
| (E) D + E | |

34. Which of the following is a positive outcome of Volvo's fiasco?
 - (A) It offered an opportunity to learn from experience.
 - (B) The lessons learnt from the mistakes were implemented in new ventures.
 - (C) It led to the development of human-centric production systems.
 - (D) The human-centric production system helped to put into practice theories and concepts which were enunciated only in text books.
 - (E) All of these
35. The closure of Volvo's new manufacturing facilities does not detract from the value of the example that was set in the area of
 - (A) Business strategy
 - (B) Cost-benefit analysis
 - (C) Business growth
 - (D) Human resource optimization
 - (E) Brand building
36. According to Gyllenhammar if the new concepts failed it would be a 'costly failure' because
 - (A) The credibility of the company was at stake.
 - (B) It would mean huge financial losses for the company.
 - (C) It may impact on company's image.
 - (D) It would be demoralizing for the employees.
 - (E) All of these

Direction for questions 37 to 40: Read the following situation and choose the best possible alternative.

37. A Programme Manager in a software outfit learned a valuable lesson firsthand. He had asked his team for some feedback on his leadership. While most of what he received was positive and supportive, he got some strong advice too, from his team, about how he could be more effective in helping a shared vision. 'We would benefit, as a team, when we walk with you while you create the goals and vision, so that we all get to the end vision together'.

What effect will the suggestion have on the team or the team leader?

- (A) Team spirit will be fostered among the team members.
- (B) It would help in fostering team spirit in the team leader.
- (C) The team leader's morale may be adversely affected.
- (D) The team would benefit because the leader would be able to take into account the abilities and hopes of people.
- (E) The ego of the team leader may be hurt.

38. Who can help a junior executive at work? Who knows what's going on? Who gets around road blocks? Who are the critical links in the information chain? The boss can be a big help by identifying and introducing people, setting up meetings and so on. Others who can help are the office administrator (who always knows who's on the way up), those in the legal department (who have an idea of the major problems the organization is facing), those in liaison (who have an idea of impending changes, whether in the market or in government regulations).

What does this suggest about the working of an organization?

- (A) Hierarchies are an inevitable part of every organization.
- (B) Every individual has an important role to play in the smooth functioning of an organization.
- (C) Networking is a skill every potential manager should develop.
- (D) Networking is a binding force which is needed to ensure camaraderie among employees.
- (E) Networking goes a long way in developing individual talent.

39. Many firms that have a system in place for employee suggestions are taking steps to improve the quality of ideas before they are submitted for review. They are encouraging employees to first discuss ideas with their colleagues to gain insights into their technical and market feasibility or how they fit with the company's objectives. Such steps are invaluable because

- (A) They would either enhance the value of the ideas or lead to their early and appropriate demise.
- (B) They would deter people from being forthcoming with their advice.
- (C) There are too many suggestions being offered by employees.
- (D) They would help in enhancing a sense of participation among employees.
- (E) They would make the employees feel valued and important if their suggestions are taken into consideration.

40. Customers who are loyal to your competitors represent market share you don't have and will likely not get. Customers who are loyal to you represent market share you already have. Protecting your most loyal customers is an obvious priority in a downturn. However, if they are spending 25% less than in better times, most of that will come directly out of what they spend in your stores. As a smart retail manager, you would, in times of downturn

- (A) Put in place ways of identifying customers who have needs but no established loyalties.
- (B) Resort to aggressive marketing in order to attract more customers.
- (C) Relax and rest on your laurels, i.e., rely on your brand name.
- (D) Introduce attractive offers to all customers thus retaining old customers and attracting new ones.
- (E) Offer your regular customers attractive deals to prompt them to spend more in your stores.

Directions for questions 41 to 43: Read the passages carefully and answer the questions that follow.

Udaan, with its headquarters in Delhi, India, began as an air taxi operator in 1991 and started its commercial operations a year later in 1992. It operated with just 24 flights across 10 destinations initially but showed exceptional growth and had more than 300 daily flights to about 60 domestic and international destinations in 2007. It was first listed in the National Stock Exchange (NSE) in the year 2004.

In January 2008, the Air Transport Association had predicted that, globally, the airline industry would lose about US \$5.2 billion by the end of 2008 based on an average price of US \$140 per barrel of oil as the rise in fuel prices would push the fuel bills of the industry for that year to US \$186 billion. The case is about the retrenchment drama that unfolded in Udaan Limited in late 2008. After showing the door to more than 1000 employees in a bid to streamline its operations and reduce its losses, Udaan was faced with immense criticism and opposition by various organizations and political parties. Udaan chairman Brijesh Goswami reinstated the employees a day later saying that he was not aware of these sackings which were done by the senior business manager. The sudden decision not only took the employees by surprise but also caused alarm in the sector. Amidst great furore and opposition by various organizations and political parties, Brijesh Goswami Chairman of Udaan reinstated the employees a day later amidst great emotional drama. Mr Brijesh Goswami was quoted as saying he had been appalled by the retrenchments of his employees, which he claimed, he had come to know only through media reports. He added that he would 'not be able to live as long as he lives' with the tough decision his management had taken and clarified that he was taking back the employees as they were 'family to him and as the head of the family he would take care of them'.



41. Which of the following can be concluded from the passage?
- Brijesh Goswami had capitulated under pressure from external parties.
 - All is not well with the organizational communication mechanisms at Udaan.
 - The company had planned to retrench more employees had there been no protests.
 - There were many loopholes in Udaan's organizational communication network.
 - None of these
42. What is the flaw in the decision taken by the senior business manager from the business point of view?
- The company decided to layoff the employees without any prior notice.
 - Such sudden lay offs make future recruitment difficult.
 - If oil prices remain high for long time the company will have no other option but to close down.
 - Such decision does not gain support from the industry.
 - None of these
43. What can be a better way to cope with the losses?
- The company should have sold off a few of its airplanes.
 - Instead of sacking the employees the management could have proposed a salary reduction and explained the circumstances behind it to all its employees.
 - The company should reduce its fares below that of its competitors so as to increase the load factor.
 - The company should sack all the experienced employees and start hiring new employees for lower salaries.
 - All the above

Directions for question 44 and 15: Select the correct alternative from the given choices.

44. Shaheshah Law the Uttar Pradesh (UP) based law firm was founded in 1982. It has a number of in-house advocates operating in all the higher courts including the Supreme Court, High Court, Labour Courts and various Tribunals. It was also accredited by the law society for training purposes. They conduct training sessions for fresh law graduates, throughout the day starting from 5 a.m. to 8 p.m. They take up various legal cases on behalf of corporate companies and individuals. On 16 July 2007 the court gave a ruling that expanded the scope of law on disability discrimination to include those who were associated with or responsible for a disabled person. The case discusses in detail the events that led to this ruling

which was considered a landmark and was expected to have huge implications on businesses. It all began when Sarla Damitri, a former legal secretary with Shaheshah Law, sued her former employer (and a partner in the firm) in August 2004 for constructive dismissal. Sarla, who had a disabled son, alleged that the firm had discriminated against her at the work place due to her association with a disabled person. She alleged that she was treated differently, subjected to criticism and insults, denied flexible working arrangements that would help her to take care of her badly disabled child and ultimately forced into accepting voluntary retirement. She claimed that other employees were allowed flexible working arrangements.

Which among the following weakens Sarla Damitri's argument that she was discriminated against because other employees were allowed flexible working arrangements while she was not.

- This is the first time there is such a request at Shaheshah Law.
 - Sarla left her previous job for the same reason.
 - Sarla Damitri has relatives at home to take care of her child.
 - The firm had two legal secretaries and so her presence at all times was not critical.
 - Only the trainees were allowed flexible working hours at the time.
45. Sumit Patil, a management trainee in the sales and marketing department of one of the largest hardware firms of the city, Sheeta Electronics, was greeted by Ganesh Singh, the zonal sales manager of that firm on the very first day of his joining. In addition to his normal responsibilities, Ganesh was entrusted with the job of training the sales executives of that city and the nearby areas on the outskirts of that city. The firm sold electronic instruments to industries, schools, colleges, banks, cinemas and other industries.
- Ganesh gave Sumit the catalogues and pamphlets describing in detail the types of electronic equipment sold by the company and the company background and showed him to his assigned desk. Thereafter, Ganesh excused himself and did not return. He did not even respond to the calls made and the messages sent by Sumit to seek clarifications though he is free. Sumit spent the whole day scanning the material and late in the evening he picked up his things and went home.
- Which of the following best describes Ganesh's training methodology?
- The trainees were expected to be fully prepared for the job before they join.
 - The trainees were trained by letting them work on their own without the help of senior officers.

- (C) Ganesh's training programme is not suited for the firm.
- (D) Training aims at providing circumstantial pressure on the trainee.
- (E) All the above

Directions for questions 46 and 47: Answer the questions based on the information given below.

Ambuja solutions, the logistics firm was growing steadily. The huge growth of the organization brought to the fore the need to recruit employees. The HR manager found that it is not difficult to recruit unskilled employees but recruiting people at the middle and top management level is going to be an uphill task. The HR team has formed a team to attract people who are already employed, busy in their jobs and are passive job seekers. The team has come up with their report indicating the reasons for looking for a change of job, their attachment to the present organization, the quantum of job satisfaction they are deriving now, their views regarding a conducive work atmosphere, etc. The team has found that these passive job seekers become active when a new employer approaches them through common friends.

46. Which of the following is a possible reason behind the HR manager's attempt to attract employees of other organizations?
- (A) Fresh candidates lack experience.
 - (B) To weaken the other organizations.
 - (C) Amount spent on training new employees can be reduced.
 - (D) Experienced personnel are required for middle and top management.
 - (E) To infuse fresh competition among the middle and top managers.
47. Based on the findings of the report which of the following steps would help the organization to attract passive job seekers?
- (A) Advertise the openings in the organization.
 - (B) Talk negative about other organizations.
 - (C) Encourage their employees to bring in potential candidates among friends and acquaintances.
 - (D) Increase the salary paid to the existing employees in the middle and top management
 - (E) Find out what keeps an employee loyal to an organization.

Directions for questions 48 to 50: Answer the questions based on the information given below.

Ravi's father is working as an agent for an insurance company. Ravi has developed interest in the field of insurance. He used to go through all insurance related laws and regulations. He appeared for several competitive exams conducted to recruit people into insurance companies. Finally, the day of joining his dream job had come. He was called for an

interview for the post of sales manager in a major multinational insurance company. He prepared meticulously for the interview. He had gone through the fundamentals of his areas of interest and study. His father conducted several mock interviews.

Ravi arrived at the venue of the interview 15 minutes before time, but the interview started one hour late. During this time, he tried to complete the pre-interview formalities. The receptionist appeared to be ill-trained and lethargic. Ravi did not feel confident that the receptionist had gone through the formalities properly. The interview rooms were more intimidating. None of the six members on the panel returned the pleasantries nor did they ask Ravi to sit. After standing for several minutes (which appeared to be several years for Ravi) one of the panel members asked Ravi to sit, but not in a pleasing manner. The chair offered to Ravi was quite uncomfortable. The attitude of the panel seemed like 'you need us, but we do not need you'. Most of the questions asked were not directly related to insurance, moreover several of them appeared sarcastic. Ravi kept his cool and answered most of the question carefully. At the end, when the panel asked him if Ravi had any questions, the exhausted Ravi, though he had prepared a list of questions, said no and left the room in disgust after thanking the panel.

48. Which among the following qualities is the interview panel trying to test in Ravi?
- (i) Resistance to change
 - (ii) Aggressiveness
 - (iii) Patience
 - (iv) Behaviour while under pressure
 - (v) Persistence
- (A) Only (i), (ii) and (iii)
 - (B) Only (iii) and (iv)
 - (C) Only (i), (iii) and (iv)
 - (D) Only (ii) and (v)
 - (E) Only (ii) and (iii)
49. Which of the following is a possible reason, why Ravi did not ask any question, even though he was given a chance to do so?
- (A) Ravi had succumbed to the preemptive tactics played by the panel.
 - (B) Ravi thought that the panel was probably not interested in him.
 - (C) Ravi made an assessment of the work environment that he may have to face.
 - (D) Ravi had decided that insurance was not his cup of tea.
 - (E) None of the above
50. Which of the following denotes both the positive and negative traits of Ravi that were displayed during the interview?

- (A) Punctuality; Resistance
- (B) Enthusiasm; Pessimism
- (C) Temperament; Hardworking nature
- (D) Enthusiasm; Resistance
- (E) Patience; Pessimism

Directions for questions 51 to 60: There is a passage given followed by certain directions. Read the directions given under the passage carefully before answering the questions that follow.

M/s. Anant Printers is a small printing press. It has three treadle machines, one modern offset machine and DTP equipment. It has nine workers for all the jobs in the press. The whole unit is just like a family and the proprietor has excellent relations with the workers. The press has a large number of orders. There is good demand and it can increase its operations, if the proprietor wishes to do so.

The proprietor has come across four offset machines in a medium-size press at Mumbai, which has been closed due to the death of its owner. If the proprietor purchases these machines, the total number of workers would increase to twenty. The trade union would come forward and build a union of the workers in M/s. Anant Printers. It is difficult to anticipate whether the wage rates could be maintained at the same level after union is formed.

One alternative is to import fully automatic machine from Germany, then the number of workers could be limited, but the capital cost is very high, besides skilled technicians will have to be appointed to run the modern automatic machines. The cost of production is expected to be very heavy.

Directions: The questions that follow relate to the preceding passage. Evaluate, in terms of the passage, each of the item given. Then select your answer from one of the following classifications.

- (A) A Major Objective in making the decision: One of the goals sought by the decision.
- (B) A Major Factor in making the decision: An aspect of the problem, specifically mentioned in the passage,

that fundamentally affects and/or determines the decision.

- (C) A Minor Factor in making the decision: A less important element bearing on/ or affecting a major factor, rather than a major objective directly.
- (D) A Major Assumption in making the decision: A projection or supposition arrived at by the decision maker before considering the factors and alternatives.
- (E) An Unimportant issue in making the decision: An item lacking significant impact on, or relationship to, the decision.

Questions:

51. Funds are available for purchasing either of the machines.
52. Union may be formed and wage rate may not be at the present level.
53. Import of machinery would involve heavy capital cost, leading to rise in cost of the production.
54. Harmonious relations exist between the present set of workers and management.
55. Operations can be expanded.
56. Union may not accept the level of wages being paid now.
57. The owner of the offset printing press in Mumbai is dead.
58. If production capacity is not increased, then potential business could be lost to rivals.
59. Buying old machines may not keep the company in the forefront of technology.
60. New imported machinery will lead to better quality resulting in more business.

ANSWER KEYS

- | | | | | | |
|---------|---------|---------|---------|---------|---------|
| 1. (C) | 11. (B) | 21. (B) | 31. (B) | 41. (A) | 51. (C) |
| 2. (C) | 12. (C) | 22. (D) | 32. (B) | 42. (A) | 52. (B) |
| 3. (D) | 13. (A) | 23. (B) | 33. (D) | 43. (B) | 53. (B) |
| 4. (B) | 14. (D) | 24. (B) | 34. (E) | 44. (E) | 54. (B) |
| 5. (C) | 15. (B) | 25. (D) | 35. (C) | 45. (B) | 55. (D) |
| 6. (A) | 16. (D) | 26. (D) | 36. (E) | 46. (D) | 56. (D) |
| 7. (A) | 17. (B) | 27. (C) | 37. (B) | 47. (C) | 57. (E) |
| 8. (D) | 18. (A) | 28. (B) | 38. (C) | 48. (B) | 58. (C) |
| 9. (D) | 19. (A) | 29. (B) | 39. (A) | 49. (B) | 59. (E) |
| 10. (C) | 20. (C) | 30. (B) | 40. (D) | 50. (E) | 60. (C) |

SOLUTIONS

Solutions for questions 1 to 5:

Q.No.	Number	(1) Seven digits	(2) At least 2 prime digits	(3) First and last digits are perfect squares. [6] First and last digits are even	(4) Middle digit even [7]. All digits are odd.	(5) Digits are in increasing order from left to right.
1	1778459	✓	✓	✓	✓	×
2	4276891	✓	✓	✓	✓	×
3	1367574	✓	✓	✓	×	×
					[X]	
4	9632578	✓	✓	×	✓	×
				[X]		
5	4556662	✓	✓	×	✓	×
				[✓]		
6	4368579	✓	✓	✓	✓	×
7	1366789	✓	✓	✓	✓	✓
8	9517531	✓	✓	✓	×	×
					[✓]	
9	1573934	✓	✓	✓	×	×
					[X]	
10	964374	×	✓	✓	×	×

1. Satisfies all the basic conditions.
∴ Superior number.
2. Satisfies all the basic conditions.
∴ Superior number.
3. Does not satisfy condition (4) and also its alternate condition.
∴ Garbage number.
4. Does not satisfy condition (3) and also its alternate condition.
∴ Garbage number.
5. Does not satisfy condition (3) but satisfies the alternate condition.
∴ Mutual number.

Solutions for questions 6 to 11: The four basic conditions from (a) to (d), given in the selection criteria are as shown in the

table below. In case a basic condition is violated, the case is verified for the respective alternate condition given. The alternate conditions are as given below:

(e) If condition (d) is violated, but at least one relative of the candidate is presently staying in Andhra Pradesh (AP) for the last 5 years, then the candidate can be admitted.

(f) If condition (b) or (c) is violated, but not both and the candidate has a good sports record, then the candidate should be advised to approach the Principal.

(g) If both the conditions (a) and (b) are violated, but the candidate is ready to donate ₹1,00,000 to the college, then the candidate should be advised to approach the Secretary.

Now let us scrutinize the applicants for the basic conditions, as given in the table below (a tick mark '✓' means that the condition is fulfilled, cross mark 'X' means that the condition is violated).



Question number	Name of the candidate	(a) SSC \geq 80% or CBSE \geq 70%	(b) Entrance exam \geq 60%	(c) Age \geq 16 years, male candidate	(d) Resident of AP	Remarks
6	Jahangir	✓	✓	✓	×	(d) violated
7	Rita	✓	✓	×	✓	(c) violated
8	Prakash	×	✓	✓	✓	(a) violated
9	Ranga	×	×	✓	✓	(a) and (b) violated
10	Ram	×	×	✓	✓	(a) and (b) violated
11	Rahim	×	×	? (age)	?	(c) and (d) unknown, (a) and (b) violated

6. In this case, condition (d) is violated, i.e., Jahangir is not a resident of AP. Hence, his case is verified for the alternate condition (e). Since, a close relative of Jahangir has been staying in AP for the last 10 years (i.e., more than the required 5 years), Jahangir is selected.
7. In this case, condition (c) is violated, i.e., Rita is a female. Then the alternate condition (f) is applied. As Rita has a good sports record (represented state in basketball), she should approach the Principal.
8. In this case, condition (a) is violated. As there is no alternate condition given for violating condition (a) alone, admission cannot be granted to Prakash.
9. In this case, both the conditions (a) and (b) are violated. Then, Ranga's case is verified for the alternate condition (g). As Ranga is ready to pay a donation of ₹1,00,000, he should be advised to approach the Secretary of the school.
10. In this case, both the conditions (a) and (b) are violated, hence, the alternate condition (g) is applied. As Ram is ready to pay a donation of more than ₹one lakh, he should be advised to approach the Secretary of the school.
11. In this case both the conditions (a) and (b) are violated in lieu of which the alternate condition (g) is satisfied

(i.e., Rahim can pay a donation of ₹1,00,000). But, no information is available to check conditions (c) and (d). Hence, we cannot take a decision as the data is inadequate.

Solutions for questions 12 to 17: The four basic conditions, from (a) to (d), given in this selection criteria are as shown in the table below.

In case a basic condition is violated, the respective alternate condition is applied in order to take a decision.

The alternate conditions are as given below:

(e) If condition (a) is violated and the hero has a success rate of greater than 50% in films but has a good success rate with the heroine he is going to work with in the film, then take the suggestion of the heroine. OR

If condition (a) is violated, but the hero is successful in the type of films the Producer is making, then take the advice of the Producer.

(f) If condition (c) is violated, but the hero demands a remuneration of less than ₹50 lakhs, then he can be selected.

(g) If condition (d) is violated, but the hero can work for at least 15 days in a month, may not be continuous, then the hero can be selected.

Now let us scrutinize all the applicants for the basic conditions (from (a) to (d)) as given in the table below (a tick mark '✓' means that the condition is fulfilled and a cross mark '×' means that the condition is violated):

Question number	Name of the hero	(a) Success rate as a hero \geq 70%	(b) Time spent in the industry \geq 5 yrs	(c) Remuneration < 10 lakhs	(d) Dates continuous \geq one week	Remarks
12	Romeo	✓	✓	✓	✓	All conditions are satisfied
13	Chris	×	?	×	?	(b) and (d) unknown and (a) and (c) are not satisfied.

(Continued)

Question number	Name of the hero	(a) Success rate as a hero $\geq 70\%$	(b) Time spent in the industry ≥ 5 yrs	(c) Remuneration < 10 lakhs	(d) Dates continuous \geq one week	Remarks
14	Ritesh	×	✓	✓	✓	(a) violated
15	Rajesh	✓	✓	✓	×	(d) violated
16	Hasmukh	×	✓	✓	✓	(a) violated
17	Roopesh	?	✓	✓	?	(a) and (d) unknown

12. In this case, Romeo satisfies all the conditions. Hence, he is selected as a hero.
13. In this case, condition (a) is not satisfied, as the information given regarding the success rate is not that of his success as a hero. Similarly, (c) is not satisfied, as he charged more than 10 lakhs per film. Conditions (b) and (d) cannot be checked, as Chris's experience in the industry and whether he can give dates continuously for at least one week is not known. Hence, the data is inadequate for taking a decision.
14. In this case, condition (a) is violated, then the alternate condition (e) is tested. As Ritesh has 90% hits in the type of films the producer is making, Producer's advice should be taken.
15. In this case, condition (d) is violated. But as Rajesh can give dates for 18 days in a month, (i.e. more than the required 15 days in a month, as in condition (g)), hence Rajesh is to be selected as the hero.
16. In this case, condition (a) is violated. But as Hasmukh is very successful with the heroine of the film, he fulfils the alternate condition (e). Hence, the suggestion of the heroine should be taken.
17. In this case, both the conditions (a) and (d) cannot be checked, as Roopesh's track record for all the 8 years is unknown, and also his ability to give dates is not mentioned, hence data is insufficient to take a decision.

Solutions for questions 18 to 23:

Question number	(a) Every student attended all lectures	(b) No body watched the movie earlier	(c) Theatre ≤ 3 kms	(d) Every student agrees	Remarks
18	✓	✓	✓	✓	All conditions are satisfied.
19	×	✓	✓	✓	(a) violated
20	✓	✓	×	✓	(c) violated
21	✓	×	✓	✓	(b) violated
22	✓	×	✓	✓	(b) violated
23	✓	×	✓	✓	(b) violated

18. In this case, as all the conditions are satisfied. Hence, the group will watch the movie.
19. In this case, condition (a) is violated, as three students out of ten have not attended all their lectures. As three is less than half of ten (the total number of students in the group), these three students should attend their lectures and others should proceed to watch the movie, as given in the alternate condition (e).
20. In this case, the theatre is more than 3 km away. Hence, condition (c) is violated. But as at least two seniors are accompanying them to watch the movie, the alternate condition (g) is fulfilled. Hence, all of them can go to watch the movie.
21. Here, condition (b) is violated, i.e., 2 out of 10 students have already watched the movie earlier. But as the movie is a hit and more than half the total number of students (i.e., 8 out of 10) would be watching the movie for the first time, the alternate condition (f) is satisfied. Hence, all of them go to watch the movie.



22. In this case, condition (b) is violated as some students have seen the movie earlier. As the number of these students is less than half of the total number of students in the group, the alternate condition (f) is fulfilled. Hence, all of them go to watch the movie.
23. In this case, condition (b) is violated as some students have seen the movie earlier. As the number of these students is less than half of the total number of students in the group, the alternate condition (f) is fulfilled. Hence, all of them go to watch the movie.

Solutions for questions 24 to 30:

Question number	(a) Land cost < 20L	(b) Estimated cost of construction < 30L	(c) Posh locality	(d) Loan ≥ 20L @ maximum of 18% p.a.	Remarks
24	✓	×	✓	✓	(b) violated
25	✓	✓	✓	?	(d) unknown
26	×	✓	✓	✓	(a) violated
27	×	✓	✓	×	(a) and (d) violated
28	✓	✓	?	?	(c), (d) unknown
29	✓	✓	✓	×	(d) violated
30	✓	✓	×	✓	(c) violated

24. In this case, condition (b) is violated, as the estimated cost of construction is more than ₹30 lakhs. As there are flats available in that locality on the ground floor, the respective alternate condition (f) is fulfilled.
25. In this case, the loan amount is not specified, which is required to check condition (d). Hence, the data is inadequate to take a decision.
26. In this case, the cost of the land is more than ₹20 lakhs. Hence, condition (a) is violated. As there is no alternate condition for the same, the house cannot be constructed.
27. In this case, the land cost is ₹20 lakhs, whereas according to condition (a) the cost of land should be less than ₹20 lakhs. Hence, condition (a) is violated. As there is no alternate condition for the same, the house cannot be constructed.
28. As no information is available to check conditions (c) and (d), the data is inadequate to take any decision.
29. Here, condition (d) is violated, as the loan available is less than the stipulated ₹20 lakhs. But the alternate condition (e) is satisfied as the loan available is ₹15,00,000, i.e., more than the stipulated ₹12 lakhs and the interest rate is 10%, i.e., less than the stipulated 12%. Hence, the matter is to be discussed with the family members.
30. In this case, condition (c) is violated as the land is not located in a posh locality. However, as all the basic amenities are available nearby, the alternate condition (g) is satisfied. Hence, the matter should be discussed with the family members.
- Solutions for questions 31 to 36:*
31. It is implied in the second sentence of para 4, 'This reiterated the company's belief.....' that the industry's policies should be employee friendly and the industry should adapt itself to the employees' requirements.
32. Refer to the 2nd para of the passage where it is stated that the human-centric work philosophy of Volvo did not match with the fiercely competitive work atmosphere of the 1990s.
33. It is implied in the passage that the closure of Volvo's plants at Uddevalla and Kalmar convey that policies should be designed according to the needs of the time (choice A). It is implied in the second third and fourth paragraphs of the passage that choices (B) and (D) can be inferred from the failure of the policies implemented by Volvo at Uddevalla and Kalmar.
34. Refer to the last paragraph of the passage where it is stated that all the given options speak about the positive outcome of Volvo's fiasco.
35. It is implied in the passage (particularly in the last para) that valuable lessons were learnt in the area of employee relations and productivity.
36. Refer to para 5 of the passage according to which all the given options are applicable.

Solutions for questions 37 to 40:

37. The passage says that the Programme Manager sought feedback on his leadership this indicates that he is keen on doing his best. So, it is certain that he would act on the advice given to him by his team members and become more open to their suggestions. Choice (D) is incorrect as it states 'how' it would be effective but not about the effect it would have.
38. The passage speaks about the importance of networking in an organization. Hence, the skill of networking is a skill every potential manager should develop. Statement – A which talks about hierarchies is rather digressing. (B) does not capture the most essential aspect of the para. (D) and (E) are not relevant to the context.
39. Encouraging employees to discuss ideas with their colleagues in order to gain insights into their technical and market feasibility is essential because such a step would enhance the value of ideas or if they are not feasible it would be abandoned before implementation, thereby saving valuable time and resources. Hence, (A) is most logical and practical.
40. The loyalties of the old customers are already established. Hence, a retail manager need not make any special efforts to lure them. But during times of recession, when the spending is low, the best way of attracting new customers is by tempting them with attractive deals. This will serve the dual purpose of retaining old customers and attracting new ones.

Solutions for questions 41 to 43:

41. Brijesh Goswami was quoted as saying he had been appalled by the retrenchments and was not aware of the sackings of 1000 employees, but the decision to retrench 1000 employees cannot be taken without prior permission from the chairman. Hence, Brijesh Goswami had capitulated under pressure from external parties.
42. The company cannot lay off its employees without prior notice and hence,
Choice (A) is definitely a flaw in the decision of the senior business manager. The question of future recruitment comes into picture when the company survives. The present problem for the company is survival. Hence, (B) is not a flaw. Choice (C) is irrelevant in the context of the question. The decision taken by Udaan does not have any effect on other companies in the industry. Hence, (D) is not a flaw.
43. It is not known whether the company has excess planes or not and it is possible that as the situation improves the company would have a shortage of planes for its requirement. For a company in loss, it is a normal practice for the employees to take a pay out to save the job and also the company. So, his company could have

considered this option after taking all the employees into confidence. Reducing fare below that of its competitors would force others to follow suit which would further bleed the industry and increase the loss. Employees with experience would have higher salaries than freshers, but as experience would count a lot in any situation, (D) is not a better way to cope with the losses.

Solution for question 44 and 45:

44. As only the trainees were allowed flexible working hours, the argument that there was a discrimination would be weakened. Hence, option (E) weakens her argument.
45. Ganesh gave Sumit all the details related to the company and its products and expected Sumit to learn the work on his own.

Solutions for questions 46 and 47:

46. Choice (A) indicates the drawback with fresh employees but does not talk about the advantage in recruiting employees of other organizations. From the passage it is clear that the organization is growing and there is a need to recruit new employees. Hence, (B) is not a reason. According to the HR manager the difficulty lies in finding the required people but not training them. Hence, (C) is not a reason. HR manager did not find a difficulty in recruiting unskilled people but the problem is with filling middle and top management posts. This implies that the HR manager is looking for experienced people. Hence, (D) is a reason.
(E) is out of context.
47. It is stated that the passive job seekers become active when a new employer approaches them through common friends. Hence,
choice (C) would help the HR manager to attract the target group.

Solutions for questions 48 to 50:

48. The panel is trying to reflect the 'you need me, but I do not need you' kind of attitude that some of the customers would show. The quality that is required in such cases is patience. The panel decided to make things unpleasant for Ravi to check how he would react when faced with a similar situation during the course of his work. The panel is trying to test his patience and his behaviour under pressure.
49. As Ravi faced a panel which was behaving in an unfriendly manner and was also asking him questions that were not directly related to insurance, he could have felt that the panel was not interested in him.
50. Ravi had kept his cool in the face of an unfriendly atmosphere. Thus, he is successful in showing good levels of patience. Ravi has seen the entire interview with



pessimism. It is clear from the sentence. The attitude of the panel seemed like....' and the sentence 'several of them are sarcastic'. This is also evident from the fact that Ravi has not asked the panel any question, though he was prepared with some questions and he was given a chance to ask questions. From this it is clear that he was pessimistic throughout. He left the interview in disgust.

Solutions for questions 51 to 60: Situation Analysis:

The present status of Anant Printers is, it is comfortably placed in terms of orders and the other business basics like a dedicated work force and adequate number of machines. However, the important aspect/issue that is raised in the passage is evident from the statement, 'There is good demand and it can increase its operations, if the proprietor wishes to do so'. The issue, hence, is of growth. The important decisions that are under consideration are mentioned below:

- (1) Whether to expand operations / volumes or to stay at the present level of volumes.
- (2) If expanding of operations is chosen, then the choice between the 'four offset machines' and the 'fully automatic machine' is to be made.

The worker relations and the final cost of production are evidently, the major criteria that need consideration.

Also, the other criteria that is required to be considered would be the wage rates, availability of skilled technicians, required capital, costs, etc.

51. The availability of funds is not explicitly mentioned as a concern/problem in the passage. Hence, it can be concluded that funds are not a major factor in making the decision. At the same time, it cannot be said that the availability of funds is not important for the decision making involved. Hence, this is a minor factor in making the decision.
52. Since the present state is that '...the proprietor has excellent relations with the workers...' and 'The whole unit is like a family...', the formation of the union will have a significant impact on these pleasant relations (and also the wage rate). This is a major factor in making the decision.
53. The final cost of production is an important factor as it affects the basic competitiveness of the press. Hence, if

imported machinery leads to high cost of production it will be a major factor in making the decision.

54. As already mentioned in the solution to Q. no. 22, the fact that harmonious relationships exist between the workers and the management is an important and major factor in making the decision.
55. The entire passage is regarding the issue of expanding operations, which is the major objective in making the decision. However, to suppose that it is possible to do so, (i.e., that there will be adequate demand) is in fact a major assumption in the decision-making process.
56. Since the basic information from the passage says 'It is difficult to anticipate whether the wage rates could be maintained at the same level after the union is formed', to suppose that the union may not accept the level of wages being paid now would be a major assumption.
57. The fact whether the owner of the offset printing press is dead or alive has practically no significance or impact on the decision-making process. It is an unimportant issue.
58. If there was a possibility of losing the "present business" to rivals, then it could be considered as a major factor in making the decision. However, the passage states 'There is good demand and it can increase its operation...' This implies that the 'present business' is not under any threat. 'Potential' business being lost to rival would not be a major factor but can be considered as a minor factor in the decision-making process.
59. The issue of being in the forefront of technology has neither been mentioned nor alluded to in the passage. Hence, this is a relatively unimportant issue in the present decision-making scenario.
60. Since it is mentioned in the passage that the present business is good and that the demand is adequate, with scope for expanding operations, improving quality is not a necessity or a major factor. However, since better quality will help win more business, it cannot be considered unimportant either. Hence, it is appropriate to consider this as a minor factor.

11

Non-verbal Reasoning

CHAPTER

LEARNING OBJECTIVES

In this chapter, you will:

- Learn about different models of non-verbal reasoning questions like:
 - Series
 - Analogies
 - Odd man out
- Learn about different patterns in which elements behave, like:
 - Shifting
 - Rotation
 - Image formation
 - Increasing/reducing the number of elements
 - Substitution

The questions in this section do not occur frequently in the CAT but carry a high weightage in the Other Management Entrance Tests (OMETs) such as, XAT, IIFT, MH-CET, MAT, etc.

INTRODUCTION

Under Non Verbal Section, you get combination of Reasoning questions but broadly asked in symbols/image format.

The questions could range from: Series, Analogies, to Odd man out etc. We can understand them better with the help of below exercise.

EXERCISES

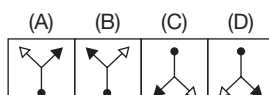
Directions for questions 1 to 5: In each of the following questions there are two sets of figures. One on the left side (problem figures) and the other on the right side marked (A), (B), (C)

and (D) (answer figures). Select one figure from the answer set which will continue the same series as given in the problem set of figures.

Problem figures

Answer figures

1.



*	*	*	*	*
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*		*	*	*
---	--	---	---	---

@	Δ		Δ	K	\$?	Δ
		P	Δ			Δ		

= Δ	= Δ	= Δ	= Δ
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$\begin{array}{c} P > \$ \\ \# / Z \\ \Pi \end{array}$	$\begin{array}{c} \# P > \\ \square / Z \\ \$ \end{array}$	$\begin{array}{c} \$ Z \square \\ \rightarrow / P \# \\ \end{array}$	$\begin{array}{c} \$ Z \\ \rightarrow / ? \\ ? / \# \square \end{array}$	$\begin{array}{c} \square \# ? \\ @ / \$ \\ \rightarrow \end{array}$
--	--	--	--	--

$\begin{array}{cc} ? & \# \\ \$ & @ \end{array} \rightarrow$	$\begin{array}{cc} + & \square \\ @ & ? \end{array} \rightarrow$	$\begin{array}{cc} \$ & @ \\ + & \square \end{array} \rightarrow$	$\begin{array}{cc} @ & \square \\ + & ? \end{array} \rightarrow$
--	--	---	--

form a series if they change from left to right according to the same rule. The number of the 'Answer Figure' which should be placed in the question marked space is the answer. All the five figures, i.e., four 'Problem Figures' and one 'Answer Figure' placed in the question marked space should be considered as forming the series.





Answer figures





Δ	Δ	?	Δ	Δ
----------	----------	---	----------	----------





Δ	Δ	Δ	Δ
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☆	☆ ☆	?	☆
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☆	☆	☆	☆




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			?	
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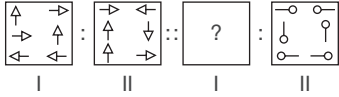
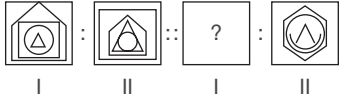
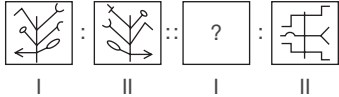
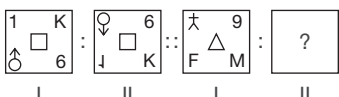
			
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	?			
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Answer figures

	=	-			-	=	
							

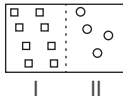
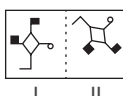
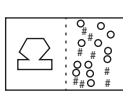
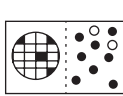
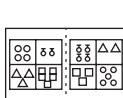
12.  (A) (B) (C) (D)
13.  (A) (B) (C) (D)
14.  (A) (B) (C) (D)
15.  (A) (B) (C) (D)

Directions for questions 16 to 20: In each of the following questions a pair of problem figures is given at the left extreme followed by four pairs of answer figures. The left figure in the problem figures bears a certain relationship with the right

figure. Out of the four pairs given in the answer figures one is similar to that pair given in the problem figures. Find out the answer pair by comparison.

Problem figures

Answer figures

16.  (A) (B) (C) (D)
17.  (A) (B) (C) (D)
18.  (A) (B) (C) (D)
19.  (A) (B) (C) (D)
20.  (A) (B) (C) (D)

Directions for questions 21 to 25: In each of the following questions three out of the given four figures are similar in a certain way and hence, they form a group. Find the one which does not belong to that group.

21. (A) (B) (C) (D)
-
22. (A) (B) (C) (D)
-

23. (A) (B) (C) (D)
-
24. (A) (B) (C) (D)
-
25. (A) (B) (C) (D)
-

Directions for questions 26 to 35: In each of the following questions, in three out of the four pairs of figures, element II is related to element I in the same particular pattern. Find out the pair in which the element II is not so related to element I.

26. (A) (B) (C) (D)
-
27. (A) (B) (C) (D)
-
28. (A) (B) (C) (D)
-
29. (A) (B) (C) (D)
-
30. (A) (B) (C) (D)
-
31. (A) (B) (C) (D)
-

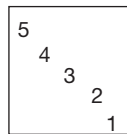
32. (A) (B) (C) (D)
- | | | | | | | | | | | | | | | | |
|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|
| □ | △ | △ | ◇ | ○ | □ | ○ | △ | △ | ○ | ◇ | ○ | △ | ▷ | □ | ◇ |
| ○ | △ | ○ | △ | □ | △ | △ | □ | □ | ◇ | △ | △ | ○ | □ | ○ | △ |
| I | II | I | II | I | II | I | II | I | II | I | II | I | II | I | II |
33. (A) (B) (C) (D)
- | | | | | | | | |
|---|----|---|----|---|----|---|----|
| | | | | | | | |
| I | II | I | II | I | II | I | II |
34. (A) (B) (C) (D)
- | | | | | | | | | | | | | | | | |
|-------|----|---|----|-------|----|---|-------|---|----|-------|----|---|----|---|----|
| A B C | B | V | C | D E F | E | D | G H I | H | G | J K L | L | J | M | N | O |
| I | II | I | II | I | II | I | II | I | II | I | II | I | II | I | II |
35. (A) (B) (C) (D)
- | | | | | | | | | | | | | | | | |
|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| I | II | I | II | I | II | I | II | I | II | I | II | I | II | I | II |

ANSWER KEYS

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

SOLUTIONS

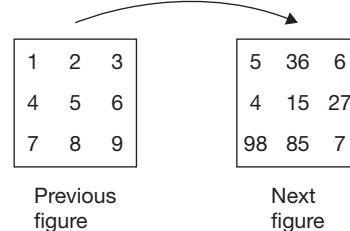
- In each figure, the mirror image and the water image are taken alternately to get the appropriate answer figure (A).
- Let the elements in each figure be:



The elements are swapped. From the second figure to the third figure, the 2nd and the 3rd elements are swapped. Similarly, the 3rd and the 4th, the 4th and the 5th, and

the 5th and the 1st elements are swapped cyclically in the remaining figures.
 \therefore The appropriate answer figure is (C).

- The elements in the first figure are rearranged as shown below to get the next figure.





A similar logic is applied from the third to the fourth and from the fifth to get the answer figure.

∴ The appropriate answer figure is (B).

4. The element ✓ is appearing 2 times, 3 times, 4 times, 5 times, 1 time and 2 times cyclically.
The element o is appearing 4 times, 5 times, 1 time, 2 times, 3 times and 4 times cyclically.
The element \$ is appearing 3 times, 4 times, 5 times, 1 time, 2 times and 3 times cyclically.
∴ The appropriate answer figure is (D).
5. The elements are shifted to adjacent blocks in clockwise direction and opposite blocks alternately and a new element is appearing in each figure in the place of bottom left element.
∴ The appropriate answer figure is (D).
6. The element is shifted by $\frac{1}{2}$ a side, 1 side, $1\frac{1}{2}$ sides, 2 sides in CW direction, respectively.
∴ The appropriate missing figure is (C).
7. The element is shifted by each time $\frac{1}{2}$ a side in CW, 1 side in ACW, $1\frac{1}{2}$ sides in CW and 2 sides in ACW directions, respectively.
∴ The appropriate missing figure is (B).
8. The element is shifted by each time $\frac{1}{2}$ a side, 1 side, $1\frac{1}{2}$ sides and 2 sides in CW direction and rotated by 45° in ACW, 90° in CW, 135° in ACW, 180° in CW, respectively.
∴ The appropriate missing figure is (D).
9. The element is rotated by 45° , 90° , 135° and 180° in CW direction, respectively.
∴ The appropriate missing figure is (A).
10. The number of sides of an element is increased each time by 1.
∴ The appropriate missing figure is (D).
11. In the first pair, from the second figure frame to the first figure frame, each element is increased by one side and shifts to the next position in clockwise direction. The similar pattern is followed in figure (A).
12. The elements in the first column are rotating by 90° and the elements in the second column are rotating by 180° . The top left and the bottom left elements are rotating in clockwise direction and the middle left element is rotating in anticlockwise direction.
Answer figure (D) is related to frame (II) of the problem figure in the same way.
13. In the first pair, from the second frame to the first frame the outer two figures are interchanged and the inner two figures are interchanged. Similar pattern is followed in figure (C).
14. The left hand side top element is interchanging with right side middle element. The right hand side top element is interchanging with the left hand side middle element. The bottom two elements are interchanged. Similar pattern is followed in figure (B).
15. The top left element and the bottom left element interchanged their positions and formed water images. Similar changes have taken place for the top right and the bottom right elements. The element at the centre rotated by 180° . This pattern can be established in the second pair by replacing the question mark with the answer figure (C).
16. In the question figure, the number of elements in second segment is half of the number of elements in the first segment. Figure (C) also poses the same relationship.
17. The water image of the element in the first segment of the question figure has been rotated by 45° in anticlockwise direction.
Figure (A) also poses the similar relationship.
18. In the question figure, the number of elements in the second segment of the figure is double the number of sides in the first segment of the figure.
Figure (D) also poses the similar relationship.
19. In the first segment of the question figure, the ratio of the number of shaded to that of unshaded elements is 1 : 4 and in the second segment it is 4 : 1. The ratio between the shaded to the unshaded is constant in the first segment and in the second segment. Figure (C) also poses the similar relationship.
20. Let us represent the figure as follows:

1	2
3	4

The number of elements in each segment will always remain the same and the elements are shifting in the second segment as follows:

4 → 3
3 → 2
1 → 4
2 → 1

Figure (A) poses the similar relationship.

21. In each figure, the left element is symmetric about the vertical axis and the second element is symmetric about the horizontal axis. Figure (D) does not follow this pattern.
22. Figure (B), (C) and (D) have the same figure in different rotated forms. Figure (A) cannot be obtained by rotating any of the other figures.
23. Two out of the four small elements are exactly at opposite places inside the circles except figure (D).
24. The 90° angle between the two arrows in the straight lines is in clockwise direction, but in (D) it is in anticlockwise direction.
25. All the elements are in opposite directions except in figure (D).
26. In each figure the second segment of the figure is the mirror image of the first figure, which has been rotated by 45° in clockwise directions.
- Figure (B) does not follow such pattern.
27. Here, in each figure, except figure (1), the elements which are five in number are becoming four. Similarly, the elements which are 3, 2 and 1 in number are becoming 2, 3 and 6, respectively.
- Figure (A) does not follow this pattern.
28. In each figure three lines are headed by three elements, out of three, one is shifting to the next line in anticlockwise direction and the other two are shifting to next line in clockwise direction. The figure (A) does not follow this pattern.

29. Each of the elements in the frame are shifting to new position without any rotation as shown below.

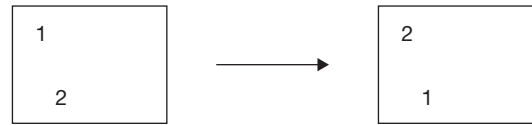
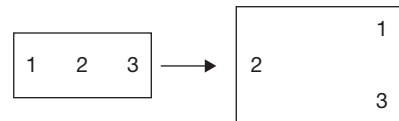


Figure (D) does not follow this pattern

30. In each pair the mirror image of upper element is rotated by 90° in anticlockwise direction. The water image of lower element is rotated by 90° in clockwise direction. Fig. (C) does not follow the above pattern.
31. The outer element is rotated by 135° in an anticlockwise direction. The inner element is rotated by 135° in a clockwise direction. This is not true in figure (C).
32. One side is added to all the other elements except in the circle. This is not true in figure (A).
33. The number of elements connected to the main figure is equal to half of the total number of the number of sides of the main figure. This is not true in figure (D).
34. The elements are changing their position as follows:



Here, 1 is changing to its water image, 2 is changing to its mirror image and 3 is changing to its water image. This is not true in figure (C).

35. Every element is rotated by 180° . This is not followed in figure (B).

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Unit 5

Mock Tests

Mock Test 1

Mock Test 2

Mock Test 3

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MOCK TEST 1

Directions for questions 1 to 4: Answer the questions on the basis of the information given below and select the correct alternative from the given choices.

Fifteen candidates from A to O were allotted seats in an examination hall. Some of the candidates are from the engineering stream and the others are from the medicine stream. There are 15 chairs in the examination hall, arranged uniformly in three columns and five rows.

The seats were allotted in such a way that no two students from the same stream are adjacent to each other either in a row or in a column. Further, the following information is also known about the students and their seating arrangements.

- (i) Four students, L, M, N and O, not all of who were from the same stream, did not attend the exam and the seats allotted to them were left vacant.
- (ii) In each row, at least one student from each stream attended the exam.
- (iii) While the number of students who were allotted seats was more for one stream, the number of students who attended was more for the other stream.
- (iv) A and B, who belong to the same stream are sitting in the same column and A is sitting in the second row of the second column.

- (v) None of C, D and E are sitting in the corner chair of their respective rows and F, H and J are adjacent to C, D and E, not necessarily in the same order.
- (vi) K and G are adjacent to A and I is to the left of B.

1. Who among the following belongs to a different stream than that of the others?
(A) K (B) G
(C) I (D) J
2. Which pair of candidates among the following pairs cannot sit in the same row?
(A) F and D (B) A and G
(C) J and I (D) B and I
3. If, in each column, there is at least one student from each of the streams, then what is the maximum possible number of students who attended in the right most column?
(A) 2 (B) 3
(C) 4 (D) 5
4. If L and K are from the same stream, then who among the following is sitting in the same row as the seat allotted to L is?
(A) B (B) A
(C) H (D) J

Directions for questions 5 to 8: A company has four departments, such as Finance, Marketing, Production and Administration. The following table provides information about the employees in the four departments. Select the correct alternative from the given choices.

Age (in years)	Finance		Marketing		Production		Administration	
	Male	Female	Male	Female	Male	Female	Male	Female
Less than 30	18	11	22	5	15	7	7	14
30 to 50	15	8	17	3	18	2	5	8
Above 50	21	7	5	0	23	1	4	12
Total	54	26	44	8	56	10	16	34



5. What percentage of employees in the Production department are in the age group from 30 to 50 years?
(A) 25.2% (B) 30.3%
(C) 28.5% (D) 33.6%
6. What proportion of males in the Administration department are more than 50 years old?
(A) 33.3% (B) 21.2%
(C) 25% (D) 28.6%
7. What percentage of female employees in the organization are in the age group between 30-50 years?
(A) 5.2% (B) 7.18%
(C) 9.6% (D) None of the above
8. What is the difference (in percentage points) between the percentage of employees who are males and in the above 50 years age group, and the percentage of employees who are females and in the less than 30 years age group?
(A) 5.2 (B) 9.1
(C) 6.5 (D) 7.8

Directions for questions 9 to 12: Answer the questions on the basis of the information given below and select the correct alternative from the given choices.

A group of five people, namely Manish, Preetam, Akhil, Sunil and Varun visits at least one and at most two of the five cities, such as Bangalore, Chennai, Delhi, Kolkata and Mumbai. We have the following additional information.

- (i) Each city is visited by at least one person and Kolkata is visited by three people.
 - (ii) Manish visits two cities and Bangalore is one of them.
 - (iii) The total number of visits (by the given five people) is 8.
 - (iv) Preetam visits more cities than Sunil, who visits Mumbai.
 - (v) Akhil visits Chennai but not Kolkata.
 - (vi) Varun visits the same cities that Manish visits.
9. Who visits Delhi?
(A) Akhil (B) Manish
(C) Preetam (D) Varun
 10. Which is the city that is visited by Manish but not Preetam?
(A) Bangalore (B) Delhi
(C) Kolkata (D) Chennai
 11. Who among the following visited Mumbai?
(A) Akhil (B) Manish
(C) Preetam (D) None of these
 12. Who among the following did not visit any of the cities that Preetam visited?

- (A) Manish (B) Varun
(C) Akhil (D) None of the above

Directions for questions 13 to 16: Answer the questions on the basis of the information given below and select the correct alternative from the given choices.

The following table gives details of the products manufactured by a company in 2016:

Product	Total Market (In crore)	Market Share of the Company (%)	Profitability of the Company (%)
A	680	12	14
B	1760	15	17
C	520	7	22
D	2350	13	8
E	980	18	11

The following table exhibits the projected increase in the total market size and the projected increase in the market share of the company for each of the given products for the year 2017 by subsequently comparing the corresponding values in 2016.

Product	Projected Increase in the Total Market Size (%)	Projected Increase in the Market Share of the Company (percentage Points)
A	15	3
B	10	5
C	20	2
D	7	7
E	15	2

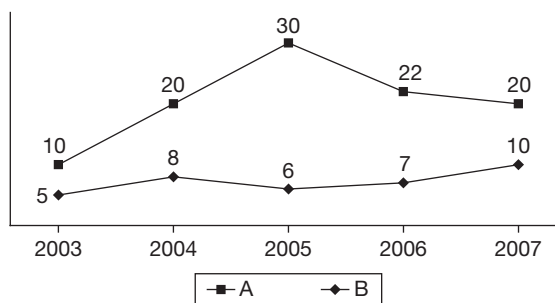
$$\text{Profitability (\%)} = \frac{\text{Profit}}{\text{Sales}} \times 100$$

13. If the company produces only the given five products, then what is the total sales (in crore) of the company in 2016?
(A) 864 (B) 852
(C) 817 (D) 788
14. The profit (in crore) made by the company in 2016 is approximately
(A) 99.8 (B) 102.5
(C) 108.2 (D) 112.7

15. If the profitability of the company for each of the five products in 2017 remains the same as that in the previous year, then the profit (in crore) made from the sales of the products in 2017 would be approximately
- (A) 247 (B) 256
(C) 292 (D) None of the above
16. What is the approximate projected percentage increase in sales of the company in 2017 when compared to that in 2016?
- (A) 82% (B) 56.7%
(C) 49.2% (D) 123%

Directions for questions 17 to 20: Answer the questions on the basis of the information given below and select the correct alternative from the given choices.

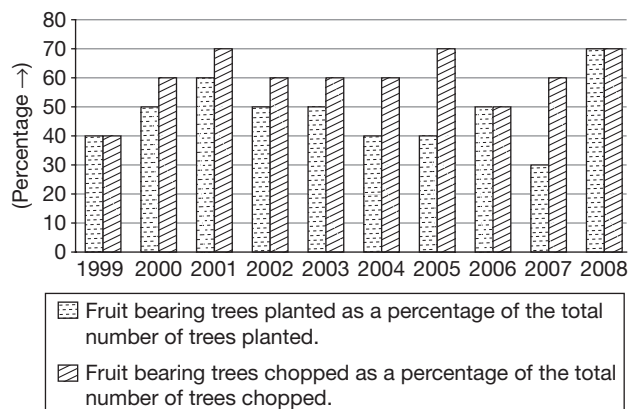
The following line graph depicts the percentage increase in the sales of two companies A and B, in four years from 2003 to 2007, when compared to their sales in the previous year:



17. In which year was the increase in sales for Company A the highest?
- (A) 2004 (B) 2005
(C) 2006 (D) 2007
18. If the ratio of the sales of companies A and B in 2002 was 1 : 2, then in 2004, the sales of A forms approximately what percentage of the sales of B?
- (A) 38% (B) 48%
(C) 58% (D) 68%
19. If the increase in sales of Company A was not more than that of Company B in any of the given years and it is known that the sales of Company A in 2003 were $x\%$ of that of Company B, then what is the maximum possible value of x ?
- (A) 22 (B) 14
(C) 16 (D) 18
20. If the sales of Company B in 2002 was Rs 180 crore, then its sales in 2007 was approximately
- (A) Rs 230 crore (B) Rs 242 crore
(C) Rs 255 crore (D) Rs 292 crore

Directions for questions 21 to 24: Answer the questions on the basis of the information given below and select the correct alternative from the given choices.

The bar graph show below provides information about the planting and chopping of fruit bearing trees for over a period of ten years.



The following changes occurred in the given time period:

- The total number of trees planted in a year increased over that of the previous year in every alternate year starting from 2000 and in the remaining years it decreased over that of the previous year.
- The total number of trees chopped in a year increased over that of the previous year for every year.

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.

21. If the total number of trees chopped increased by 10% every year from 1999 to 2003 and in 2001, the number of fruit bearing trees planted is equal to the number of fruit bearing trees chopped, then in at least how many years from 1999 to 2003 was the number of fruit bearing trees chopped less than the number of fruit bearing trees planted?
- (A) 1 (B) 2
(C) 3 (D) 0
22. What is the minimum number of years in the given period in which the number of fruit bearing trees that are planted, increased over that of the previous year? _____
23. What is the maximum number of years from 2000 to 2008 in which the number of fruit bearing trees that are chopped can be equal to that of the previous year? _____
24. The percentage change in the total number of trees planted with respect to the previous year is same as every year from 2000 to 2008, then the number of fruit bearing



trees planted in the year 2002 can be equal to that of the year

- (A) 2000 (B) 2004
(C) 2008 (D) Cannot be determined

Directions for questions 25 to 28: Answer the questions on the basis of the information given below and select the correct alternative from the given choices..

A group of six people A, B, C, D, E and F are compared with each other in terms of their heights. Further, no two people have the same height. The following information is also known:

- (i) Neither F nor B is the shortest.
- (ii) Neither A nor C is the tallest.
- (iii) F is taller than not more than three people and B is taller than not less than three people.
- (iv) A is taller than E, who is shorter than C, who is shorter than D, who is taller than B.
- (v) F is taller than A but shorter than D.
- (vi) C is taller than A but shorter than B.

25. Which of the following is definitely true?

- (A) B is the second tallest.
(B) F is the third shortest.
(C) C is taller than F.
(D) A is the shortest.

26. Who among the following is ranked as the second shortest?

- (A) A (B) E
(C) F (D) Cannot be determined

27. Which of the following can be the ascending order of their heights?

- (A) DBFACE (B) DBCFEA
(C) DBFCAE (D) None of the above

28. If the number of people shorter than C is the same as the number of people taller than F, then who is the third tallest?

- (A) D
(B) C
(C) F
(D) Cannot be determined

Directions for questions 29 to 32: Answer these questions on the basis of the information given below.

Ashok, Bhargav, Chetan, Dhruv, Eswar, Faizal and Govind were seven students in the same class. After when the marks for the class test in mathematics were announced, they gave the following replies as none of them was happy with their respective marks:

- Ashok : Bhargav, Chetan and I, together scored 195.
Bhargav : Chetan, Dhruv and I, together scored 210.
Chetan : Dhruv, Eswar and I, together scored 196.
Dhruv : Eswar, Faizal and I, together scored 208.
Eswar : Faizal, Govind and I, together scored 213.
Govind : All seven of us together scored 491.

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.

29. How many marks were scored by Dhruv? _____

30. What are the marks scored by Govind? _____

31. If no student had a score less than 50, then who scored the highest marks?

- (A) Bhargav
(B) Dhruv
(C) Govind
(D) Cannot be determined

32. If Eswar scored 65 marks, then how many marks did Bhargav score? _____

ANSWER KEYS

- | | | | | | | |
|------|-------|-------|-------|-------|-------|--------|
| 1. D | 6. C | 11. D | 16. C | 21. A | 25. A | 29. 83 |
| 2. C | 7. D | 12. C | 17. D | 22. 3 | 26. A | 30. 88 |
| 3. B | 8. C | 13. A | 18. C | 23. 2 | 27. D | 31. C |
| 4. A | 9. C | 14. C | 19. D | 24. C | 28. D | 32. 79 |
| 5. B | 10. A | 15. D | 20. C | | | |

SOLUTIONS

Solutions for questions 1 to 4: As no candidates of the same stream are sitting adjacent to each other either in a row or in a column, so the candidates can be arranged in the following ways.

Case (i): Table (i)

E	M	E
M	E	M
E	M	E
M	E	M
E	M	E

Case (ii): Table (ii)

M	E	M
E	M	E
M	E	M
E	M	E
M	E	M

In the above arrangement, E denotes a candidate from the engineering stream and M denotes a candidate from the medical stream

Thus, there will be a maximum of 8 students and a minimum of 7 students from each of the stream who are allotted seats in the hall.

From condition (iii), the number of candidates who did not attend the exam is more for the stream in which more number of candidates are allotted to the hall.

From condition (i), there is at least one candidate from each of the stream who did not attend the exam. Thus, the number of candidates who did not attend is 3 for the stream in which 8 candidates are allotted to the hall and it is 1 for the other stream.

Thus, the number of candidates allotted, the number of people who did not attend the exam and the number of people who attended the exam can be tabulated as follows.

	Stream I	Stream II
Allotted	8	7
Did not attend	3	1
Attend	5	6

Using condition IV and V, we can determine that A, B, C, D and E are sitting in the middle column with A in the second row and B in the fourth and C, D and E in the remaining three rows in any order.

It is known that there is at least one candidate from each stream in each of the rows and as F, H, J belong to the same stream as B (as they are adjacent to C, D, E) and as K and G are adjacent to A so, I must be in the same row as B.

Based on the condition, the candidates are allotted seats as shown in the following table.

F/H/J/-	C/D/E	F/H/J/-
k/4	A	k/4
F/H/J/-	C/D/E	F/H/J/-
I	B	-
F/H/J/-	C/D/E	F/H/J/-

Here, '-' indicates that the seat is / can be left vacant. From the above diagram it can be concluded that A, B, F, H and J belong to one stream whereas C, D, E, K, G and I belongs to the other stream.

1. K, G, I belong to one stream and J belongs to the other stream.
2. From Table (iii), we can see that only B and I are sitting in the fourth row and the third seat is vacant.
3. As K, G, and I belong to the same stream at least one among F, H, J should be in the left most column. The maximum possible number of students in the right most column is two among F, H, J and one among K, G, i.e., a total of 3 candidates.
4. Since L and K belong to the same stream, the seat allotted to L must be the seat to the right of B. From the given options, B is the only person who is sitting in the same row as the seat is allotted to L.

Solutions for questions 5 to 8:

5. Total employees in the Production department = 66
Number of employees in the age group from 30 to 50 years = 20
 \therefore Required value = $\frac{20}{65} \times 100 = 30.3\%$
6. Number of males in the Administration department = 16.
Number of males of age greater than 50 years = 4.
Required value = $\frac{4}{16} \times 100 = 25\%$.
7. Total number of employees in the organization = 248
Number of females in the age group from 30 to 50 years = 21
Required value = $\frac{21}{248} \times 100 = 8.46\%$



8. Number of males in the above 50 years age group as a percentage of total employees = $\frac{53}{248} \times 100 = 21.4\%$

Number of females less than 30 years age group as a percentage of total employees = $\frac{37}{248} = 14.9\%$

The required difference = 6.5 percentage points.

Solutions for questions 9 to 12: Given, Preetam visited more cities than Sunil.

- Preetam visited two cities and Sunil visited one city i.e., Mumbai. Also, given that Akhil did not visit Kolkata (but visited Chennai).
- Manish, Preetam and Varun visited Kolkata.

From the remaining three visits (among the 8 visits) it is given that Manish visited two cities and Bangalore is one of them. Also, Varun visited the same cities as Manish.

As Delhi must be visited by at least one, Preetam visited Delhi.

Akhil	–	Chennai
Manish	–	Bangalore, Kolkata
Preetam	–	Delhi, Kolkata
Sunil	–	Mumbai
Varun	–	Bangalore, Kolkata

9. Preetam visits Delhi.

10. Bangalore is the required city.

11. Only Sunil visited Mumbai.

12. Akhil did not visit any city that Preetam visited.

Solutions for questions 13 to 16:

13. The total sales of the company in 2016

$$\begin{aligned}
 &= 680 \times \frac{12}{100} + 1760 \times \frac{15}{100} + 520 \times \frac{7}{100} \\
 &\quad + 2350 \times \frac{13}{100} + 980 \times \frac{18}{100} \\
 &= 81.6 + 264 + 36.4 + 305.50 + 176.4 = 863.9 \text{ crore}
 \end{aligned}$$

14. The profit made by the company is

$$\begin{aligned}
 &= 81.6 \times \frac{14}{100} + 264 \times \frac{17}{100} + 36.4 \times \frac{22}{100} \\
 &\quad + 305.5 \times \frac{8}{100} + 17.4 \times \frac{11}{100} \\
 &= 11.42 + 44.88 + 8.0 + 24.44 + 19.4 \\
 &= 108.2 \text{ crore (approximately).}
 \end{aligned}$$

15. The total market for all the products, the market share of the company, the sales of the company and the profit it makes in each product is given below.

Product	Market size	Market share of company (%)	Market share (in crore)	Profit (in crore)
A	782	15	117.3	16.42
B	1936	20	387.2	65.82
C	624	9	56.16	12.36
D	2514.50	20	503.0	40.24
E	1127	20	225.4	24.80

∴ The profit would be approximately = 159.6 crore.

16. The projected sales of the company in 2017 = 1289
The sales in 2016 = 864 crore

$$\therefore \text{Projected increase} = \frac{425}{864} \times 100 = 49.2\%$$

Solutions for questions 17 to 20:

17. If the sales of Company A in 2004 is 100, then the sales in 2005 is 130, in 2006 it is 158.6 and in 2007 it is 190.32. The increase in the different years are given below.

Year	Increase
2005	30
2006	28.6
2007	31.72

∴ The increase is the highest in 2007.

18. If the sales of Company A was 100 in 2002, its sales in 2004 would be $100 \times 1.1 \times 1.2 = 132$.

The sales of Company D in 2002 would be 200 and the sales in 2004 would be $200 \times 1.05 \times 1.08 = 227$.

$$\text{Required value} = \frac{132}{227} \times 100 = 58\%.$$

19. Assume that the initial sales of A and B in 2002 were $1000k_1$ and $1000k_2$, respectively. The sales and the increase in sales in the subsequent years can be tabulated as shown below for both the companies A and B.

A				B		
Year	Sales	Growth Rate	Increase in Sales	Sales	Growth Rate	Increase in Sales
2002	1000k ₁	—	—	1000k ₂	—	—
2003	1100k ₁	10%	100k ₁	1050k ₂	5%	50k ₂
2004	1320k ₁	20%	220k ₁	1134k ₂	8%	84k ₂
2005	1716k ₁	30%	396k ₁	1202k ₂	6%	68k ₂
2006	2093k ₁	22%	377k ₁	1286k ₂	7%	84k ₂
2007	2512k ₁	20%	419k ₁	1415k ₂	10%	129k ₂

Since A never had a higher increase in sales than B in any of the years, the following can be calculated.

$$50k_2 \geq 100k_1, \quad 68k_2 \geq 396k_1, \quad 129k_2 \geq 419k_1$$

$$84k_2 \geq 220k_1, \quad 84k_2 \geq 377k_1,$$

$$68k_2 > 396k_1 \Rightarrow \frac{k_2}{k_1} \geq \frac{396}{68} = 5.82$$

This takes care of all the other inequalities above. The ratio of sales of A to that of B in 2003 will be at most

$$= \frac{1100k_1}{1050k_2} \leq \frac{1100}{1050} \times \frac{1}{5.82} = 0.18 = 18\%$$

∴ Maximum value of x is 18.

20. Sales of B in 2005 would be $= 180 \times 1.05 \times 1.08 \times 1.06 \times 1.07 \times 1.1 = 255$

Solutions for questions 21 to 24:

21. Let the total number of trees planted in 2001 be x and the number of trees chopped in 1999 be 100.

∴ The total number of fruit bearing trees chopped in 1999, 2000, 2001, 2002 and 2003 will be 100(0.4), 110(0.6), 121(0.7), 133.1(0.6) and 146.41(0.6), i.e., 40, 66, 84.7, 79.86 and 87.846, respectively.

$$x = \frac{84.7}{0.6} = 141.1$$

∴ The total number of trees planted in 2000 will be greater than 141.

⇒ The number of fruit bearing trees chopped in 2000 will be greater than 70.

As the number of trees planted in 1999 can be as low as 10, in this year the number of fruit bearing trees chopped can be more than the number of fruit bearing trees planted.

Similarly, if the number of trees planted in 2002 and 2003 are 150 and 10, respectively, then the number of fruit bearing trees chopped will be greater than the number of trees planted.

∴ In only 2000, the number of fruit bearing trees chopped was definitely less than the number of fruit bearing trees planted.

22. The years in which the percentage of fruit bearing trees and the total number of trees planted definitely increased, therefore, it would be the minimum number of years in which the number of fruit bearing trees increased.

This can be observed only in the year 2000, 2006 and 2008.

23. We cannot definitely say that the number of fruit bearing trees that are chopped are equal to that of the previous year but for years 2002 and 2005 as the total number of trees chopped has been increased in the next year, the percentage of trees chopped has been reduced in the next year. Hence, there is a possibility that they could be equal. Hence, the maximum number of years from 2000 to 2008 in which the number of fruit bearing trees that are chopped can be equal to that of the previous year and they are two.

24. When there is an equal percentage change, it increases and decreases alternately, starting with an increase in the final quantity which is always less than the initial quantity. Let the number of trees planted in the year 2002 be x . Let the number of fruit bearing trees planted in the years 2000, 2004 and 2008 be p , q and r .

$$p > q > r \text{ and}$$

$$\therefore p > x > q > r$$

Considering the given choices, we derive the following.

$$(A) 0.5p > 0.5x$$

$$(B) 0.4q < 0.5x$$

$$(D) 0.7s \text{ can be equal to } 0.5x.$$

Solutions for questions 25 to 27: The following information is available.

$$(i) F, B \neq \text{Shortest}$$

$$(ii) A, C \neq \text{Tallest}$$

$$(iii) F \neq 1\text{st or } 2\text{nd} (\Rightarrow F = 3, 4, \text{ or } 5) \quad B \neq 4\text{th, } 5\text{th or } 6\text{th}$$

$$(\Rightarrow B = 1, 2, \text{ or } 3)$$

$$(iv) A > E ; D > C > E ; D > B.$$

$$(v) D > F > A$$

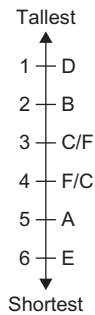
$$(vi) B > C > A$$



Based on the above information, we get the following.

- (A) From (iv) and (v), we conclude that D is the tallest.
- (B) From (i), (iii) and (iv), we conclude that E is the shortest.
- (C) From (iv), (v) and (vi), we conclude that A is the 5th tallest or the second shortest.
- (D) From (vi), B is taller than C, A and E (E is the shortest), but shorter than D. Hence, B must be the second tallest.
- (e) No information available about comparing the heights of F and C. Hence, F, C = 3 and 4, in any order.

Hence, we get the following arrangement:



Based on the above data, we solve the given questions.

- 25. From conclusion (2), B is the second tallest.
 - 26. From conclusion (c), A is ranked the second shortest.
 - 27. As it can be observed, DBFCAE is the descending order of their heights and not the ascending order.
 - 28. Even with the given information, the answer cannot be determined.
- Solutions for questions 29 to 32:** Let the marks of Ashok, Bhargav, Chetan, Dhruv, Eswar, Faizal and Govind be A, B, C, D, E, F and G, respectively.
- $$A + B + C = 195 \rightarrow (1)$$
- $$B + C + D = 210 \rightarrow (2)$$
- $$C + D + E = 196 \rightarrow (3)$$
- $$D + E + F = 208 \rightarrow (4)$$
- $$E + F + G = 213 \rightarrow (5)$$
- $$A + B + C + D + E + F + G = 491 \rightarrow (6)$$
- $$(6) - ((1) + (4)) = 491 - (195 + 208) = 403$$
- $$\Rightarrow G = 491 - 403 = 88$$
- $$(6) - ((2) + (5)) = 491 - (210 + 213)$$
- $$\Rightarrow A = 68$$
- $$(2) - (1) \Rightarrow D - A = 15 \text{ or } D = 83$$
- 29. D = 83
 - 30. G = 88
 - 31. From (1), we get $B + C = 127$ and from (3), we get $C + E = 113$ and from (5), we get $E + F = 125$. Since no student scored less than 50, Govind should have scored the highest. Choice (C)
 - 32. Given, $E = 65 \Rightarrow C = 196 - 65 - 83 = 48$.
 $\therefore B = 210 - 48 - 83 = 79$

MOCK TEST 2

Directions for questions 1 to 4: Answer the questions based on the information given below and select the correct alternative from the given choices.

The following table provides some demographic details of the eight states from A through H in a particular year.

Name of the State	Total Population (in million)	Majors	Minor Males	Minor Females	Minors (in million)
		As a Percentage of Total Population			
A	29.7	61.6	20.3	18.1	11.40
B	45.7	67.2	17.0	15.8	15
C	21.3	70.1	15.3	14.6	6.36
D	30.2	56.6	23.8	19.6	13.1
E	26.1	64.1	16.7	19.2	9.37
F	10.3	55.7	24.3	20	4.56
G	11.7	56.2	23.2	20.6	5.12
H	38.5	67.2	15.4	17.4	12.63

- Minors form approximately what percentage of the population of all the eight states put together?
(A) 28% (B) 36%
(C) 40% (D) 44%
- Approximately what percentage of the total population of states A, D and H are majors?
(A) 57.2% (B) 59.1%
(C) 62.3% (D) 66.2%
- What is the approximate number (in million) of minor females in states A, B and C together?
(A) 15.7 (B) 14.2
(C) 20.1 (D) 18.4
- How many of the eight states have more than 6 million minor males?
(A) 3 (B) 4
(C) 2 (D) 5

Directions for questions 5 to 8: Answer the questions based on the information given below and select the correct alternative from the given choices.

A group of six friends P, Q, R, S, T and U attended a party. There are two housewives, one doctor, one editor, one manager and one engineer in the group.

There are two married couples in the group. The engineer is married to S, a housewife. T is not a housewife. No woman in the group is either an editor or a doctor. One of the two housewives is married to P. U, the manager is married to R, the doctor.

- T is a/an
(A) Manager (B) Editor
(C) Doctor (D) Engineer
- Who among the following is a married couple?
(A) P and S (B) Q and T
(C) S and T (D) P and Q



7. How many people in the group are males?
 (A) 2
 (B) 3
 (C) 4
 (D) Cannot be determined
8. Who among the following is married to Q?
 (A) P
 (B) S
 (C) T
 (D) None of the above

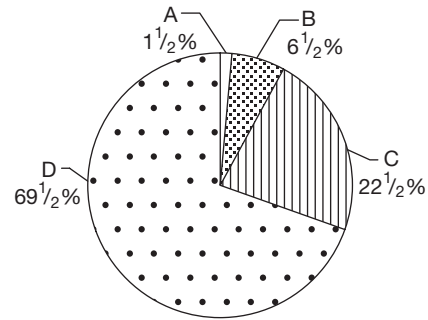
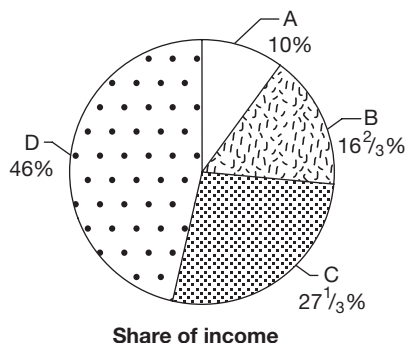
Directions for questions 9 to 12: Answer the questions based on the information given below and select the correct alternative from the given choices.

The citizens of Kya Kya island had to pay income tax on their income and for any individual, the rate of tax applicable increased with an increase in the income of the individual. Rupee was the currency of Kya Kya island and only the citizens who earned ₹12000 per year or less did not have to pay any income tax. For any individual who earned more than ₹ 12000 per year, the incident tax was calculated based on three income slabs, such as Slab 1, Slab 2 and Slab 3 as shown in the table given below.

Income Slab	Range of Income (I) (in Rs.)	Total Tax Incident
Slab 1	$12,000 < I \leq P$	10% of income above ₹12000
Slab 2	$P < I \leq Q$	10% of $(P - 12000)$ + 20% of income above P
Slab 3	$Q < I$	10% of $(P - 12000)$ + 20% of $(Q - P)$ + 40% of income above Q

The two pie-charts given pertains to the income and the tax paid by a family of four members A, B, C and D.

The first pie-chart shows the share of income of each member of the family, as a percentage of the total income of all the four put together and the second pie-chart shows the share of the tax paid by each member of the family as a percentage of the total tax paid by all the four put together.



9. The value of P is
 (A) ₹ 20,000 (B) ₹ 25,000
 (C) ₹ 30,000 (D) Cannot be determined
10. What was the income of D?
 (A) ₹ 46,000 (B) ₹ 69,000
 (C) ₹ 92,000 (D) None of the above
11. What was the amount of tax paid by C?
 (A) ₹ 9000 (B) ₹ 6750
 (C) ₹ 4500 (D) ₹ 2250
12. Which of the following is the value of Q?
 (A) ₹ 30,000 (B) ₹ 45,000
 (C) ₹ 60,000 (D) None of the above

Directions for questions 13 to 16: Answer the questions on the basis of the information given below and select the correct alternative from the given choices.

A group of eight students A, B, C, D, E, F, G and H wrote an exam conducted by an Assistant Professor named Asim. Asim ranked the students in the decreasing order of their marks in the exam, such that two or more students who get the same mark will get the same rank (say N) and the student who has the next highest mark will get the next rank (i.e., N + 1) and so on.

Later, Asim submitted the same to his superior, Professor Ganesh. The Professor was not satisfied and asked Asim to give revised ranks from 1 to 8, to the eight students in the decreasing order of their marks. If two or more students get the same mark and compete for the same rank (say N), then the student with the least number of attempts among them should be ranked the best (i.e., N), the one with the next least number of attempts, the next best (i.e., N + 1) and so on. When Asim ranked the students accordingly, that the following information was observed.

- Of the students whose ranks were changed, the change in the rank of B was less than that of any other student and the change in the rank of G was more than that of any other student.
- Only D's rank changed by 3.

- (iii) The number of questions attempted by C was less than that of A, but his revised rank was not better than that of A, which, in turn was 6.
- (iv) Initially, D and E had the same rank.
- (v) Initially, there was no rank which was given to more than three students.
- (vi) No two students had the same number of attempts.


NOTE

Between any two ranks, the numerically lower rank is considered to be the better rank.

13. What is the revised rank of D?
 (A) 4 (B) 5
 (C) 7 (D) Cannot be determined
14. Who are the students who initially got the 1st rank?
 (A) H and F (B) B, D and E
 (C) B, H and F (D) D, E and H
15. What is the change in the rank of C?
 (A) 2 (B) 4
 (C) 5 (D) Cannot be determined
16. Who got the revised rank of 1?
 (A) B (B) F
 (C) E (D) Cannot be determined

Directions for questions 17 to 20: Answer the questions based on the information given below and select the correct alternative from the given choices.

The following table gives the ranks of a few Indian companies based on Sales, Profit After Tax (PAT), Net Fixed Assets (NFA) and Market Capitalization (M. Cap) (all values in crore) for the year 2004.

Company	Sales (in crore)	Sales rank	PAT (in crore)	PAT rank	NFA (in crore)	NFA rank	M. Cap (in crore)	M. Cap rank
IOC	116775.50	1	7004.8	2	27333.2	4	52759	3
ONGC	32078.40	5	8664.4	1	30853.4	2	114089	1
Reliance	51801.50	2	5160.1	4	35146.0	1	75348	2
NTPC	19484.30	7	5281.30	3	28956.7	3	42877	7
HPCL	51517.60	3	1904.0	6	7074.3	11	11272.5	21
BPCL	47984.10	4	1694.6	10	7453.5	9	10884	23
TCS	7122.70	21	1612.40	11	674.7	76	51666	4
INFOSYS	4760.9	30	1243.50	13	970.3	56	45917	5
WIPRO	5132.70	27	914.90	16	794.7	69	44540	6
SAIL	21528.40	6	2512.10	5	13536.1	5	19949	12

17. If profit percentage is defined as $\frac{\text{PAT}}{\text{Sales}}$, which of the following companies had the highest profit percentage?
 (A) NTPC (B) TCS
 (C) INFOSYS (D) SAIL
18. How many of the companies given have a rank which is better (i.e., numerically smaller) than at least three other companies given in each of the four categories?
 (A) 2 (B) 3
 (C) 4 (D) 5
19. Which of the following companies has the highest ratio of M. Cap to sales?
 (A) WIPRO (B) TCS
 (C) NTPC (D) INFOSYS
20. If VFM of a company is defined as $\frac{\text{NFA}}{\text{M.Cap}}$, then which of the following is the correct order of the VFMs of the four companies, such as SAIL, BPCL, HPCL and NTPC?
 (A) SAIL > BPCL > HPCL > NTPC
 (B) SAIL > BPCL > NTPC > HPCL
 (C) BPCL > SAIL > NTPC > HPCL
 (D) SAIL > NTPC > BPCL > HPCL

Directions for questions 21 to 24: Answer the questions on the basis of the information given below.

Two robots Yasuku and Samurai guard Mr. Tigochenko's house. They are programmed in such a way that the movement of the puppet robot, Yasuku depends on the movement of the master robot, Samurai. Whenever the master robot takes a turn, the puppet robot will also take a similar turn, i.e., if the Samurai turns to the right by 45° , at the same time Yasuku also



turns to the right by 45° . The speed of Yasuku is twice the speed of Samurai. Every night, both the robots will start moving from the same point and at the same time but in two opposite directions, i.e., if one goes to north, the other goes to south and they will never stop moving until the next day morning.

Directions for question 21: Select the correct alternative from the given choices.

21. One day Samurai started travelling and moved 48 metre west, then 14 metre south. How far is Yasuku from their starting point?
- (A) 100 m, south-west
(B) 100 m, north-west
(C) 50 m, south-west
(D) 100 m, north-east

Directions for questions 22 to 24: Type in your answer in the space provided below the question.

22. One day Samurai started travelling and moved 100 metre towards south, 75 metre towards east and 200 metre towards north. What is the distance (in m) between the two robots? _____
23. The distance between the two robots is 30 metre and Yasuku is to the left of Samurai, who is facing north. If Samurai walks straight 40 metre and then 65 metre to his right, then the distance (in metre) between Yasuku and the starting point is _____
24. One day Samurai started travelling and moved 54 metre towards east and 72 metre towards south. What is the minimum distance Yasuku must travel to meet Samurai? _____

Directions for questions 25 to 28: Answer the questions on the basis of the information given below.

The following table gives the production capacity of the five refineries, namely P, Q, R, S and T of an oil company, SPCL, the demand at the company's four outlets, such as A, B, C and D and the transportation costs involved in transporting the oil from the different refineries to the outlets.

Transportation Cost (in Rupees/kilolitre)				
Refinery (production Capacity in Kilolitres/day)	Outlet (Demand in kilolitres/day)			
	A (40)	B (30)	C (10)	D (20)
P (30)	500	300	600	200
Q (10)	600	400	400	100
R (30)	300	400	700	400
S (20)	200	300	400	200
T (10)	400	300	600	100

In the above table, the number given in the brackets alongside each refinery gives the production capacity (in

kilolitres per day) of that refinery and the number given in the brackets alongside each outlet gives the demand (in kilolitres per day) at that outlet. The number given in the cell corresponding to a refinery and an outlet gives the transportation cost (in rupees per kilolitre) incurred for transporting oil from that refinery to that outlet.

For example, the production capacity of refinery P is 30 kilolitres/day and the demand at outlet A is 40 kilolitres/day and the cost of transporting one kilolitre of oil from refinery P to outlet A is 500.

Assume that the company currently operates only the refineries and outlets mentioned above and the production at the refineries on any day is transported to the outlets such that the demand at all the outlets is met.

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.

25. The daily cost (in ₹) of transportation of oil to all the outlets is at least. _____
26. If due to a disruption in the supply lines to some of the outlets, refinery P can supply oil to only outlets A and C, then the daily cost (in ₹) of transportation of oil to all the outlets is at least. _____
27. Consider that the daily cost of transportation of oil to all the outlets is the least possible. The daily cost of transportation to all the outlets would increase by the maximum amount, if there is a disruption (blockage) in the supply line connecting
- (A) P and B (B) S and D
(C) Q and C (D) T and B
28. Consider that the daily cost of transportation of oil to all the outlets is the least possible. If the company plans to decrease the daily cost of transportation of oil to all the outlets by doubling the production capacity of exactly one of the refineries, then which refinery should it select so as to reduce the transportation cost by the maximum amount?
- (A) S (B) Q
(C) R (D) P

Directions for questions 29 to 32: Answer the questions on the basis of the information given below.

As a part of selecting his team for the Indian Premier League, Shah Rukh Khan had shortlisted ten players, they are Ishant, Ponting, Akthar, Sourav, Warne, Lee, Dhoni, Symonds, Harbhajan and Sreesanth who were to be auctioned in the first stage. His idea was to select only players from among the shortlisted ten, adhering to all the following conditions.

- (i) If the team includes one among Symonds, Sreesanth and Harbhajan, it must also include the other two.

- (ii) The team must include either Akthar or Lee, but not both.
- (iii) If the team includes Ishant, then it must also include Ponting and vice versa.
- (iv) Ponting and Harbhajan cannot be selected together.
- (v) The team must include exactly one among Warne, Dhoni and Symonds.
- (vi) Ponting and Sourav cannot be selected together.

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.

29. If exactly five of the ten players were selected, then who among the following must be selected?

- (A) Ponting (B) Dhoni
(C) Warne (D) Sourav

30. If it is known that Ishant was one of the players selected, then how many of the other nine players were selected?

31. If only three of the ten players were selected, then who among the following is definitely not selected?

- (A) Warne (B) Sourav
(C) Ponting (D) Lee

32. Among the ten players, at most how many can be selected together? _____

ANSWER KEYS

- | | | | | | | |
|------|-------|-------|---------|-----------|-------|-------|
| 1. B | 7. B | 13. B | 19. D | 25. 26000 | 30. 3 | 31. B |
| 2. C | 8. D | 14. C | 20. C | 26. 34000 | 31. C | 32. 5 |
| 3. A | 9. B | 15. B | 21. D | 27. A | 32. 5 | 33. C |
| 4. A | 10. B | 16. D | 22. 375 | 28. A | 29. B | 34. B |
| 5. B | 11. C | 17. A | 23. 170 | 29. D | 30. B | |
| 6. A | 12. D | 18. C | 24. 180 | | | |

SOLUTIONS

1. Total population of minors of all the states put together (in million)

$$= 11.4 + 15 + 6.36 + 13.1 + 9.37 + 4.56 + 5.12 + 12.63$$

$$= 77.54$$

Total population of all the states put together (in million)

$$= 29.7 + 45.7 + 21.3 + 30.2 + 26.1 + 10.3 + 11.7 + 38.5$$

$$= 213.5$$

$$\therefore \text{Required \%} = \frac{77.54}{213.5} \times 100 \approx 36\%.$$

2. Total population of majors in states A, D and H (in million)

$$= 29.7 \times \frac{61.6}{100} + 30.2 \times \frac{56.6}{100} + 38.5 \times \frac{67.2}{100}$$

$$= 18.3 + 17.1 + 25.87 = 61.27$$

$$\therefore \text{Required \%} = \frac{61.27}{(29.7 + 30.2 + 38.5)} \times 100$$

$$= \frac{61.27}{98.4} \times 100 \approx 62.26\%$$

Alternative Solution:

As the population of A and D are nearly the same, the percentage in these two states put together is about 59 and if state H is also considered, then the percentage should be slightly above that as the value in state H is 67.2.

3. Total population of female minors (in million)

$$= 29.7 \times \frac{18.1}{100} + 45.7 \times \frac{15.8}{100} + 21.3 \times \frac{14.6}{100}$$

$$\approx 5.4 + 7.2 + 3.1 = 15.7$$



4. Number of minor males in A = $29.7 \times 0.203 = 6.0291$ million
 Number of minor males in B = $45.7 \times 0.17 > 6$ million
 Number of minor males in C = $21.3 \times 0.153 < 6$ million
 Number of minor males in D = $30.2 \times 0.238 > 6$ million
 Number of minor males in E = $26.1 \times 0.167 < 6$ million
 Number of minor males in F and G are less than 6 million
 Number of minor males in H = $38.5 \times 0.154 = 5.929 < 6$ million
 Hence, in three states A, B and D, the given condition is satisfied.

Solutions for questions 5 to 8:

Given that:

Engineer	Housewife
(Male)	(S)
Manager	Doctor
(U)	(R)

As neither the editor nor the doctor is a female, in the second couple U is the female and R is the male.

As P is married to a housewife.

\Rightarrow P must be the engineer and S is his wife.

Engineer \Leftrightarrow Housewife
 (P) (S)

As T is not a housewife, he is the editor and Q is the housewife.

5. T is the editor.
 6. P and S is a married couple.
 7. There are three males.
 8. Q is a housewife but is not married to any person among the six people in the group.
 The answer is not given in the options.

Solutions for questions 9 to 12: The share of income and the share of taxes paid is as follows:

Share of income	Share of taxes paid
A – 10%	A – 1.5%
B – 16.67%	B – 6.5%
C – 27.33%	C – 22.5%
D – 46%	D – 69.5%

It is given that the tax rates are 0%, 10%, 20% and 40% depending upon the income. For the first 10% of the income, the tax paid is 1.5% of the total tax paid, for the next $6\frac{2}{3}\%$ ($16\frac{2}{3}\% - 10\%$), it is 5% ($6.5 - 1.5$) and so on which is as given.

Let the total income be X and the total tax paid be Y.

Income (X)	Taxes paid (Y)
First 10% (for A) of X	1.5% of Y
Next $6\frac{2}{3}\%$ (for B) of X	5% of Y
Next $10\frac{2}{3}\%$ (for C) of X	16% of Y
Next $18\frac{2}{3}\%$ (for D) of X	47% of Y

Now as for the income up to ₹12,000 there is no tax and the income of A is more than ₹12,000. Some part of his income which exceeds ₹12,000 is taxed at 10% and the remaining part at 20% or whole income which exceeds ₹12,000 is taxed at 10%.

Now from the last row of the table, $18\frac{2}{3}\%$ of X = 47% of Y and so at that rate of tax, X is approximately equal to 2.5 Y.

In the previous row, $10\frac{2}{3}\%$ of X = 16% of Y and so X = 1.5Y. From this we can say that all of this $10\frac{2}{3}\%$ is not taxed at the same rate as the last $18\frac{2}{3}\%$. From the second row, we get $6\frac{2}{3}\%$ of X = 5% of Y or X = 0.75Y which is exactly half of that in the previous case.

\therefore The $10\frac{2}{3}\%$ was taxed at double the rate at which the $6\frac{2}{3}\%$ was taxed. As some part of the final $18\frac{2}{3}\%$ was taxed at a higher rate than what the $10\frac{2}{3}\%$ was taxed, the only possibility is that, some part of $18\frac{2}{3}\%$ was taxed at 40%, the whole of $10\frac{2}{3}\%$ was taxed at 20% and $6\frac{2}{3}\%$ was taxed at 10%. The maximum limit of Slab 1, i.e., P is the same as the income of B as the entire part of C's income which exceed B's income is taxed at 20%.

Now as all the income of B which exceed that of A, i.e., $6\frac{2}{3}\%$ of the total income is taxed at 10%, at that slab (i.e., 10%)

$$6\frac{2}{3}\%X = 5Y$$

$$\text{Or } X = 0.75Y$$

As A paid a tax of 1.5Y, his taxable income is 2X, or his income is Rs. 12,000 + 2X and the income of B (which is equal to P) is 12,000 + 2X + $6\frac{2}{3}\%X = 12,000 + 8\frac{2}{3}\%X$

$$\text{Now } 12,000 + 8\frac{2}{3}\%X = \frac{16\frac{2}{3}}{10} (12,000 + 2X)$$

$$12,000 + 8\frac{2}{3}\%X = 20,000 + 3\frac{1}{3}\%X$$

$$\therefore 5.33X = 8000$$

$$\text{Or } X = 1500$$

\therefore Income of A = 12000 + 3000 = ₹15,000 and the income of B, C and D are respectively ₹25,000, ₹41,000 and ₹69,000.

As the tax rate up to 25,000 is 10% (as P is the same as income of B, as found earlier), A would have paid a tax of ₹300 which is 1.5% of the total tax paid.

\therefore The taxes paid by others are B – ₹1300, C – ₹4500 and D – ₹13,900.

As income of C is ₹41,000 and all of his income is taxed at 20%, the rate of 40% is definitely applicable only above ₹41,000.

The tax up to an income of ₹41,000 is ₹4,500 and for an income of ₹69,000 it is ₹13,900. At some amount Q, between 41,000 and 69,000, the tax rate doubles from 20% to 40%.

$$\therefore (Q - 41,000) \times 0.2 + (69,000 - Q) \times 0.4 = 13,900 - 4500$$

$$\therefore 0.2Q - 8200 + 27600 - 0.4Q = 9400$$

$$0.2Q = 10000$$

$$Q = 50,000$$

9. The value of P is ₹25,000.

10. The income of D is ₹69,000.
11. The amount of tax paid by C is ₹4500.
12. The value of Q is ₹50,000.

Solutions for questions 13 to 16: Given that:

The change in G's rank is more than that of any other person. The person with maximum change should get a revised rank of 8.

∴ G's revised rank is 8.

Given that A got sixth rank.

The revised rank of C was not better than that of A.

∴ C must have got seventh rank.

Let us look at a particular case (Hypothetical) to understand the changing of ranks.

Rank	Students	
N	P	Q
N + 1	R	S
N + 2	T	U

One of the people among P and Q does not have any changes in the rank. Further, the change in the rank of the lesser ranked among P and Q = The change in the rank of higher ranked among R and S.

B's rank changed by the least value. Hence, it must have changed by one.

∴ There must be two other people who got the same rank as B. (∵ If there is only one person, then B cannot be the only person whose rank changed by 1)

Initial rank 1:	?	B	?
	Least attempts	Second least attempts	Most attempts

Similar is the case for G and there must be one more person who got the same rank as G.

G	
---	--

Further, C and G initially must have got the same rank. A must have got the next best rank to that of C and G.

Now, D's rank changed by 3.

The only possibility is that D must have got rank 2 initially and 5 in the final rankings. (As changing from 1 to 4 is ruled out)

E and A also must have got the same rank.

Further, B's rank changed by the least. Therefore, he must have got 1 initially and 2 in the final rankings. H and F are the remaining two people who got the first rank initially.

Similarly, we can sort out the ranks of all other people and the final table obtained will be as follows:

Initial ranks:

1	H/F	B	F/H
2	E	D	A
3	C	G	

Revised ranks:

1	F/H
2	B
3	H/F
4	E
5	D
6	A
7	C
8	G

13. Revised rank of D is 5.
14. B, H and F got 1st rank initially.
15. C's rank changed by four.
16. Either F or H would have got a revised rank of 1.
17. Only for NTPC, ONGC and Infosys PAT is more than 25% of sales.
- For Infosys, profit percentage = $\frac{1243.5}{4760.9} \times 100$
= 26.12%
- For NTPC, profit percentage = $\frac{5281.3}{19484.3} \times 100$
= 27.1%
18. Only four companies, i.e., IOC, ONGC, Reliance and NTPC satisfy the given condition.
19. By observation, the ratio of M. Cap to sales is the highest for Infosys.

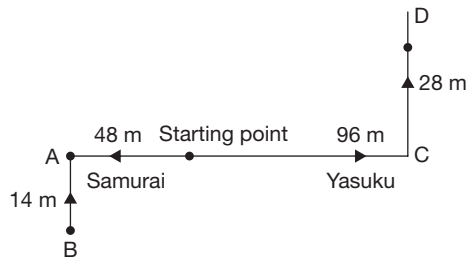
20. For BPCL it is $\frac{7453.5}{10884} = 68.5\%$

For SAIL it is $\frac{13536.1}{19949} = 67.85\%$

For HPCL it is $\frac{7074.3}{11272.5} = 62.75\%$

And for NTPC it is $\frac{28956.7}{42877} = 67.53\%$

21.



$$\begin{aligned}\text{Now } OD &= \sqrt{OC^2 + CD^2} = \sqrt{96^2 + 28^2} \\ &= 100 \text{ m towards north-east.}\end{aligned}$$

22. From starting point:

Horizontal distance of Samurai = 75 m

Vertical distance of Samurai = $(200 - 100) = 100$ m

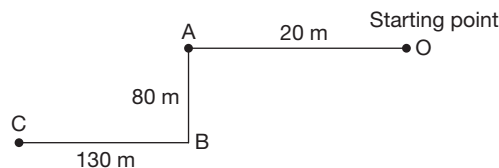
The shortest distance of Samurai

$$= \sqrt{75^2 + 100^2} = 125 = 125$$

Now, as Yasuku moves with twice the speed of Samurai.

The distance between Yasuku and Samurai is $125 \times 3 = 375$ m.

23. The distance between the robots is 30 m, i.e., Yasuku is 20 m away from the starting point. Now the path traced by Yasuku is as follows.



$$\text{Now } OC = \sqrt{(CB + OA)^2 + AB^2} = 170 \text{ m.}$$

24. Since Samurai travelled 54 m east and 72 m south, Yasuku would have travelled 108 m west and 144 m north. Further, it is not possible for Yasuku and Samurai to meet at any point other than the starting point.

Hence, the minimum distance that Yasuku must travel will be along the line connecting the starting point to yasuku's location.

Minimum distance that Yasuku needs to travel

$$= \sqrt{108^2 + 144^2} = 180 \text{ m.}$$

25. The lowest cost of transportation occurs when the oil is transported along the cheapest routes available, which are shown below.

$$T - D \rightarrow 10 \text{ kl} \rightarrow 10 \times 100 = ₹1000$$

$$Q - D \rightarrow 10 \text{ kl} \rightarrow 10 \times 100 = ₹1000$$

$$P - B \rightarrow 30 \text{ kl} \rightarrow 30 \times 300 = ₹9000$$

$$S - A \rightarrow 10 \text{ kl} \rightarrow 10 \times 200 = ₹2000$$

$$R - A \rightarrow 30 \text{ kl} \rightarrow 30 \times 300 = ₹9000$$

$$S - C \rightarrow 10 \text{ kl} \rightarrow 10 \times 400 = ₹4000$$

$$\text{Total} = ₹26,000.$$

26. As P can be used for supplying only to A or C, the minimum cost of transportation in this case would be

$$P - C \rightarrow 10 \text{ kl} \rightarrow ₹6000$$

$$P - A \rightarrow 20 \text{ kl} \rightarrow ₹10,000$$

$$Q - D \rightarrow 10 \text{ kl} \rightarrow ₹1000$$

$$T - D \rightarrow 10 \text{ kl} \rightarrow ₹1000$$

$$R - B \rightarrow 30 \text{ kl} \rightarrow ₹12,000$$

$$S - A \rightarrow 20 \text{ kl} \rightarrow ₹4000$$

$$\text{Total} = ₹34,000$$

27. The cheapest supply lines were already determined in the first question of the set. Now we have to determine the supply line whose disruption would cause the transportation cost to increase by the maximum amount. Choices (B), (C) and (D) can be straight away ignored as they are not part of the cheapest route. Hence, the increase in transportation cost would be the highest, if the supply line P - B is disrupted.

28. As far as the cost of transporting at each of the outlets is considered, most of the outlets receive the oil at a low transportation cost from the refinery S. Hence, if the capacity of refinery S is doubled, then the savings in the expenditure will be more.

29. Only one of Warne, Dhoni and Symonds can be selected and only one of Akthar and Lee can be selected. So also, Ponting and Harbhajan or Ponting and Sourav cannot be selected together.

∴ The team of five can be Symonds, Sreesanth, Harbhajan, Sourav and one among Akthar or Lee.

30. If Ishant was selected, then definitely Ponting has to be selected, which means that Sourav, Harbhajan, Symonds, Sreesanth, one of Akthar and Lee and one of Warne and Dhoni cannot be selected.

∴ A total of four players or three players other than Ishant can be selected.

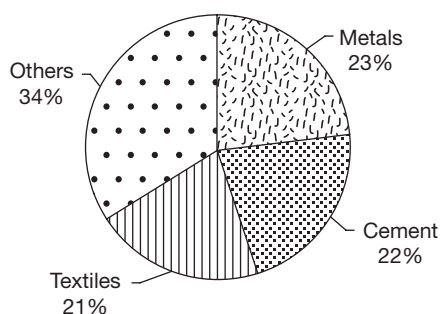
31. One of Akthar and Lee and one of Warne and Dhoni must be definitely selected. Symonds cannot be selected as the players selected would exceed three in that case. Sourav can be selected while Ponting cannot be selected in which case Ishant also has to be selected and the number of players selected becomes four.

32. As all of Symonds, Sreesanth and Harbhajan must be selected or none of them must be selected, to have the largest number of players selected, all the three must be selected. In that case Warne, Dhoni, Ponting, Ishant and one of Akthar or Lee cannot be selected.

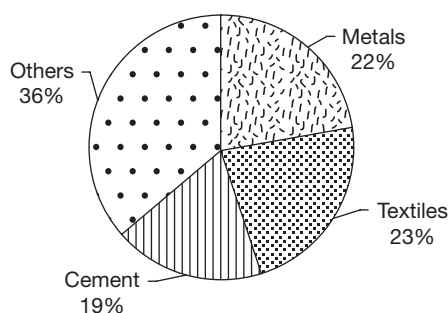
∴ At most five players can be selected.

MOCK TEST 3

Directions for questions 1 to 4: These questions are based on the following pie charts, which provides the breakup of the sales turnover of an industrial group from different sectors in 2013 and 2015. Select the correct alternative from the given choices.



Year 2013
Turnover = ₹ 450 crore



Year 2015
Turnover = ₹ 650 crore

- Which sector recorded the maximum percentage growth in the two-year period?
(A) Metals (B) Cement
(C) Textiles (D) Others
- If metals are expected to continue at the same percentage growth/decrease for the period from 2015 to 2017 as

in from 2013 to 2015, then the turnover (in crore) from metals in 2017 would be

- (A) 172.5 (B) 187.5
(C) 205.6 (D) 197.5

3. The annual growth rate of cement sales is

- (A) 8.6% (B) 10.5%
(C) 12.4% (D) 13.6%

4. If 'Others' grew by 20% in 2016 and the total group turnover grew by 10%, both when compared to 2015, then 'Others' constituted what percentage of the total group turnover in 2016?

- (A) 36.2% (B) 39.2%
(C) 38.4% (D) 40.8%

Directions for questions 5 to 8: Answer the questions based on the information given below and select the correct alternative from the given choices.

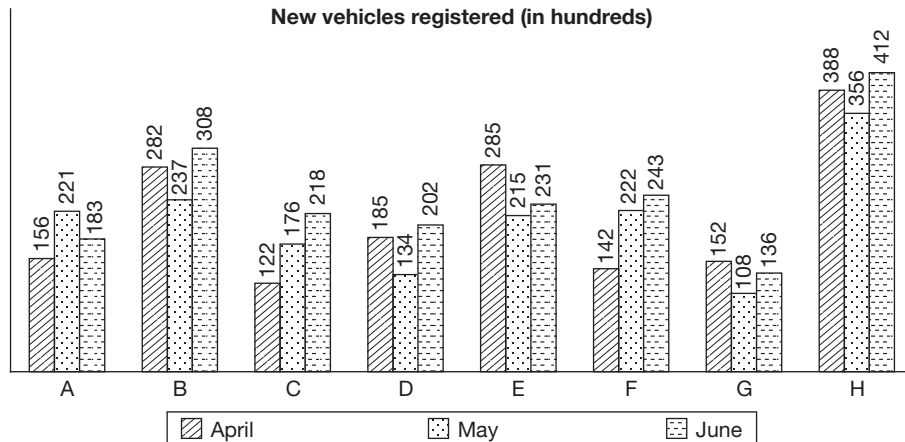
A software company is planning to conduct campus interviews in eight cities, namely in Delhi, Mumbai, Kolkata, Chennai, Hyderabad, Lucknow, Ahmedabad and Indore. While finalizing the order of the cities the company has to visit, it follows certain conditions as given below.

- Indore must be visited before Mumbai.
 - Kolkata must be visited before Delhi.
 - Chennai and Ahmedabad must be visited after Kolkata.
 - Ahmedabad must be visited after Hyderabad.
 - Indore must be visited before Lucknow, which in turn must be visited before Kolkata.
5. If Chennai is the fourth city to be visited by the company, then which of the following statements must be true?
(A) Delhi is to be visited before Mumbai.
(B) Ahmedabad is the seventh city to be visited by the company.
(C) Lucknow is the third city to be visited by the company.
(D) Hyderabad is not the third city to be visited by the company.



6. If Hyderabad is the seventh city to be visited by the company, then which of the following statements is definitely false?
- (A) Lucknow is the second city to be visited by the company.
 (B) Lucknow is the third city to be visited by the company.
 (C) Kolkata is the fourth city to be visited by the company.
 (D) Kolkata is the fifth city to be visited by the company.
7. If Hyderabad is to be visited after Chennai, then which of the following statements could be true?
- (A) Lucknow is the fourth city to be visited by the company.
 (B) Kolkata is the fifth city to be visited by the company.
 (C) Delhi is the sixth city to be visited by the company.
 (D) Chennai is the seventh city to be visited by the company.
8. If Kolkata is the fourth city to be visited by the company, then which of the following statements cannot be true?
- (A) Indore is the second city to be visited by the company.
 (B) Hyderabad and Ahmedabad are to be visited before visiting Chennai.
 (C) Mumbai is the last city to be visited by the company.
 (D) Hyderabad and Mumbai are to be visited after visiting Kolkata.

Directions for questions 9 to 12: These questions are based on the following bar chart, which shows the number of new vehicles registered in three different months in eight cities, such as A, B, C, D, E, F, G and H. Select the correct alternative from the given choices.



9. The average number of new vehicles registered per city in the month of April was
- (A) 18,600 (B) 19,700
 (C) 21,800 (D) None of these
10. From April to May, which city had the highest percentage growth in the number of new vehicles registered?
- (A) A (B) C
 (C) F (D) None of these
11. For how many of the given cities was the number of new vehicles registered in the month of May less than the average number of new vehicles registered (per month) in that city in the three given months?
- (A) 7 (B) 4
 (C) 5 (D) 6
12. Among the following cities, which city had the lowest number of new vehicles registered in the given period?
- (A) A (B) C
 (C) D (D) F
- Directions for questions 13 to 16:** Answer the questions based on the information given below and select the correct alternative from the given choices.
- Five books are stacked up, one over the other, each belonging to a different subject among Botany, Anatomy, Zoology, Neurology and Dentistry, not necessarily in the same order. The following information is also known.
- (i) The Neurology book is just below the Anatomy book.
 (ii) There are four books above the Zoology book.
 (iii) The Botany book is above the Dentistry book and there is at least one book between them.
13. How many books are there below the Anatomy book?
- (A) 1 (B) 2
 (C) 3 (D) 4

14. Which book has an equal number of books above it and below it?
 (A) Anatomy (B) Neurology
 (C) Dentistry (D) None of the above
15. The number of books between the Botany book and the Zoology book is
 (A) 3 (B) 2
 (C) 1 (D) None of the above
16. How many books are below the Dentistry book?
 (A) 1 (B) 2
 (C) 3 (D) Cannot be determined

Directions for questions 17 to 20: Answer the questions based on the information given below.

Peoplereach.com is an internet company engaged in the business of collecting details of potential employees and selling these details to other organizations. The company collects data based on the details of people from different categories by evaluating on their job profile. For each person in each category, the company collects the details of one or more of the six features, such as Name, Age, Address, Experience, Phone Number and E-mail ID. The following table gives the information available in the database of the company about the number of people in each category, and the percentage of people in that category for whom the details of each feature are available.

Category	Number of people	Percentage of people for whom the details of the feature are available					
		Name	Age	Address	Experience	Phone number	E-mail ID
School Teachers	16000	100%	85%	70%	90%	65%	80%
Pharmacists	3000	100%	75%	95%	80%	70%	60%
Doctors	60000	100%	50%	60%	70%	65%	100%
Professors	10000	100%	70%	75%	60%	85%	90%
Civil Engineers	25000	100%	40%	60%	50%	65%	85%
MBAs	150000	100%	50%	55%	70%	65%	100%
CAs	2600	100%	80%	50%	40%	50%	90%
Mechanical Engineers	42000	100%	85%	70%	95%	60%	80%
Nurses	18000	100%	50%	40%	60%	75%	40%
Accountants	12000	100%	40%	70%	75%	90%	85%
Ex-Servicemen	15000	100%	65%	75%	40%	80%	60%
Electrical Engineers	22000	100%	70%	65%	60%	70%	90%
Computer Engineers	26000	100%	80%	60%	65%	50%	100%

In the above table, for example, the phone numbers of 65% of the school teachers in the database (i.e., 65% of 16,000) are available. Assume that no person belongs to more than one category.

17. The number of doctors, each of whose name, phone number and address is available, is at least. _____
18. The number of mechanical engineers, for whom the details of exactly four of the six features are available, is at least. _____
19. The number of professors for whom at least two of the three features, like address, phone number and E-mail ID are available, is at least. _____
20. For at most how many of the CAs are the details of exactly five of the six features available? _____

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

Moody's, a modelling agency was on the lookout for new models. It had called 150 candidates for the purpose of recruiting models who were tall, dark and handsome. The break-up of the candidates with different attributes in that group of 150 is as follows.

- Tall and handsome but not dark = 9
- Dark and handsome but not tall = 12
- Tall or dark but not handsome = 107

Each candidate had at least one of the three attributes that the agency was looking for.

The agency could find only one person who satisfied its criteria and so was considering relaxing the requirements a little. It was also found that, for any attribute, the number of

candidates who had that attribute alone did not exceed one-third of the total number of candidates called.

21. What is the minimum number of candidates who had at least two of the three attributes? _____
22. If the number of candidates who were dark is less than those who were tall, then at least how many candidates were dark and as well as tall? _____
23. If exactly half of the candidates who were tall and were also dark and exactly half of the candidates who were dark were also tall, then how many candidates were only tall? _____
24. If the number of candidates who were tall is twice that of those who had at least two attributes, then at least how many candidates were only dark? _____

Directions for questions 25 to 28: Answer the questions based on the information given below and select the correct alternative from the given choices.

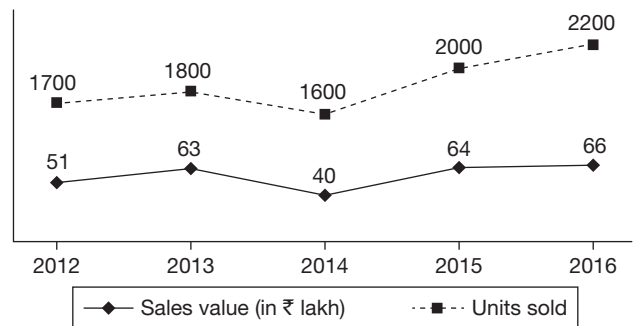
Seven politicians, namely P, Q, R, S, T, U and V are invited to a special meeting. They are seated in a row. As S and V had to leave early, they must be seated at the two extreme left seats in any order. T must be seated at the centre and P and R must have at least three people between them.

25. Which of the following people cannot be seated at either of the ends?
(A) P (B) R
(C) U (D) V
26. Which of the following pair of people cannot be seated together?
(A) P and U (B) T and R
(C) R and V (D) Q and S
27. Which of the following pair of people cannot be the two people adjacent to T?
(A) R and U (B) Q and R
(C) Q and V (D) P and U
28. If there are exactly two people between Q and S, then who among the following is sitting four places to the left of U?

- (A) T (B) R
- (C) S (D) V

Directions for questions 29 to 32: Answer the questions based on the information given below and select the correct alternative from the given choices.

The following graph provides the details of the number of units sold and the total sales value of Company X, which produces bicycles for the period from 2012 to 2016.



29. What was the average price per bicycle sold in 2014?
(A) Rs. 2700 (B) Rs. 2200
(C) Rs. 2500 (D) Rs. 3000
30. In which of the following years was the percentage increase in the average price per bicycle the highest?
(A) 2013 (B) 2014
(C) 2015 (D) 2016
31. In how many of the given years was the sales (by volume) of bicycles less than that of the average sales (by volume) in the entire period?
(A) 1 (B) 2
(C) 4 (D) 3
32. If, in 2017, both the number of units sold increases by 25% and the total sales (value) by 50% when compared to 2016, then what is the average price per bicycle sold in 2017?
(A) Rs. 3200 (B) Rs. 3500
(C) Rs. 3900 (D) Rs. 3600

ANSWER KEYS

- | | | | | | | |
|------|-------|-------|-----------|--------|-------|-------|
| 1. C | 6. D | 11. C | 16. A | 21. 29 | 26. D | 31. D |
| 2. D | 7. C | 12. B | 17. 15000 | 22. 12 | 27. C | 32. D |
| 3. C | 8. D | 13. C | 18. 0 | 23. 34 | 28. C | |
| 4. B | 9. D | 14. B | 19. 7500 | 24. 41 | 29. C | |
| 5. D | 10. C | 15. A | 20. 1820 | 25. C | 30. C | |

SOLUTIONS

1. By observation we can say that though 'Others' and 'Textiles' have increased their share by the same percentage points, since 'Textiles' has a lower base, its growth rate should be maximum.

$$2. \text{ Turnover from metals in 2013} = \frac{23}{100} \times 450 = 103.5 \text{ crore}$$

$$\text{In 2015} = \frac{22}{100} \times 650 = 143.0$$

$$\text{Growth rate} = \frac{143.0 - 103.5}{103.5} \times 100 = 38.16$$

$$\therefore \text{ Turnover in 2017} = 143.0 \times \frac{138.16}{100} = 197.5 \text{ crore}$$

$$3. \text{ Turnover in 2013} = \frac{22}{100} \times 450 = 99 \text{ crore}$$

$$\text{In 2015} = \frac{19}{100} \times 650 = 123.5$$

$$\% \text{ growth} = \frac{24.5}{99} = 24.75$$

$$\text{Annual growth} = \frac{24.75}{2} = 12.37\%$$

4. Let the total turnover in 2015 be 100 crore.

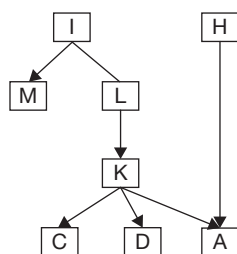
$$\therefore \text{ 'Others' } = 36 \text{ crore}$$

$$\text{ 'Others' in next year} = 36 \times \frac{120}{100} = 43.2 \text{ crore}$$

$$\text{Total} = 100 \text{ crore}$$

$$\therefore \text{ Score of 'Others' } = \frac{43.2}{110} \times 100 = 39.2\%$$

Solutions for questions 5 to 8: The given information can be represented as follows (Each city is represented by the first letter of its name).

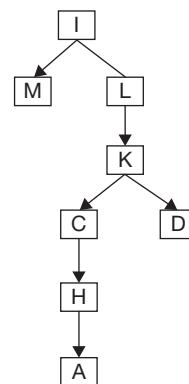


5. Given that Chennai is the fourth city to be visited. As Indore, Lucknow and Kolkata are to be visited before Chennai, they are to be visited first, second and third, respectively. Hence, Hyderabad cannot be the third city to be visited.

6. As Hyderabad is the seventh city to be visited, Ahmedabad is the eighth city to be visited.

Hence, the only cities that can be visited before Kolkata are Indore, Mumbai and Lucknow. Therefore, Kolkata cannot be visited fifth.

7. If Hyderabad is visited after Chennai, the representation is as follows.

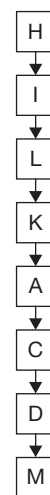


In the above case, five cities are to be visited after Lucknow. Hence, Lucknow can be visited second and third. Therefore, choice (A) is false.

Similarly, choices (B) and (D) can be eliminated. Delhi can be the sixth city to be visited as in the following sequence.

IMLKCDHA.

8. If Kolkata is the fourth city to be visited, then the representation is as follows.



From the above representation, we can say that (A), (B) and (C) can be true. Choice (D) cannot be true.



9. The average number of new vehicles registered in the month of April

$$= \frac{156 + 282 + 122 + 185 + 285 + 142 + 152 + 388}{8}$$

$$= \frac{1712}{8} = 214 \text{ (in hundreds).}$$

10. In May, only for city F there was more than 50% increase in the number of new vehicles registered.
11. The number of new vehicles registered in May was less than the average for the three months in cities B, D, E, G and H.
12. The number of new vehicles registered in different cities are
 A – $156 + 221 + 183 = 560$
 C – $122 + 176 + 218 = 516$
 D – $185 + 134 + 202 = 521$
 F – $142 + 222 + 243 = 607$
 It was the least for city C.

Solutions for questions 13 to 16: The 5 books are Botany, Anatomy, Zoology, Neurology and Dentistry. Let us represent these books by their starting letters, i.e., B, A, Z, N, D, respectively.

From (i), N is just below A. From (ii), Z is the bottom most book since there are a total of five books and Z has 4 above it. From (iii), Botany is above Dentistry and they are having at least one book between them, N and A must be between them.

∴ The arrangement is as follows.

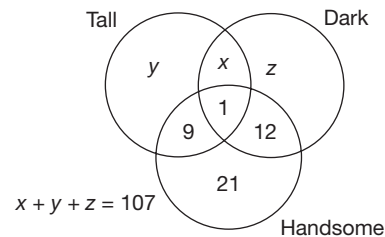
B
A
N
D
Z

13. There are 3 books below Anatomy book.
14. Neurology book has 2 books above it and 2 below it.
15. There are 3 books between Botany and Zoology.
16. There is only one book below the Dentistry book.
17. As the name is available for all the people, i.e. 100%, the least number of doctors for whom the name, phone number and address are available happens when the number of doctors for whom the address and phone numbers are available is the minimum,
 i.e., $(60 + 65) - 100 = 25\%$, i.e., 15,000.
18. The number of mechanical engineers for whom exactly four of the six details were available can be zero, as the total data available is on an average of 4.9 items per person ($100 + 85 + 70 + 95 + 60 + 80 = 490$) and it can be due to a majority of them having exactly five of their details

available and for the others on, two or three of the six details being available.

19. The number of professors for whom at least two of address, phone number and e-mail ID are available would be the least when for the maximum number of professors exactly one detail is available and for others all the three details are available.
 Total = $75 + 85 + 90 = 250$
 ∴ The required value would be the least when for 25% of them exactly one detail is available and for the rest 75% of all the three details are available.
20. As one should have exactly five of six features, he should not have one of the features with least percentage values. Consider the three least percentages available, i.e., 50%, 40% and 50%.
 Exactly two among these three must be available.
 ∴ $\frac{50 + 40 + 50}{2} = 70\%$ and as other features have more than 70% availability, 70% of 2600 = 1820.

Solutions for questions 21 to 24: Drawing the Venn diagram with the given conditions:



Only handsome = $150 - (107 + 9 + 1 + 12) = 21$

21. To find the minimum number of candidates who had at least two of the three attributes, we have to maximize the number of candidates with just one single attribute. But as it is mentioned that at most fifty candidates (i.e., one-third of 150) had any one single attribute, there must be at least seven people who were both tall and dark (i.e., $x \geq 7$). Required value = $7 + 9 + 1 + 12 = 29$
22. Given that: Tall > Dark
 Tall = $10 + x + y$
 Dark = $13 + x + z$
 $\Rightarrow 10 + x + y > 13 + x + z$
 $\Rightarrow 10 + y > 13 + z$
 $y > z + 3$
 The maximum possible value of y is 50.
 The maximum possible value of z is 46.
 ∴ The minimum possible value of x is $107 - (50 + 46) = 11$.
 Hence, the number of people who are tall as well as dark is at least $(x + 1) = 12$.

23. Given that: 50% of tall are also dark and 50% of dark are also tall.

$$\Rightarrow 9 + y = 1 + x$$

and also,

$$z + 12 = x + 1$$

Now adding (i) + (ii), we get:

$$21 + y + z = 2x + 2$$

$$21 + (107 - x) = 2x + 2$$

$$128 - 2 = 3x$$

$$x = \frac{126}{3} = 42$$

Only tall = $y = x - 8$ (from (i)) = 34

24. The number of people who were only dark (i.e., z) should be as minimum as possible.

$\therefore (x + y)$ should be the maximum.

The maximum possible value of y is 50.

Given that, tall = 2 (candidates with at least two attributes)

$$(60 + x) = 2(22 + x)$$

$$x = 16$$

$$z = 107 - (x + y) = 107 - (16 + 50) = 41$$

Solutions for questions 25 to 28: T is at the centre and S and V are at the extreme left. We have:

$$\underline{S/V} \quad \underline{V/S} \quad \underline{\quad T \quad} \quad \underline{\quad \quad}$$

P and R are separated by at least three people, i.e., we have the following final arrangement.

$$\underline{S/V} \quad \underline{V/S} \quad \underline{P/R} \quad \underline{T} \quad \underline{Q/U} \quad \underline{U/Q} \quad \underline{R/P}$$

25. U can never be at either of the ends.
 26. Q and S can never be seated together.
 27. V can never be adjacent to T.
 28. From the given condition, V must be at the extreme left, S must be to the right of V. Q must be to the right of T

and U must be to the right of Q. Hence, S is sitting four places to the left of U. Choice (C)

29. The average price per bicycle sold in the various years are as follows.

$$2012 = \frac{51}{1700} \text{ lakhs} = ₹3000$$

$$2013 = \frac{63}{1800} \text{ lakhs} = ₹3500$$

$$2014 = \frac{40}{1600} \text{ lakhs} = ₹2500$$

$$2015 = \frac{64}{2000} \text{ lakhs} = ₹3200$$

$$2016 = \frac{66}{2200} \text{ lakhs} = ₹3000$$

30. The highest percentage increase occurred in the year 2015.

31. Average sales for the given period

$$= \frac{1700 + 1800 + 1600 + 2000 + 2200}{5}$$

$$= \frac{9300}{5} = 1860.$$

The sales was less than the average in 2012, 2013 and 2014.

32. Number of units sold in 2017 = $2200 \times 1.25 = 2750$

Total sales (value) = $66 \text{ lakhs} \times 1.5 = 99 \text{ lakhs}$

$$\text{Average price} = \frac{99}{2750} \text{ lakhs} = 3600$$

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