**CAT**apult Courseware

# Module 2
# DI-LR

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# DI-2.1 | DEDUCTIVE REASONING 1

THEORY

## Introduction

In Deductive Reasoning sets in Data Interpretation, the data may be presented in table or bar graph or in any other format. However, the questions do not involve intensive calculations similar to the sets in Module 1. The questions are more logical in nature and require you to deduce information from the given data.

This Class has total 9 sets on Deductive Reasoning in three different exercises.

## CLASS EXERCISE

**The following data is applicable to questions 1 – 6:**

- There are 7 candidates for the post of president of the "Old Reliables" club - P, Q, R, S, T, U and V.
- The election is conducted in three rounds.
- In the first round, each eligible voter casts 3 votes (for 3 different candidates). The 2 candidates with the least votes are eliminated
- In the second round, each eligible voter casts 2 votes (for 2 different candidates). The 2 candidates with the least votes are eliminated
- In the third round, each eligible voter casts 1 vote.
- A candidate who is taking part in a given round is not eligible to vote in that round, but once eliminated (s)he becomes eligible to vote in further rounds. All other club members are eligible to vote.
- In each of the three rounds, all the voters who were eligible for that round cast their vote(s).
- In the first round, a total of 129 votes were cast in all, and the top three candidates were Q (25 votes), V (20 votes) and P (18 votes).
- In the second round, R received 8 votes more than she did in the first round, Q was 3 votes behind R, and T, with 15 votes, was in 3rd place.
- In the third round, R scored the same number of votes as she did in the first round, and ended up winning the election. Q finished last in the third round.

1.

a) How many people voted in the first round?

1) 43 2) 47 3) 45 4) Cannot be determined

b) How many votes were cast in the second round?

1) 45 2) 47 3) 86 4) 90

c) How many people voted in the third round?

1) 43 2) 47 3) 45 4) Cannot be determined

d) How many members does the "Old Reliables" club have in total?

1) 43 2) 48 3) 50 4) 55

2.

a) Who got eliminated in the first round?

1) T and R 2) R and U 3) U and S 4) S and T

b) Who got eliminated in the second round?

1) S and V 2) V and P 3) P and T 4) P and U

3.

a) How many votes did R, S, T and U manage between them in the first round?

1) 60 2) 66 3) 68 4) 69

b) How many votes did R get in the first round?

1) 14 2) 16 3) 17 4) 19

4.

a) How many votes did R get in the second round?

1) 24 2) 25 3) 22 4) 27

b) How many votes did P and V manage between them in the second round?

1) 24 2) 26 3) 27 4) 28

5.

a) How many votes did R get in the third round?

1) 17 2) 14 3) 19 4) 16

b) How many votes did Q get in the third round?

1) 17 2) 14 3) 19 4) 16

6. * What is the minimum number of people who should have voted for the eventual runner-up in order to make him the sole winner?

1) 2 2) 3 3) 4 4) 1

**Answer questions 7 – 11 based on the following information:**

A, B, C, D are the lead actors and P, Q, R, S are the lead actresses of daily soaps shown on 4 channels, CCD, ICP, EE and JJN.
Table 1 gives the number of shows on each channel, in which each actress plays a lead role.
Table 2 gives the number of shows on all these channels in which these actors and actresses play lead pairs. Every show has only one lead pair.

| | P | Q | R | S |
|---|---|---|---|---|
| **CCD** | 2 | 0 | 1 | 1 |
| **ICP** | 1 | 2 | 0 | 1 |
| **EE** | 2 | 0 | 2 | 0 |
| **JJN** | 1 | 2 | 0 | 1 |

Table 1

| | P | Q | R | S |
|---|---|---|---|---|
| **A** | 2 | 1 | 1 | 0 |
| **B** | 1 | 0 | 1 | 2 |
| **C** | 2 | 1 | 0 | 1 |
| **D** | 1 | 2 | 1 | 0 |

Table 2

Further, it is known that:
- P and B act as a lead pair on a show on JJN.
- No two daily soaps on any channel have the same lead actor.

7. Who is the lead actress on B's show on ICP?
   1) R 2) R or P 3) S 4) Cannot be determined

8. C and Q are the lead pair on a show on which channel?
   1) EE 2) ICP 3) JJN 4) ICP or EE

9. P and D are the lead pair on a show on which channel?
   1) CCD 2) EE 3) ICP 4) CCD or EE

10. From the given data, the lead pairs of how many shows can be exactly determined?
    1) 16 2) 15 3) 14 4) 12

11. Who play/s the lead actor/s opposite R on EE?
    1) B & A or B & D 2) D 3) A 4) A and D

**Answer questions 12 –19 based on the data below:**

Two psychologists, Dr. Alfonso and Dr. Ferreira have come up with a new test – The Ferreira-Alfonso Intelligence and Logic test (FAIL) – to measure IQ. To check the validity of this test, they administer it to a large batch of candidates.

- The test consists of 50 multiple choice questions, each with 5 options (only 1 of which is correct).
- The test is initially scored by awarding every correct answer 4 marks, and deducting 1 mark for every wrong answer (no marks are awarded for unattempted questions). This is the raw score.
- After this, 50 marks are added to the raw score and this result is recorded as the final IQ score.
- Two people with the same score, having the same number of questions correct, are deemed to have achieved the score in the same way, irrespective of which specific question they have answered correctly or wrongly.
- However, two people with the same score, but with different number of questions correct, are deemed to have achieved the score in two different ways.

12. What is the minimum IQ score which cannot possibly be achieved?
    1) 239 2) 249 3) 189 4) 251

13. How many possible different IQ scores could be achieved?
    1) 244 2) 245 3) 250 4) 251

14. Which is the highest IQ score which could be achieved in two different ways?
    1) 180 2) 200 3) 230 4) 243

15. If all the students in a particular class got a different number of correct answers, and all of them got an IQ score of 100, what is the maximum number of students who could have been in that class?
    1) 8 2) 6 3) 5 4) 7

16. If Jenny answered 3 more questions correctly than Penny, but scored the same IQ score, what is the maximum number of questions Jenny could have answered right?
    1) 35 2) 36 3) 37 4) 38

17. If Denny attempted 41 questions, which of the following could be his IQ score?
    1) 219 2) 147 3) 124 4) 100

18. * Which IQ score can be achieved in the maximum number of different ways?
    1) 0 2) 50 3) 100 4) 150

19. * What is the highest IQ score that can be achieved in 3 different ways?
    1) 160 2) 190 3) 210 4) 240

**Answer questions 20 – 23 based on the data below:**

A game is being played at the Gotham Casino in which a participant can bet on a number or a group of numbers from 2 to 12 (at a fee of $5 per number). So for example, betting on "All odd numbers" would cost $25, as there are 5 odd numbers available. In all, 6 rounds are played in a game. In each round, two dice are rolled and the sum is noted. If this sum is one of the chosen group of numbers, then the participant wins $10. In a particular game, the following bets were placed by 4 friends:

- Alfred bet on the group "Numbers divisible by 3"
- Bruce bet on the group "Prime numbers"
- The Commissioner bet on the group "Numbers greater than 8"
- Dent bet on the group "Even numbers"

It turns out that in each of the six rounds the total score was different. At the end of the six rounds, Alfred lost $20, Bruce made $5, while the other two made no profit or loss.

20. What is the difference between the smallest and the largest total across the 6 turns?

1) 7 2) 8 3) 9
4) 10 5) Cannot be determined

21. Which of the following bets would have proven the most profitable?

1) Odd Primes 2) Cubes 3) All from 2-12
4) Squares 5) Multiples of 5

22. Which of the following additional numbers could Dent have bet on and still made no profit or loss?

1) 5 & 7 2) 5 & 11 3) 3 & 9
4) 3 & 11 5) 7 & 11

23. What is the maximum possible profit a person could have made in this game?

1) $30 2) $25 3) $20
4) $35 5) $15

## Challengers

**Read the following information and answer the questions given below:**

There are 4 light switches labelled A, B, C and D in a row, and they are connected to 4 bulbs of different colours (Blue, Green, Yellow and Red) in a room. Each combination of switches results in a different lighting pattern in the room.

Radhika walks into the room and starts playing a game with the switches. She decides that in every move of her game, she will press exactly two adjacent switches at a time. For example if the switches, in order, are initially On, Off, Off, Off, then her possible moves could be:

(a) press switches A and B resulting in Off, On, Off, Off OR
(b) press switches B and C resulting in On, On, On, Off OR
(c) press switches C and D resulting in On, Off, On, On

Note: Radhika can make as many moves as she likes.

1. If the four switches, in order, are On, Off, Off, On initially, then which of the following could not be their final positions, in order, however many moves are made?

   1) On, Off, On, Off
   2) Off, Off, Off, Off
   3) On, On, On, On
   4) On, On, On, Off

2. If the four switches, in order, are Off, On, Off, Off initially, then how many different lighting patterns can Radhika create by making any number of moves?

   1) 4 2) 8 3) 12 4) 16

**Additional Information for questions 3 and 4:** After a while Radhika changes the rules and now decides that in a single move she can press any two switches, not necessarily adjacent.

3. If the four switches, in order, are On, On, Off, Off initially, then how many different lighting patterns can Radhika create in a single move?

   1) 6 2) 3 3) 7 4) 4

4. If the four switches, in order, are On, On, Off, Off initially, then how many different lighting patterns can Radhika create by making any number of moves?

   1) 4 2) 8 3) 12 4) 16

# PRACTICE EXERCISE-1

**DIRECTIONS for questions 1 to 4: Refer to the data given below and answer the questions that follow:**

Paradise Island is a famous tourist destination in Bali. The only mode of transport on the island is horse-carts. There are five tourist attractions on the island, named A, B, C, D and E along a straight path. Bali Transport Authority (BTA) operates horse carts between A and E on the island. The carts start at A and stop at B, C and D in that order before reaching their destination at E. Tourist attractions B, C, D and E are located at a distance of 5 km, 15 km, 35 km and 40 km respectively from A. For the first 5 km, the total passenger fare is 5 Twitts and for every subsequent 5 km distance, the total passenger fare increases by 3 Twitts.

The following points are known about the passengers in the horse carts on Christmas day:

1] Exactly 10 passengers boarded the horse-cart at each of the destinations A, B, C and D.

2] Out of the 10 passengers who boarded the cart at A, only one passenger alighted at E. The remaining 9 alighted at B, C or D.

3] The number of passengers who alighted the horse cart at B, C, D and E were 2, 7, 13 and 18 respectively.

4] The number of passengers who travelled between A and D (i.e. boarded at A and alighted at D) was equal to the number of passengers who travelled between B and C (i.e. boarded at B and alighted at C).

5] The total fare collected from the passengers who boarded at A was 161 Twitts while the total fare collected from the passengers who boarded at C was 152 Twitts.

1. What was the total fare collected from passengers who boarded at B (in Twitts)?

   1) 161 2) 152 3) 50 4) 176

2. Which among the following is the maximum?

   1) The number of passengers who boarded at A and alighted at C.
   2) The number of passengers who boarded at A and alighted at D.
   3) The number of passengers who boarded at B and alighted at D.
   4) The number of passengers who boarded at C and alighted at D.

3. Out of the passengers who boarded at B, at which of the following tourist destinations did the maximum passengers alight?

   1) C 2) D 3) E 4) Cannot be determined

4. Out of the passengers who alighted at D, from which of the following tourist destinations did the minimum passengers board?

   1) A 2) B 3) C 4) Cannot be determined

**DIRECTIONS for questions 5 to 8: Refer to the data given below and answer the questions that follow:**

Bungaland Public Service Commission (BPSC) conducts Bungaland Administrative Service (BAS) examination for prestigious and lucrative administrative positions in the country of Bungaland. The examination consists of 4 sections, named sections I, II, III and IV with 75 questions each. A correct answer gets four marks (+4) while one mark is deducted for every incorrect answer (-1). The maximum possible marks a student can score in each section is 300.
Total 6 students, named A, B, C, D, E and F appeared for the examination. It is known that all the students attempted all the questions in each section. The following table shows the number of questions each student answered correctly in the two sections taken together.

| | I+II | I+III | I+IV | II+III | II+IV | III+IV |
|---|---|---|---|---|---|---|
| A | 111 | 87 | 73 | 110 | 96 | 72 |
| B | 105 | 86 | 86 | 95 | 95 | 76 |
| C | 73 | 49 | 64 | 66 | 81 | 57 |
| D | 137 | 105 | 117 | 96 | 108 | 76 |
| E | 112 | 103 | 104 | 77 | 78 | 69 |
| F | 126 | 91 | 118 | 85 | 112 | 77 |

The section in which the sum total of marks scored by all the six students is highest is called the 'easiest' section.

Students are shortlisted for second round of evaluation process (which includes an interview) if his/her score in each section (when expressed as a percentage of maximum possible score in that section) is at least 35% and the sum of his/her score in the four sections taken together (when expressed as a percentage of maximum possible score in the four sections taken together) is at least 60%.

5. Who got the maximum number of questions incorrect?

   1) A 2) D 3) E 4) C

6. Two students scored equal total marks (the sum of the marks scored in the four sections). Who were they?

   1) A and B
   2) B and E
   3) A and E
   4) No two students scored equal total marks

7. Which was the easiest section in the exam?

   1) Section IV 2) Section III 3) Section II 4) Section I

8. How many students out of the six were shortlisted for the second round of evaluation?

   1) 0 2) 1 3) 2 4) More than 2

**DIRECTIONS for questions 9 to 12: Refer to the data and answer the following questions.**

"BKC Cha Raja" is a public Ganesh festival celebrated in the vicinity of IMS head-office in BKC, Mumbai. Amit, Brijesh, Chitra and Deepika are the four volunteers who are actively involved in the celebrations of "BKC Cha Raja". The following partially-filled table gives the information about the donations collected by each of them (in Rupees) from four housing societies, named P, Q, R and S, located nearby.

| | P | Q | R | S | Total | Maximum donation |
|---|---|---|---|---|---|---|
| Amit | 620 | | | | 3430 | 980 |
| Brijesh | | | | 180 | 2320 | 760 |
| Chitra | 300 | | | | 2880 | 940 |
| Deepika | | | | 120 | 1080 | 480 |
| Total | 2040 | 2870 | 2740 | 2060 | 9710 | |

The following points are known:

1] The entries shown in the table (except the total and maximum donation) are the entries corresponding to the minimum donation collected by a person from the four societies. For example, the minimum donation collected by Amit from any society was Rs. 620 and that was collected from society P.

2] The column named "Maximum donation" shows the maximum donation collected by the volunteer from the four societies. For example, the maximum donation collected by Brijesh from any society was Rs. 760.

3] Each volunteer collected his/her maximum donation from a different society.

4] No volunteer collected equal donation from any two societies.

5] Brijesh collected more donation from Society Q than from Society R.

6] The amount of donation collected by all the volunteers from each society was a multiple of 10.

9. What is the difference in the amount collected by Chitra from Society Q and Society R?

1) Rs. 50 2) Rs. 20 3) Rs. 80 4) Cannot be determined

10. If the amount collected by Deepika from society Q is a natural number multiple of the amount collected by her from society R, what is the amount collected by her from society R?

1) Rs. 120
2) Rs. 160
3) Rs. 200
4) This situation is not possible

11. What was the difference in the amount collected by Brijesh from societies P and S?

1) Rs. 120 2) Rs. 100 3) Rs. 460 4) Cannot be determined

12. Which of the following cannot be the amount collected by Amit from society R?

1) Rs. 930 2) Rs. 860 3) Rs. 840 4) Rs. 900

**DIRECTIONS for questions 13 to 16: Refer to the data and answer the following questions.**

Akash, Vijay, Ranjeet and Sharad are the four leading actors while Monica, Priti, Priya and Swati are the four leading actresses in TV serials on four different TV channels named Channel 1, Channel 2, Channel 3 and Channel 4. Four TV serials are shown on each of the 4 TV channels. In each TV serial, exactly one of the four actors and exactly one of the four actresses mentioned above are paired with each other. Each pair of actor and actress acts in only one TV serial.

The following table shows the number of TV serials on different channels that the four actors and the four actresses are part of.

| Channel | Actors | | | | Actresses | | | |
|---|---|---|---|---|---|---|---|---|
| | Akash | Vijay | Ranjeet | Sharad | Monica | Priti | Priya | Swati |
| Channel 1 | 2 | 0 | 1 | 1 | 1 | 2 | 0 | 1 |
| Channel 2 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 2 |
| Channel 3 | 1 | 2 | 1 | 0 | 0 | 1 | 2 | 1 |
| Channel 4 | 0 | 1 | 2 | 1 | 2 | 1 | 1 | 0 |

Additionally, the following points are also known:

1] Ranjeet and Swati act together in a TV serial on Channel 3.
2] Akash and Monica act together in a TV serial on Channel 2.
3] Ranjeet and Priya do not act together in a TV serial on Channel 3.
4] Sharad and Monica do not act together in a TV serial on Channel 4.

13. For how many TV serials can the pair of actor and actress be uniquely determined?

14. On which channel do Ranjeet and Monica act together in the same TV serial?

15. On which channel do Priti and Vijay act together in the same TV serial?

16. On which channel do Vijay and Priya act together in the same TV serial?

# DI-2.2 | DEDUCTIVE REASONING 2

THEORY

## Introduction

In Deductive Reasoning sets in Data Interpretation, the data may be presented in table or bar graph or in any other format. However, the questions do not involve intensive calculations similar to the sets in Module 1. The questions are more logical in nature and require you to deduce information from the given data.

This chapter has total 5 sets on Deductive Reasoning in two different exercises.

## CLASS EXERCISE

**DIRECTIONS for questions 1 to 4: Refer to the data and answer the questions that follow.**

The year is 1609. Spanish marauders have plundered the town of Potosi in South America and collected gemstones from there. These gemstones are sent back to Spain, which are sold in different markets of Europe. The following points are known:

1. Out of the gemstones sent to Spain in a particular year, some are sold in the same year while the gemstones that remain unsold at the end of the year are sold in the following years.
2. The selling price of "new" gemstones (those which are being sold in the same year that they arrive in Spain) increases by 10 Pesetas every year
3. The selling price of "old" gemstones (those which are sold in a later year to that in which they arrived) depreciates by 5 Pesetas every year with respect to their selling price in the previous year.

For example, if the selling price of the gemstones that were sent to Spain in 1609 and sold in the same year was "X" Pesetas, then the selling price of the gemstones that were sent in 1610 and sold in 1610 was "X + 10" and the selling price of those sent in 1611 and sold in 1611 was "X + 20". However, if the gemstones that were sent in 1610 were sold in 1611, then the selling price will be X + 10 – 5 = (X + 5) Pesetas and if they are sold in 1612, the selling price will be X + 5 – 5 = X Pesetas. This is applicable for all years.

The following table outlines some information about the number of gemstones sent to Spain and sold in the years from 1609 to 1615 (Some cells have been intentionally left blank). "––" sign in any cell indicates that all the gemstones sent to Spain in a particular year have been sold till the previous year. For example, all the gemstones sent to Spain in 1609 have been sold till the year 1612 and as a result, "––" sign appears in the first row for the years 1613, 1614 and 1615.

| | | Year of Sale | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **1609** | **1610** | **1611** | **1612** | **1613** | **1614** | **1615** | **Total** |
| **Year of sending gemstones to Spain** | **1609** | 35 | 30 | | | --------- | -------- | -------- | 100 |
| | **1610** | X | | | 25 | | 15 | -------- | 150 |
| | **1611** | X | X | 70 | | 40 | | 15 | 200 |
| | **1612** | X | X | X | | 115 | -------- | -------- | 250 |
| | **1613** | X | X | X | X | | | 40 | 300 |
| | **1614** | X | X | X | X | X | | 80 | 350 |
| | **Total** | | | 125 | | | | | |

The following table outlines the total revenue generated in Pesetas by selling the gemstones over the years (Revenue is calculated as the sum of the products of the selling prices and the number of gemstones sold).

| | | Year of Sale | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **1609** | **1610** | **1611** | **1612** | **1613** | **1614** | **Total revenue generated from gemstones sent in that year** |
| **Year of sending gemstones to Spain** | **1609** | 700 | | | 50 | 0 | 0 | 1450 |
| | **1610** | X | 1500 | | | 450 | | 3350 |
| | **1611** | X | X | | 1750 | 1200 | 625 | 6675 |
| | **1612** | X | X | X | 6750 | | 0 | 11925 |
| | **1613** | X | X | X | X | 8400 | | 13700 |
| | **1614** | X | X | X | X | X | | 15700 |

It is known that 60 gemstones that were sent to Spain in 1613 and 120 gemstones that were sent in 1614 were not sold till the end of 1615.

1. How many gemstones were sold in 1614?
2. Which year saw the maximum % increase in the total revenue generated over the previous year?
3. How many gemstones sent to Spain during the years up to and including 1613 were left unsold at the end of the year 1613?
4. In how many years were less than 35% of the gemstones sent to Spain sold in the same year?

**DIRECTIONS for questions 5 to 8: Refer to the data and answer the following questions.**

National Admission Test (NAT) is the entrance test for admission to prestigious National Institutes of Management (NIMs) in India. Students appear for NAT and depending on their performance in NAT, different NIMs call the students for WAT and PI. In order to be called for WAT and PI, students need to score marks more than or equal to the cut-off marks in each of the three sections as well as total marks.

NAT-2016 consists of three sections, namely VA+RC section, DI+LR section and QA section. The number of questions in the three sections is 34, 32 and 34 respectively. Each correct answer gets 12 marks while there is a differential negative marking for incorrect answers in each section. First 5 incorrect answers in each section attract a negative marking of 3 marks per question, next 5 incorrect answers in each section attract a negative marking of 4 marks per question, while from 11th question onwards, every incorrect answer in each section attracts negative marking of 6 marks. There is no penalty for unattempted questions.

National Institute of Management-Calcutta (NIMC) identified the following cut-offs for giving calls for WAT and PI round:

| Section | Cut-off |
|---|---|
| VA+RC | 109 |
| DI+LR | 85 |
| QA | 97 |
| Total | 393 |

5. What can be the maximum number of questions that a student can attempt in NAT-2016 to ensure that the student scores marks exactly equal to the cut-offs of each of the three sections?

   1) 100 2) 99 3) 98 4) 97

6. If a student scores exactly 393 marks, while managing to clear all the sectional cut-offs as well, what is the maximum number of questions that he/she can get incorrect?

   1) 54 2) 45 3) 49 4) 47

7. If a student attempts 75 questions and scores marks equal to the cut-off marks in each of the three sections, what can be the maximum possible number of questions incorrectly answered by the student?

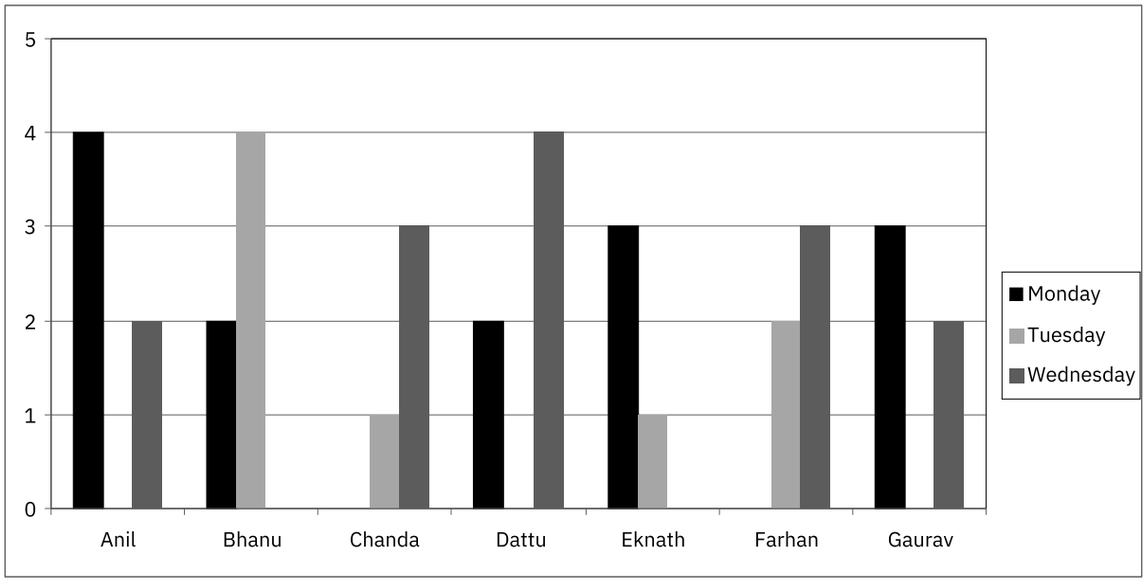
   1) 37 2) 38 3) 39 4) 40

8. What is the minimum number of questions that a student needs to attempt to ensure that he/she scores exactly 393 marks?

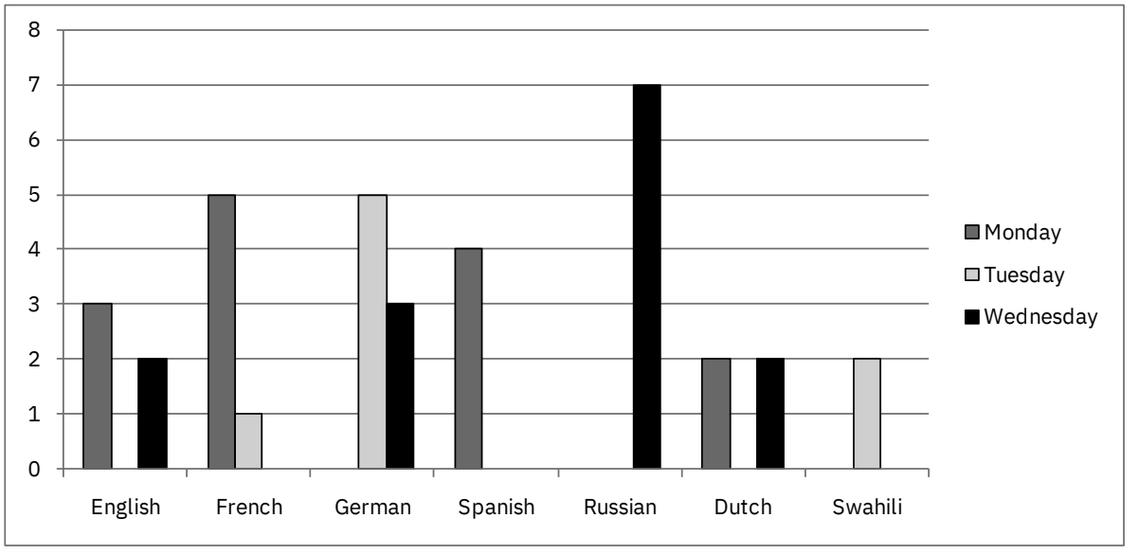
   1) 40 2) 42 3) 38 4) 34

**DIRECTIONS for questions 9 to 12: Refer to the data and answer the following questions.**

Seven friends named Anil, Bhanu, Chanda, Dattu, Eknath, Farhan and Gaurav are working on a joint presentation on evolution of family of languages in the world. As a part of the preparation for their presentation, they read certain number of articles in seven different languages, namely English, French, German, Spanish, Russian, Dutch and Swahili over three days of the week, namely Monday, Tuesday and Wednesday.
Following graph gives the summary of total number of articles read by each of the seven friends on each of the three days:




Following graph gives the summary of total number of articles read by the seven friends in each of the seven languages on each of the three days:



Additionally following information is known:

1] Each friend read articles on only two days out of Monday, Tuesday and Wednesday.

2] Each friend read articles in only one language on the day when they read articles.

3] When Chanda read articles in any language on any day, no other friend read any other article in that language on that day.

4] Only one friend read articles written in only one language. All other friends read articles written in at least two languages.

9. Who among the following read articles in Russian language on Wednesday?

1) Dattu and Farhan
2) Dattu and Chanda
3) Anil, Chanda and Gaurav
4) Anil, Farhan and Gaurav

10. Who among the following read articles in French language on Monday?

1) Bhanu and Eknath
2) Bhanu and Gaurav
3) Dattu and Eknath
4) Cannot be determined

11. For how many friends can the languages of all the of articles read on both days be uniquely determined?

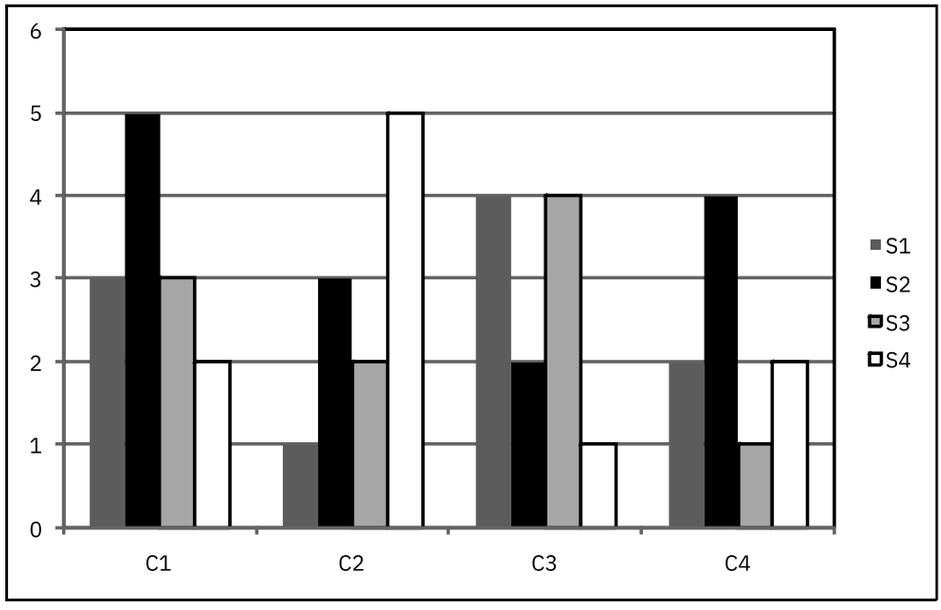
1) 4 2) 5 3) 6 4) 7

12. Articles in which of the following languages were read by maximum number of friends?

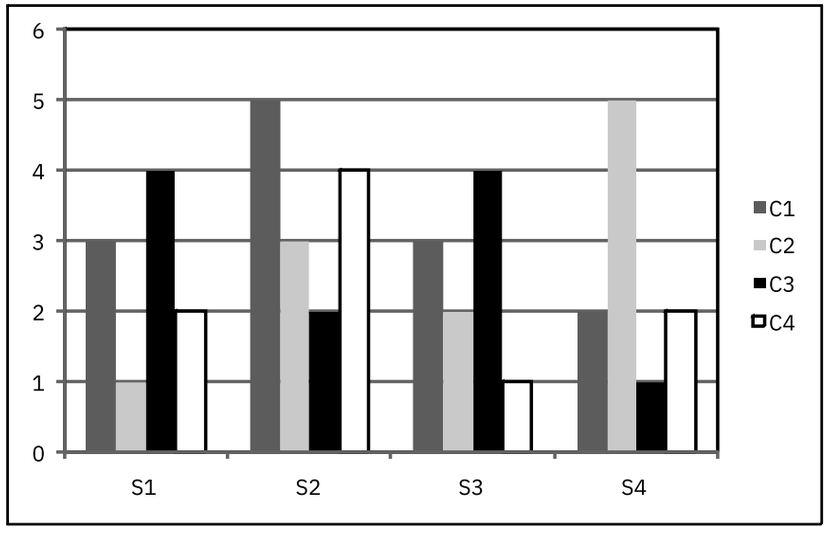
1) English 2) Russian 3) German 4) Dutch

**DIRECTIONS for questions 13 to 16: Refer to the data given below and answer the questions that follow:**

In an International Science Conference held at Copenhagen, Denmark, total 44 researchers in four different subjects, namely Physics, Chemistry, Mathematics and Biology participated. The researchers were from one of the four different countries, namely America, Britain, China and Denmark.
The following graph shows the distribution of the researchers according to the countries. Note that the names of the countries have been disguised as C1, C2, C3 and C4.




The following graph shows the distribution of the researchers according to the subjects. Note that the names of the subjects have been disguised as S1, S2, S3 and S4.



Following points are known:

1] Had there been one more researcher from America and one fewer researcher from China, the number of researchers from America and China would have been equal.
2] Had there been one more researcher from Britain and one fewer researcher from Denmark, the number of researchers from Britain and Denmark would have been equal.
3] Had there been two more researchers in Mathematics and two fewer researchers in Chemistry, the number of researchers in Mathematics and Chemistry would have been equal.
4] Had there been one more researcher in Biology, the number of researchers in Biology and the number of researchers from America would have been equal.
5] The numbers of researchers from America in all the four subjects were distinct natural numbers.
6] The numbers of researchers from Denmark in Mathematics was 1.
7] Britain and Denmark are the countries from Europe.
8] Mathematics and Physics are called 'numerical sciences'

13. How many researchers in Biology from China participated in the conference?

1) 5 2) 3 3) 2 4) Cannot be determined

14. How many researchers in numerical sciences from Europe participated in the conference?

1) 6 2) 8 3) 9 4) Cannot be determined

15. Which of the following is highest?

1) Number of researchers in Chemistry from China
2) Number of researchers in Chemistry from America
3) Number of researchers in Physics from Denmark.
4) Number of researchers in Mathematics from Britain

16. The number of researchers in all the four subjects for how many countries can be uniquely determined?

1) 0 2) 2 3) 3 4) 4

## Challengers

**DIRECTIONS for questions 1 to 4: Refer to the data and answer the following questions.**

Four families in the neighbourhood, named Aggarwal, Bhalla, Chandrasekharan and Deodhar, have certain number of adults and children. The number of adults in all the four families is between 2 and 4 (both included). The number of children in all the four families is between 2 and 4 (both included). Each adult in each family collects either 200 rupees or 300 rupees while each child in each family collects either 100 rupees or 200 rupees as donation for a local charity everyday for 4 days. All the adults of any family collect the same amount on any particular day. Similarly, all the children of any family collect the same amount on any particular day. The following table shows the total amount collected by the four families as donation over four days:

| Day | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|---|---|---|---|
| Aggarwal | 1000 | 1400 | 1200 | 1600 | 5200 |
| Bhalla | 1200 | 1500 | 900 | 1200 | 4800 |
| Chandrasekharan | 1400 | 1200 | 800 | 1000 | 4400 |
| Deodhar | 1000 | 1700 | 1400 | 1300 | 5400 |

The following points are known:

1] Over the four days, the adults and children in each family collected a differentcombination of per-head amounts. That means the amounts collected by the adults and children of each family on the four days, in some order, were (200,100), (300,100), (200,200) and (300,200).

2] The number of adults and children in only one of the four families was equal.

1. Both the number of adults and the number of children in how many of the four families can be uniquely determined?

   1) 1 2) 2 3) 3 4) 4

2. What was the total amount (in Rs.) collected by children in Chandrasekharan family over the four days?

   1) 1200 2) 2400
   3) 1800 4) Cannot be determined

3. Out of the four families, what is the maximum number of members in any family (including adults and children)?

   1) 5 2) 6
   3) 7 4) Cannot be determined

4. What is the total amount (in Rs.) collected by adults in the four families combined on Day 1?

   1) 2400 2) 2200
   3) 2000 4) Cannot be determined

# DI-2.3 | OBSERVATION AND CALCULATION BASED SETS

THEORY

## Introduction

In this class, we will build upon the concepts of Calculative and Deductive Data Interpretation learnt in earlier classes.

This Chapter has total 14 sets on both Calculative and Deductive Data Interpretation (including Practice Exercises).

## CLASS EXERCISE

**Directions for questions 1 to 4: Refer to the table below and answer the questions that follow.**

A company has 6 factories (F1, F2 ... F6), 8 depots (D1, D2 ... D8) and 9 retailers (R1, R2 ... R9). Goods produced at a factory have to be sent to a depot, and then from there to a retailer. The cost of transportation is proportional to the distance the goods have travelled and hence the company aims to minimise distance of dispatch of goods. The distances from the factories to the depots are given in Table 1 below, while Table 2 shows the distances (in km) from the depots to the retailers.

| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|---|---|---|---|---|---|---|---|---|
| **F1** | 142.1 | 104.9 | 18.7 | 168.5 | 134.5 | 14.3 | 67.0 | 6.4 |
| **F2** | 217.6 | 66.3 | 40.5 | 96.7 | 12.5 | 143.4 | 71.5 | 53.3 |
| **F3** | 211.2 | 113.0 | 47.7 | 170.8 | 211.0 | 125.5 | 105.1 | 4.0 |
| **F4** | 58.6 | 25.1 | 173.2 | 249.7 | 83.2 | 221.6 | 131.2 | 72.6 |
| **F5** | 10.3 | 88.1 | 125.4 | 26.5 | 7.2 | 87.9 | 127.1 | 128.1 |
| **F6** | 124.0 | 200.0 | 67.4 | 195.4 | 18.0 | 140.2 | 48.3 | 103.5 |

**Table 1**

| | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 |
|---|---|---|---|---|---|---|---|---|---|
| **D1** | 231.3 | 485.5 | 134.0 | 475.0 | 497.9 | 84.6 | 334.2 | 317.3 | 365.2 |
| **D2** | 195.3 | 375.1 | 104.2 | 443.7 | 254.7 | 168.7 | 269.9 | 476.6 | 217.1 |
| **D3** | 307.8 | 188.4 | 37.7 | 143.8 | 285.3 | 191.3 | 381.5 | 266.7 | 99.2 |
| **D4** | 348.0 | 48.3 | 165.1 | 419.6 | 45.6 | 85.1 | 24.2 | 94.8 | 471.3 |
| **D5** | 22.9 | 188.6 | 342.1 | 134.9 | 61.1 | 414.0 | 475.6 | 228.6 | 114.6 |
| **D6** | 347.5 | 41.0 | 490.4 | 472.6 | 237.5 | 221.1 | 267.4 | 317.9 | 23.2 |
| **D7** | 433.5 | 489.1 | 343.4 | 102.4 | 97.5 | 190.7 | 241.8 | 190.9 | 204.4 |
| **D8** | 269.3 | 138.2 | 453.9 | 235.5 | 182.9 | 349.3 | 243.3 | 462.8 | 454.7 |

**Table 2**

1. The minimum distance that goods produced at F4 would have to travel to reach R7 is:
   1) 255.7 km  2) 273.9 km  3) 295.0 km  4) 315.9 km

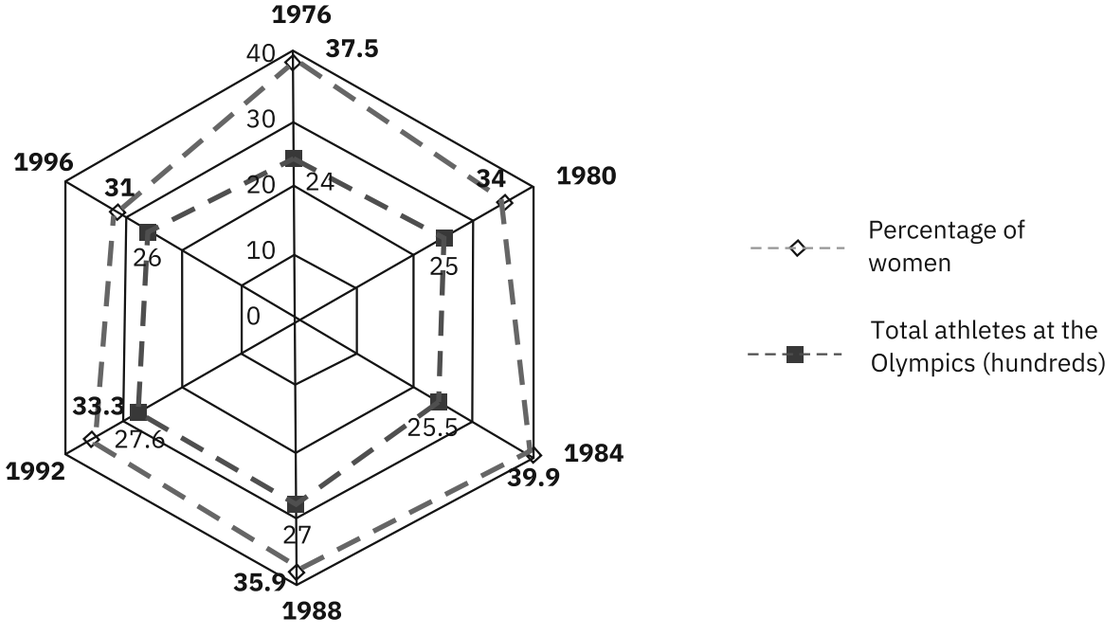
2. What is the minimum distance that could have been traversed by goods passing though D6?
   1) 37.5 km  2) 30.1 km  3) 55.3 km  4) 35.4 km

3. The largest distance from any one factory to any one retailer is:
   1) 712.0 km  2) 715.5 km  3) 718.2 km  4) 721.0 km

4. In how many ways can a unit be dispatched from a factory to a retailer?
   1) 72  2) 486  3) 432  4) 54

**Directions for questions 5 to 8: Refer to the table below and answer the questions that follow.**

The chart below shows statistics of male and female participation over six consecutive editions of the Olympic games (1976 – 1996).




5. Find the difference between the maximum and minimum number of men across the given years.
   1) 128 2) 411 3) 316 4) 341 5) 374

6. In how many of the given years did more than a thousand women participate?
   1) 0 2) 1 3) 2 4) 3 5) 4

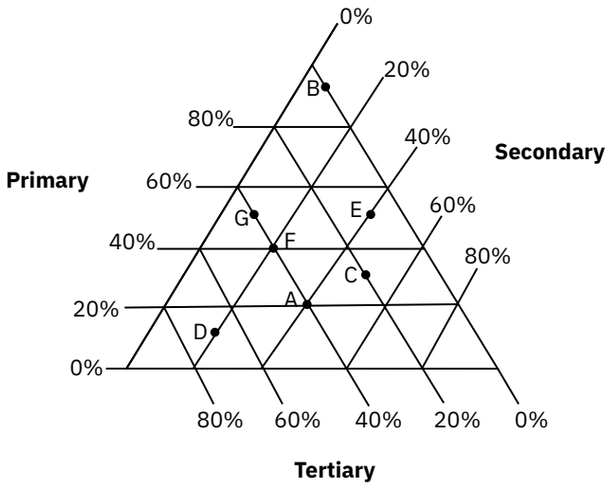
7. In which of the given years did the minimum number of women take part?
   1) 1980 2) 1988 3) 1996
   4) 1992 5) None of the above

8. If in the next Olympics, in 2000, the total number of athletes goes up by 10% but the number of men remains constant, what will be the percentage of women?
   1) 37.3 2) 33.7 3) 28.2 4) 31.8 5) 39.9

**Directions for questions 9 to 12: Refer to the table below and answer the questions that follow.**

Figure 1 below gives the percentage of industries in the Primary, Secondary and Tertiary sectors of the economy for various countries. Figure 2 gives the total number of industries in each country.

**Figure 1**




| | Country | Total industries (millions) |
|---|---|---|
| A | Argentina | 375 |
| B | Burundi | 18 |
| C | Canada | 510 |
| D | Denmark | 182 |
| E | Egypt | 298 |
| F | Finland | 39 |
| G | Greece | 79 |

Figure 2

Note: Development Index is defined for a country as percentage of Tertiary Industries in that country minus percentage of Primary Industries in that country.

9. Which two countries have approximately the same percentage of industries in the Primary sector?
   1) E and B 2) G and E 3) A and D 4) B and C 5) F and G

10. Which two countries have approximately the same number of industries in the Secondary sector?
   1) B and E 2) D and F 3) A and C 4) G and A 5) G and F

11. Which two countries, combined, have approximately 50% of their industries in the Tertiary sector?
   1) A and D 2) B and E 3) C and F 4) D and G 5) E and A

12. Which two countries have the same Development Index?
   1) A and E 2) B and F 3) C and G 4) D and A 5) E and B

**Directions for questions 13 to 17: Refer to the table below and answer the questions that follow.**

The Shantiben Charitable Trust runs a hostel for working women. The monthly fees for accommodation, maintenance and meals are calculated on the basis of the gross monthly salary of the inmates as follows:

- Accomodation = 7.5% of gross monthly salary
- Maintenance = 2% of gross monthly salary
- Meal Charges = 1% of gross monthly salary
- Total Fees = Accomodation + Maintenance + Meal Charges

In addition it is known that:

- The charitable trust contributes 50% of the total monthly gross salary of all the inmates towards the maintenance of the hostel.
- Anarkali, Basanti, Chaitrali, Devyani, Esha and Falguni are six inmates of the hostel. Their accommodation charges are Rs. 1125, 3075, 1275, 1950, 1050 and 4125 in some order.
- Anarkali pays Rs.10 less than Falguni as meal charges.
- Chaitrali pays Rs.945 more than Esha as total fees.
- Basanti has the highest gross salary.

13. Who has the lowest gross salary?

1) Falguni 2) Esha 3) Anarkali 4) Devyani

14. How much does Esha pay as accommodation charges?

1) Rs.1125 2) Rs.3075 3) Rs.1275 4) Rs.1950

15. How much percent more than Chaitrali does Basanti pay?

1) 267% 2) 223% 3) 34% 4) 112%

16. What is the total amount that the hostel earns from these six women on account of maintenance charges?

1) Rs.3360 2) Rs.1680 3) Rs.4800 4) Rs.2400

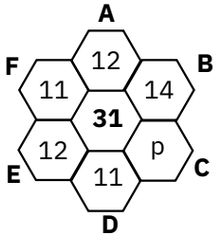
17. In a particular month, the charitable trust contributes Rs.200000 towards the maintenance of the hostel. The gross salary of these six women is what percentage of the total gross salary of all the inmates?

1) 50% 2) 42% 3) 33% 4) Indeterminable

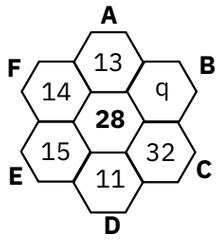
**Directions for questions 18 to 22: Refer to the table below and answer the questions that follow.**

Four parties (Liberals, Democrats, Independents and Others) are contesting the elections in Gondwana, a country with 6 states (Arriva, Beneficia, Carina, Demesia, Eluria and Fera). The national newspaper "The Daily" is doing an analysis of the election results, and have prepared a chart with whatever information they have been able to collect. In the data below, the central hexagon for each party indicates the percentage of the total valid votes cast received by that party. The six hexagons surrounding it represent the votes received by the party in each of the six states as a percentage of the total votes received by the party. (Note: some values are unknown and hence are replaced by p, q, r and s.)

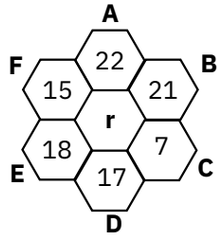
*Liberals*



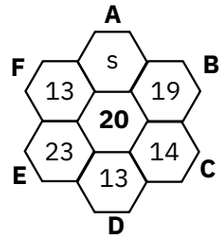

*Democrats*




*Independents*




*Others*




The paper also assigns each party a statistical measure of variation called the V-Grade; defined as the difference between the maximum and minimum votes obtained in that party across the six states, as a percentage of the total valid votes cast.

The party which holds the most votes in the maximum number of states will form the government.

18. Which party captures the maximum number of votes in Fera?
1) Liberals 2) Democrats 3) Independents 4) Others

19. What is the V-grade of the "Others" party?
1) 2 2) 20 3) 2.2 4) Cannot be determined

20. Which party is assigned the highest V-grade?
1) Liberals 2) Democrats 3) Independents 4) Others

21. Which party will form the government?
1) Liberals 2) Democrats 3) Independents 4) Others

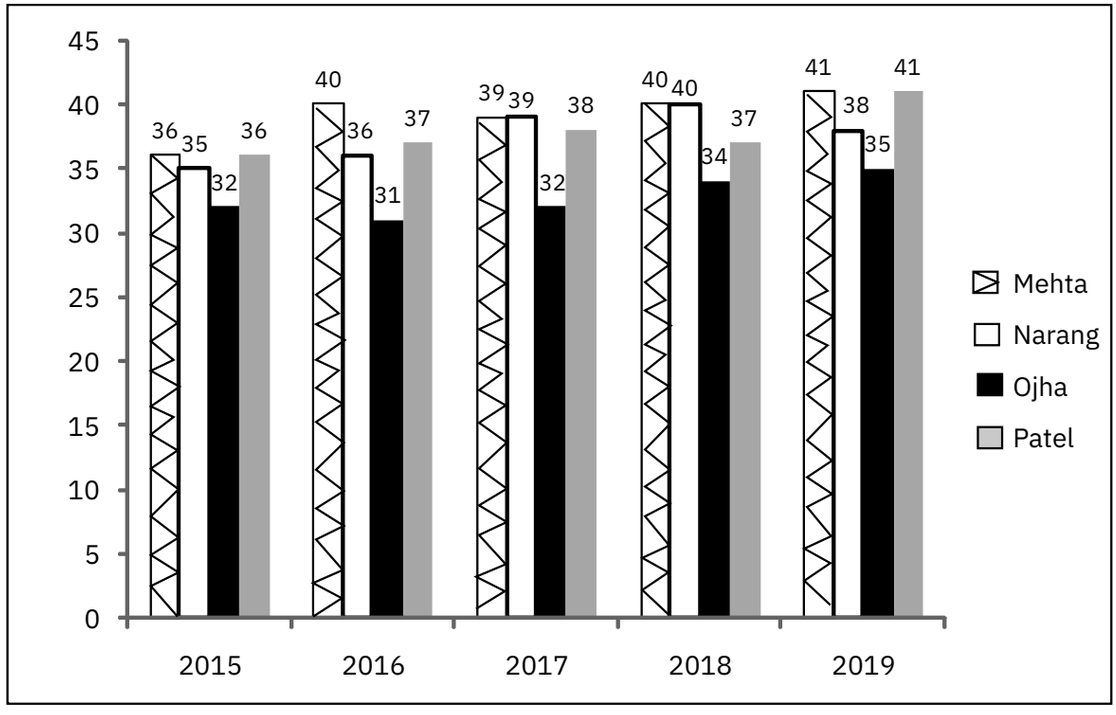
22. If p, q, r and s are expressed in terms of number of votes, then which of the following is true?
1) p = 3q 2) r = 6s 3) r = 2p 4) r= 5q

**Challengers**

**Directions for questions 1 to 5: Refer to the table below and answer the questions that follow.**

There are four rich families in the village of Lakhanpur: the Mehtas, the Narangs, the Ojhas and the Patels. In the year 2015, these families have 7, 6, 6 and 5 members respectively. All four families are on excellent terms, and during the years 2016 to 2019, in each year, on January 1st, exactly one marriage takes place (that is, a girl from one of the four families marries a boy from another of the four families and goes to stay with that family). No other marriages, and no births or deaths, take place during the given time period. No member of any of the families had a birthday in December or January. None of those getting married is over thirty years old at the time of marriage.

The graph below shows the average age of each family during the given time period (with each family member's age being calculated as completed years on the 31st of December of that year).



1. In which year did a girl from the Mehta family get married?
   1) 2016 2) 2017 3) 2016 or 2017 4) Cannot be determined

2. In which year did a boy from the Mehta family get married?
   1) 2016 2) 2017 3) 2016 or 2017 4) Cannot be determined

3. On 31st Dec 2019, how old was the girl originally from the Ojha family who got married?
   1) 20 2) 26 3) 28 4) Cannot be determined

4. On 31st Dec 2015, how old was the boy originally from the Patel family who got married?
   1) 20 2) 26 3) 28 4) Cannot be determined

5. Which family showed an increase in the number of members over the time period?
   1) Ojha 2) Patel
   3) Both Ojha and Patel 4) None of these

# PRACTICE EXERCISE-1

**DIRECTIONS for questions 1 to 4: Refer to the data and answer the questions that follow.**

Shweta appeared for an exam in her college. The exam had five subjects, namely Biology, Chemistry, Mathematics, Physics and Statistics. Each subject had two papers, named Paper-I and Paper-II. Both papers of each subject had maximum marks out of 100 and it is known that marks scored by her in all the papers of all the subjects were integers.

**Following table shows the sum of her total marks (sum of the marks in Paper-I and Paper-II) and the sum of her marks only in Paper-I in the combination of three subjects:**

| Combination | Sum of Total marks | Sum of marks in Paper-I |
|---|---|---|
| Physics + Chemistry + Biology | 490 | |
| Physics + Mathematics + Statistics | 420 | |
| Chemistry + Biology + Mathematics | 450 | 234 |
| Physics + Chemistry + Statistics | 480 | |
| Biology + Mathematics + Statistics | 410 | 235 |

Further it is known that the ratios of her marks in Paper-I to her marks in Paper-II in the five subjects (in no particular order) were 7:3, 13:7, 3:2, 1:1 and 2:3.

1. What was the difference between the maximum marks scored by Shweta in any paper (Paper-I or Paper-II) of any subject and the minimum marks scored by her in any paper (Paper-I or Paper-II) of any subject?

   1) 47 2) 60 3) 54 4) Cannot be determined

2. In which paper did Shweta score maximum marks among all the subjects (both Paper-I and Paper-II)?

   1) Statistics Paper-I 2) Chemistry Paper-I
   3) Chemistry Paper-II 4) None of the above

3. In which subject was the difference between her scores in Paper-I and Paper-II the maximum?

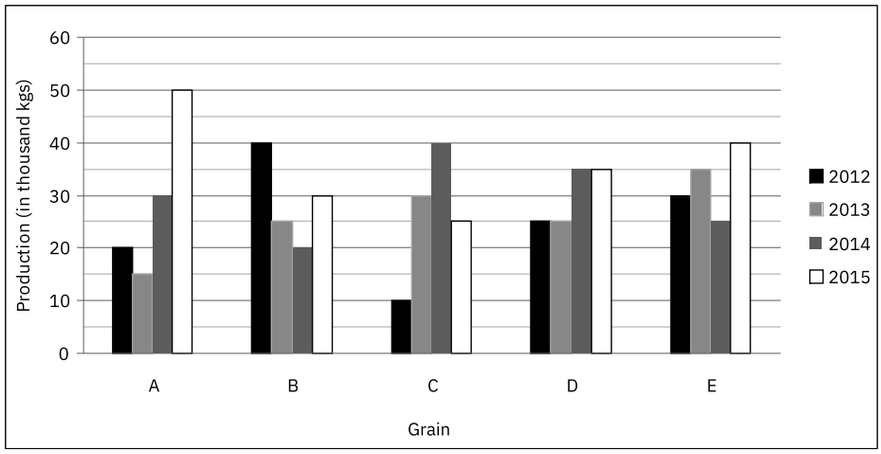
   1) Physics 2) Mathematics 3) Biology 4) Cannot be determined

4. Shweta scored equal marks in at least two (out of the 10) papers. What was her score in those papers?

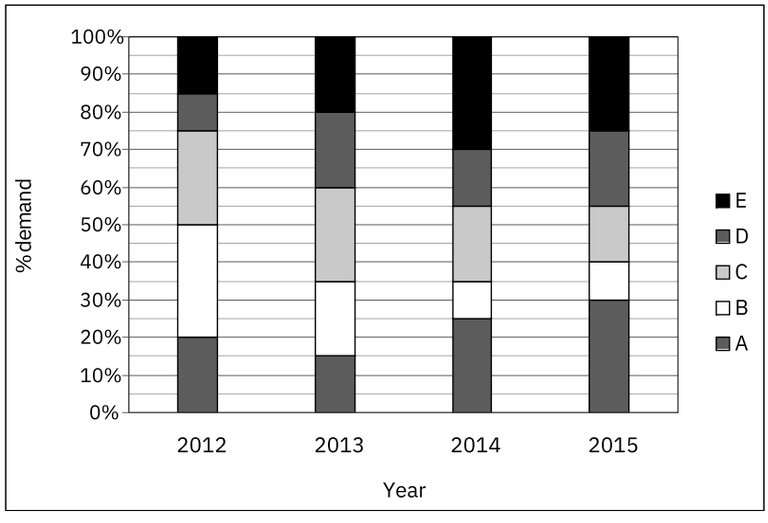
   1) 84
   2) 91
   3) 90
   4) She did not score equal marks in any two papers

**DIRECTIONS for questions 5 to 8 : Refer to the data and answer the following questions.**

State of Dakshin Pradesh is famous for agriculture. Total five types of grains, namely A, B, C, D, and E are grown in the state. If the production of a type of grain is less than the demand for that grain, the difference between the demand and the production is imported. If the production of a type of grain is more than the demand for that grain, the difference between the production and the demand is exported.
Following graph shows the total production (in thousand kgs) of the five types of grains in Dakshin Pradesh.



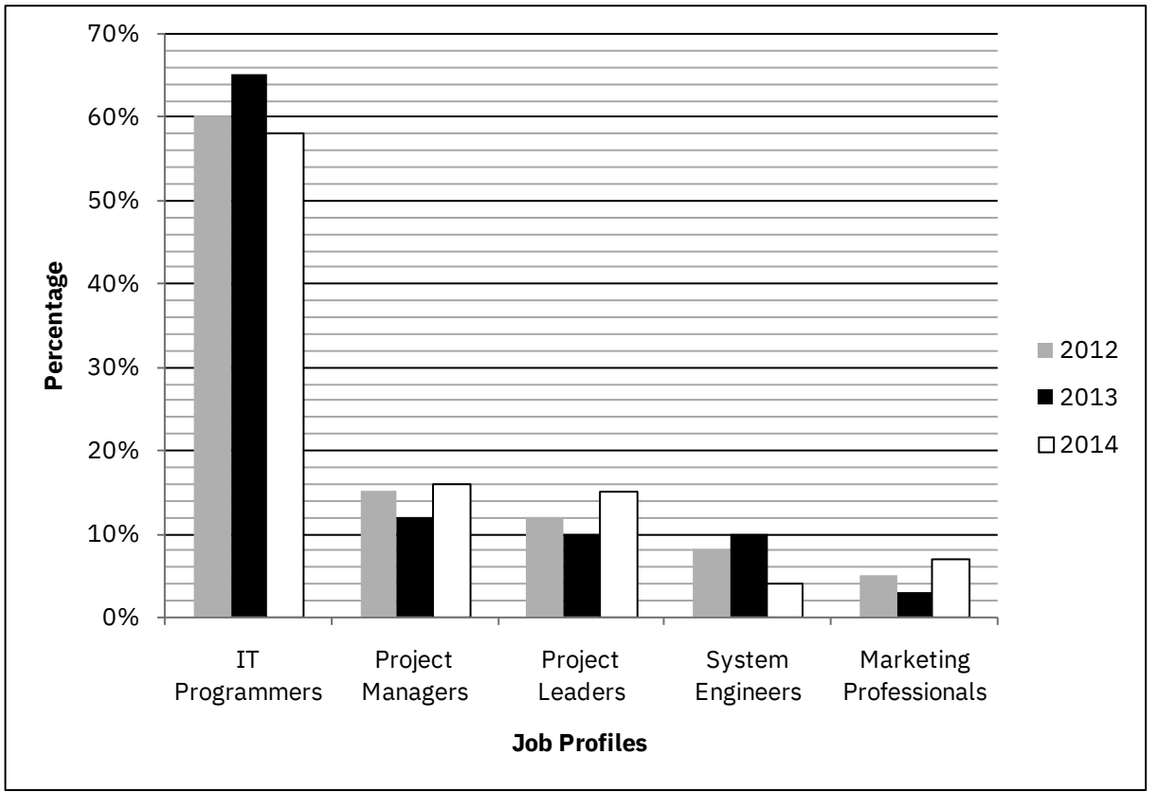

The total demand of the five types of grains taken together was 100,000 kgs in 2012. The percent increase in the total demand of the five types of grains taken together registered an increase of 20%, 10% and 25% respectively in 2013, 2014 and 2015 over corresponding values the previous year.
The following graph shows the percent break-up of the demand of each grain in each of the four years.



5. How many types of grains were exported in each of the four years given?
6. In how many years were all the five types of grains exported?
7. In which year was the export of commodity B the highest, when expressed as a percentage of the production of commodity B in Dakshin Pradesh in that year?
8. For how many commodities was the demand in Dakshin Pradesh exactly equal to the production in at least one year (and therefore there was neither import nor export of that grain in that year)?

**DIRECTIONS for questions 9 to 12: Refer to the data given below and answer the questions that follow:**

New Age Solutions Pvt. Ltd. is a Bangalore-based IT services company. The following graph shows the percentage of employees working in different job profiles in the company over the three years – 2012, 2013 and 2014. These are the only job profiles available in the company.



9. If the number of Project Leaders increased by 20% in 2013 over 2012, what is the percent change in the total number of employees working with the company between 2012 and 2013?

   1) 44% 2) 33% 3) 48.75% 4) 35%

10. If the number of employees increases by x% in 2013 over 2012 and the number of employees reduces by x% in 2014 over 2012, which of the following can be the value of 'x' so that the number of employees in exactly one job profile is equal over each of the three years?

    1) 10 2) 20 3) 30 4) 40

11. Between 2012 and 2014, if the number of employees in the company increases by 10% every year over the previous year, what is the approximate difference in percentage points in the percentage change in the number of Project Managers between 2012 and 2014 and the percentage change in the number of Project Leaders between 2012 and 2014?

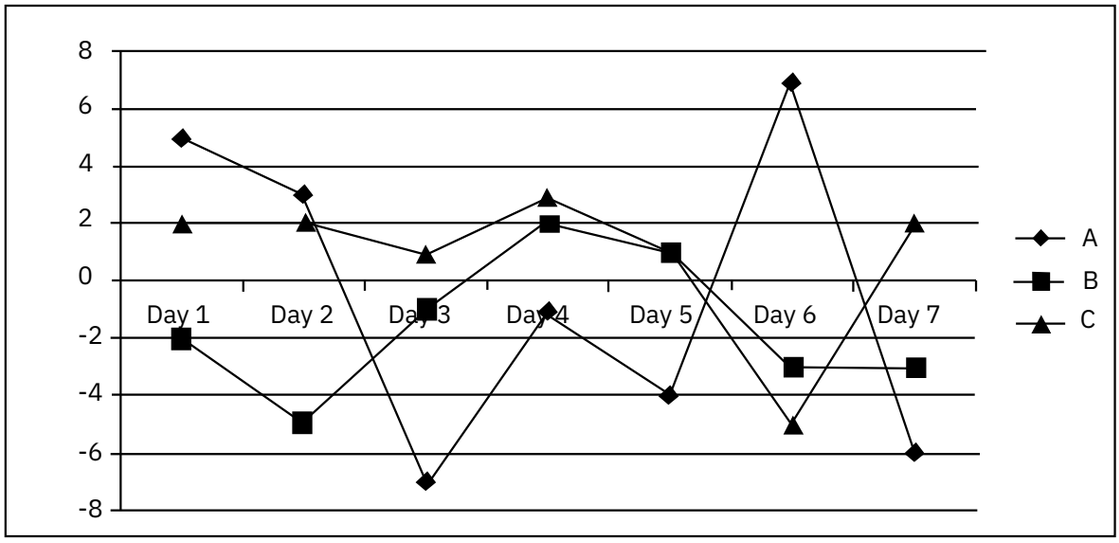
    1) 18.5 percentage points
    2) 29.1 percentage points
    3) 22.1 percentage points
    4) More information is needed to answer the question

12. If the number of employees in each of the job profiles in 2014 was greater than their corresponding numbers in 2012, which of the following can be the percent change in the total number of employees in 2014 over 2012?

    1) 98% 2) 105% 3) 74% 4) 63%

**DIRECTIONS for questions 13 to 16: Refer to the data given below and answer the questions that follow:**

The value of each of three stocks A, B, and C was recorded on a Sunday (labelled day 0). The movement of the three stocks over the course of the subsequent week was monitored (with day 1 being Monday and day 7 being the subsequent Sunday). The graph below shows the percentage change on each day (as compared to the previous day) of the value of each stock. All the percentage changes are integers. (Note: Enter your answers as a non-negative integer)




13. On which day (from 1 to 7) does stock A achieve its maximum value?

14. On which day (from 1 to 7) does stock C achieve its minimum value?

15. If the value of each of the three stocks on day 0 was $12.5, the stock which reached the highest value over the course of the week did so on which day?

16. How many of the stocks ended the week at a lower value than they had on day 0?

# PRACTICE EXERCISE-2

**DIRECTIONS for questions 1 to 3: Refer to the data and answer the following questions.**

Bharat Mata Products, an FMCG company founded by Krishnadev, has a peculiar distribution structure to reach the end customers. The company has five regional distributors, named R1, R2, R3, R4 and R5, who supply the goods to five state-level distributors, named S1, S2, S3, S4 and S5, who in turn supply the goods to five district-level distributors, named D1, D2, D3, D4 and D5. District-level suppliers cannot procure goods directly from regional distributors.
Each state-level distributor has one unique regional distributor as a 'preferred distributor' from whom it prefers to acquire the goods. S1, S2, S3, S4 and S5 have R1, R2, R3, R4 and R5 respectively as 'preferred distributors'.
Similarly each district-level distributor has one unique state level distributor as a 'preferred distributor' from whom it prefers to procure the goods. D1, D2, D3, D4 and D5 have S1, S2, S3, S4 and S5 respectively as their 'preferred distributors'.
Each district-level distributor can procure maximum 60 tonnes of goods from its preferred state-level distributor and maximum 40 tonnes of goods from each of the other state-level distributors. Similarly, each state-level distributor can procure maximum 300 tonnes of goods from its preferred regional distributor and maximum 200 tonnes of goods from each of the other regional distributors.
The following table shows the distribution costs per kg of goods from a regional distributor to a state-level distributor (in paise/kg)

| | R1 | R2 | R3 | R4 | R5 |
|---|---|---|---|---|---|
| S1 | 33 | 46 | 60 | 42 | 97 |
| S2 | 88 | 24 | 29 | 59 | 73 |
| S3 | 64 | 84 | 23 | 80 | 36 |
| S4 | 51 | 38 | 89 | 28 | 72 |
| S5 | 55 | 32 | 43 | 27 | 12 |

The following table shows the distribution costs per kg of goods from a state-level distributor to a district-level distributor (in paise/kg)

| | S1 | S2 | S3 | S4 | S5 |
|---|---|---|---|---|---|
| D1 | 21 | 46 | 47 | 78 | 86 |
| D2 | 98 | 11 | 43 | 70 | 50 |
| D3 | 53 | 69 | 27 | 44 | 60 |
| D4 | 35 | 60 | 87 | 16 | 27 |
| D5 | 91 | 59 | 34 | 68 | 23 |

( Note: 1 tonne = 1000 kg; 1 Rupee = 100 Paise)

1. If the district-level distributor D4 has a requirement of 120 tonnes of goods, then which of the following will be the minimum total expenditure incurred by D4 for procuring the required quantity of goods?

   1) Rs. 27200 2) Rs. 27300 3) Rs. 27400 4) Rs. 27500

2. Which state-level distributor would incur the lowest expenditure for procuring 700 tonnes of goods?

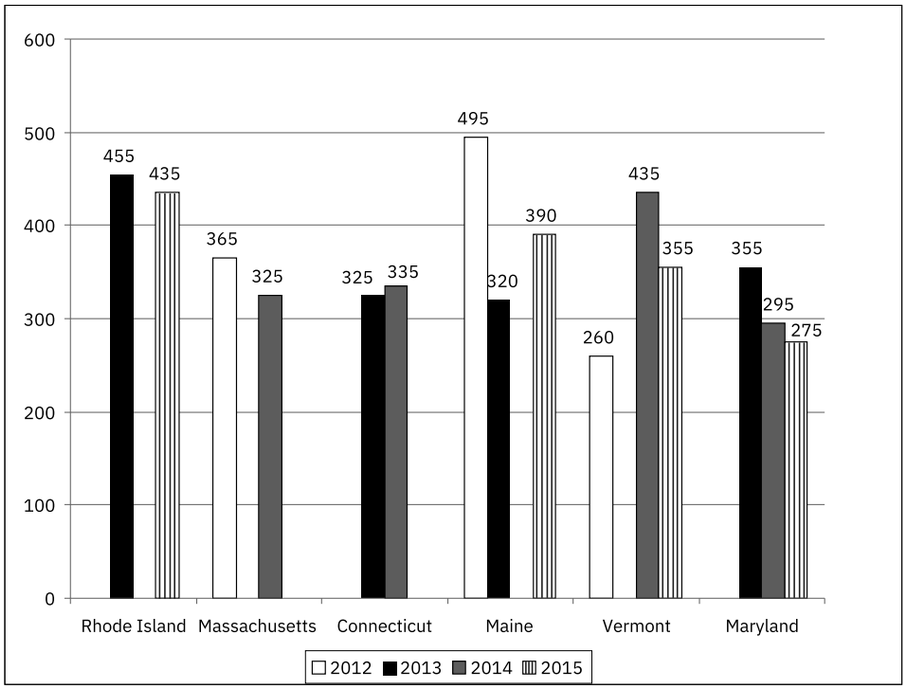
   1) S2 2) S3 3) S4 4) S5

3. If the restriction on district-level distributors to procure maximum 60 tonnes from the preferred state-level distributor was relaxed and the district-level distributors were free to procure as much quantity as they want from any one state-level distributor, for how many district-level distributors would the minimum cost of procuring 100 tonnes of goods have been less than 50% of what it would cost when the original restriction was in place?

   1) Zero 2) One 3) Two 4) More than two

**DIRECTIONS for questions 4 to 7: Refer to the data and answer the following questions.**

The following graph shows the partial data of the number of Rhodes scholars from six different states in the North-Eastern part of the US over four years, namely 2012, 2013, 2014 and 2015.




The following table shows the information on the average number of Rhodes Scholars in some of these states over the given period:

| State | Average per year |
|---|---|
| Rhode Island | 386.25 |
| Massachusetts | 367.5 |
| Connecticut | 386.25 |
| Vermont | 383.75 |
| Maryland | 311.25 |

It is also known that the average of the number of Rhodes Scholars in these states over 2012, 2013 and 2015 were 367.5, 385, and 380.8333 respectively.

4. What percent of Rhodes scholars from the total Rhodes scholars of Massachusetts are from the year 2013?

   1) 24.32% 2) 22.46% 3) 25.17% 4) Cannot be determined

5. What percent of Rhodes scholars from all the states in the year 2012 & 2013 were from Connecticut?

   1) 17.49% 2) 25% 3) 16.5% 4) Cannot be determined

6. What is the difference in the number of Rhodes scholars from Vermont in 2013 and the number of Rhodes scholars from Rhode Island in 2014?

   1) 130 2) 120 3) 165 4) Cannot be determined

7. Which of the following is highest?

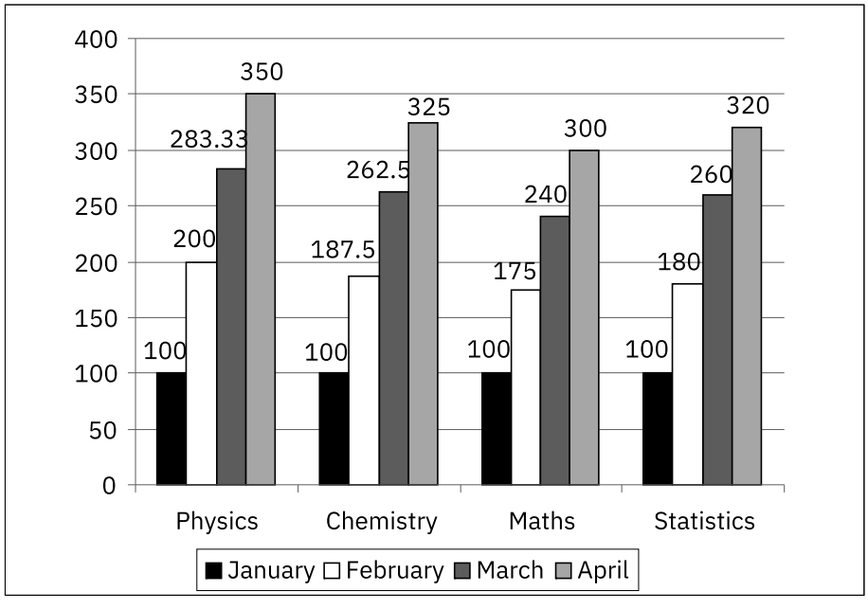
   1) Number of Rhodes scholars in Rhode Island in 2012.
   2) Number of Rhodes scholars in Massachusetts in 2013.
   3) Number of Rhodes scholars in Vermont in 2013.
   4) Number of Rhodes scholars in Maryland in 2012.

**DIRECTIONS for questions 8 to 11: Refer to the data and answer the following questions.**

Members of the Erudite Science Club in a college start four funds – Physics, Chemistry, Maths and Statistics, to buy books on these four subjects. The intention was to contribute to the fund over four months – January, February, March and April, and buy books in May using the total amount collected. Not all the members of the club contributed to the funds every month but when they did, each person contributed Rs.100 to any one of the four funds in a month, not necessarily the same fund every month.

For each of the four funds, the number of students who contributed in each of February, March and April was either equal to or one greater or one lesser than their corresponding numbers in the previous month. For example, if 'n' students contributed to the Physics fund in February, then the number of students who contributed to the Physics fund in March can be 'n - 1', or 'n' or 'n + 1'.

The following bar graph shows the average amount collected in each fund in each of the four months. The average in a given month is defined as the total amount contributed to the fund till that month (including that month) divided by the maximum number of students who have contributed to the fund in any month up-to that month (including that month).



8. What was the total amount (in Rs.) contributed by the students in all the four funds combined in April?

9. What was the maximum number of students who contributed to any fund in any month?

10. If each student contributed to a fund only once in these four months, what can be the maximum number of students who contributed in the four months?

11. What was the maximum contribution (in Rs.) to any fund over the given four months period?

**DIRECTIONS for questions 12 and 13: Refer to the data and answer the following questions.**

Trump visited a casino in Las Vegas with certain amount of dollars with him. He played 6 games numbered 1, 2, 3, 4, 5 and 6 in that order. He won all the odd-numbered games but lost all the even-numbered games. In all the odd-numbered games, he pledged the entire amount that he had with him at the beginning of that particular game whereas in all the even-numbered games, he pledged only half the amount that he had with him at the beginning of that particular game.

The following were the rules of the games:
1. In all the games that he won, he won as much amount that he had pledged and also got back his originally-pledged amount.
2. In all the games that he lost, he lost a certain portion of the amount he had pledged. He got his originally-pledged amount back after deducting the amount he had lost in that game. In the first game that he lost, he lost ½ of the amount he had pledged, in the second game that he lost, he lost 2/3rd of the amount he had pledged whereas in the third game that he lost, he lost 3/4th of the amount he had pledged.

Finally, at the end of 6 games, he walked out with $1000.

12. How much amount did Trump pledge in game 3?

13. What was the difference between the amount (in $) that Trump walked out with at the end of 6 games and the amount (in $) he brought with him at the beginning?

# LR-2.1 RELATIONSHIPS, CODING AND LOGICAL STATEMENTS

THEORY

## Introduction

Sometimes questions based on relations, coding and logical statements are asked in different entrance examinations. In this class, we will discuss a few of these examples.

Family tree logical problems mainly deal with the hierarchical structure of a family i.e., grandparents, parents, children etc. Various relationships between the family members of two or three generations will be given. The entire family tree has to be constructed by putting the various relationships together.

## Relations at a glance

### brother-in-law

The brother of one's spouse.
The husband of one's sister.
The husband of the sister of one's spouse

### sister-in-law

The sister of one's spouse.
The wife of one's brother.
The wife of the brother of one's spouse.

### mother-in-law

The mother of one's spouse.

### father-in-law

The father of one's spouse.

### son-in-law

The husband of one's daughter.

### daughter-in-law

The wife of one's son.

### grandfather

The father of one's mother or father.

### sibling

Person having one or both parents in common with another; a brother or sister.

**cousin**

A child of one's aunt or uncle. Also called first cousin.

A relative descended from a common ancestor, such as a grandparent, by two or more steps in a diverging line.

**second cousin**

A child of a first cousin of one's parent.

A child of one's first cousin.

**uncle**

The brother of one's mother or father.

The husband of one's aunt.

**aunt**

The sister of one's father or mother.

The wife of one's uncle.

**nephew**

Son of one's brother or sister.

**niece**

Daughter of one's brother or sister.

**maternal**

Related through one's mother, such as a maternal grandmother being the mother's mother.

**paternal**

Related through one's father, such as a paternal grandmother being the father's mother.

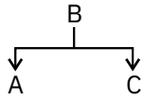
### Diagrammatic representation of a family tree

To build a family tree, certain standard notations are used in this book to indicate a relationship between the members of the family. It is not necessary to follow them implicitly, you can formulate your own notations to draw the family tree quickly and accurately.

**Notations**

1. A is a male — 

2. A is a female — 

3. Sex of A not known — A
4. A and B are married to each other — A = B
5. A and B are siblings — A ↔ B
6. A and C are B's children — 

7. A is the uncle/aunt of B — 

8. A is the only child of B — 

## Concept Builders

### Solved Example (1)

In these type of questions, the gender of all the family members is known.

**Directions for questions 1 to 4: Refer to the data below and answer the questions that follow:**

A family of Aamir, Basanti, Chander, Deepak, Esha, Farida, Ganesh, Hansika and Inder, consists of 3 generations. The following information is given about the family.

- Aamir is married to Basanti and has 2 sons and 1 daughter Esha.
- Ganesh is Basanti's son-in-law.
- Deepak is Farida's brother-in-law and Esha's brother.
- Chander has 2 children, and they are the only grandchildren in the family.

**Q1 :** How is Chander related to Ganesh?

**Q2 :** Deepak is Aamir's _____.

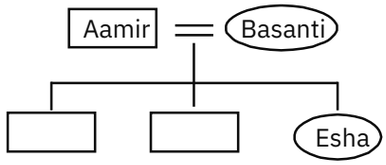
**Q3 :** Aamir is Inder's _____.

**Q4 :** How is Ganesh related to Hansika?

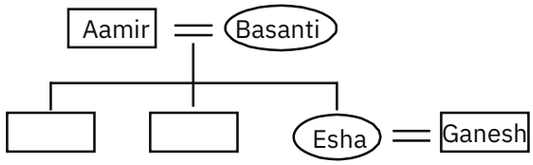
**Solution**

a] The family consits of 3 generations and 9 members.

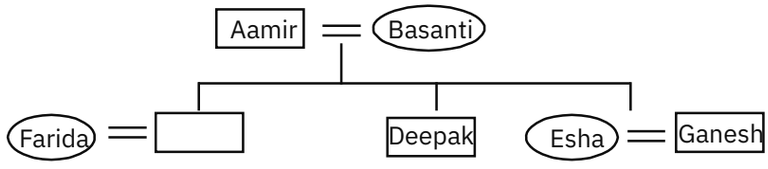
b] Aamir is married to Basanti and has 2 sons and 1 daughter Esha.



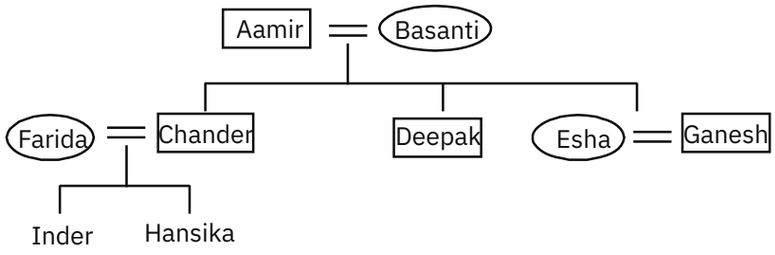

c] Ganesh is Basanti's son-in-law



d] Deepak is Farida's brother-in-law and Esha's brother.




e] Since its a family of 3 generations, Chander has to be married to Farida as he has 2 children who have to be Inder and Hansika. Hence the whole tree is represented as:




From this, we get to know all the relationships and can answer all the questions.

**A1 :** Chander is Ganesh's brother-in-law.

**A2 :** Deepak is Aamir's son.

**A3** : Aamir is Inder's grandfather.

**A4** : Ganesh is Hansika's uncle.

**Solved Example (2)**

In these type of questions gender of some family members is not known.

Directions for questions 1 to 3: Refer to the data below and answer the questions that follow:

A, B, C, D, E and F are related to each other as given here. B is F's daughter in-law. D is A's only grandchild. C is D's only uncle. A has only 2 children F and C, one male and one female (not necessarily in the same order). E is the father of C.

**Q1 :** Who is the grandmother of D?

**Q2** : Who is the mother-in-law of B?

**Q3** : If a girl G is married into the family, then what is the relationship between G and D?

**Solution**

To make a family tree from the given data, we will first identify the males and the females in the family and then try to put each of them in their respective position in the tree.

**Step I:** Identify the sex of A, B, C, D, E, and F.

From the given conditions we can determine who are the males/females in the above group.

a] B is F's daughter-in-law

b] C is D's only uncle

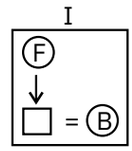
c] A has 2 children F and C, one male and one female. Since C is male, F is female.

d] E is the father of C.

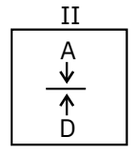

**Step II:** Try to identify the positions of the members in the family tree. For this, determine the number of generations involved from the statements. D is A's only grand child. Thus, we know that there are three generations.

**Step III:** Use the conditions to arrange A, B, C, D, E and F in these three generations.

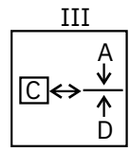
a] B is F's daughter-in-law.



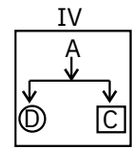

b] D is A's only grandchild.



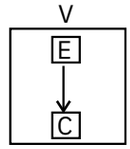

c] C is D's uncle.

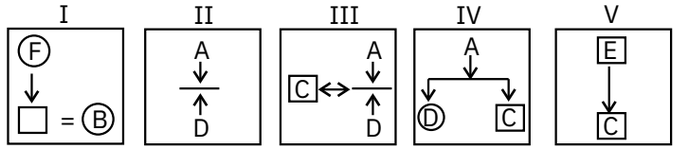


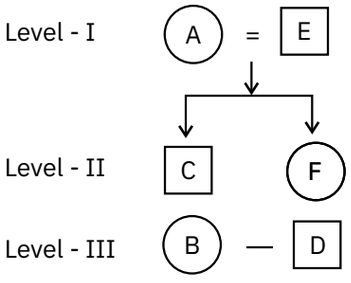

d] A has only two children F and C, one male and one female.




e] E is C's father.






Question (1) and (2) can be answered easily by looking at the family tree. A is the grandmother of D and F is the mother-in-law of B. For question (3), C is the only male in the family who is unmarried. G will be married to C and hence she will be D's aunt.

**Solved Example (3)**

Sometimes we also have single questions in family tree based on logical inferences

**Q :** Rachel says, "Paul's father is the only son of my father", how is Rachel related to Paul?

**A :** Only son of Rachel's father –– Rachel's brother. So, Paul's father is Rachel's brother or Rachel is the sister of Paul's father i.e., Rachel is Paul's paternal aunt.

**Q** : Pointing to a photograph, Reggie says, "This man's wife's mother-in-law is my mother". How is Reggie related to the man in the photograph?

**A** : Man's wife's mother-in-law is the man's mother who is also the mother of Reggie. Hence, the man in the photograph is either Reggie or Reggie's brother.

## Codes

A code is a rule for converting a piece of information (for example, a letter, word, or phrase) into another form or representation, not necessarily of the same sort. Decoding is the reverse process of converting data, which has been sent by a source, into information understandable by a receiver. This chapter introduces you to some basic methods of encoding and decoding.

### Methods of Encoding & Decoding

#### Letter Coding

Here the real alphabets in a word are replaced by certain other alphabets according to a specific rule to form its code. It is required to detect the common rule.

**Q :** In a certain language, if 'MADRAS' is coded as 'NBESBT', how is 'BOMBAY' coded?

1) CPNCBX 2) CPNCBZ 3) CPOCBZ 4) CQOCBZ

**A :**

| | | | | | | |
|---|---|---|---|---|---|---|
| | M | A | D | R | A | S |
| +1 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| | N | B | E | S | B | T |

Clearly, each letter in the word 'Madras' is moved one step forward to obtain the corresponding letter of the code. So, in 'BOMBAY', B will be coded as C, O as P, M as N, B as C, A as B and Y as Z. Thus, the code becomes CPNCBZ. Hence, [2].

**Q :** In a certain code 'SIKKIM' is written as 'THLJJL'. How is 'TRAINING' written in that code?

1) SQBHOHOH 2) UQBHOHOF 3) UQBJOHHO 4) UQBJOHOH

**A :**

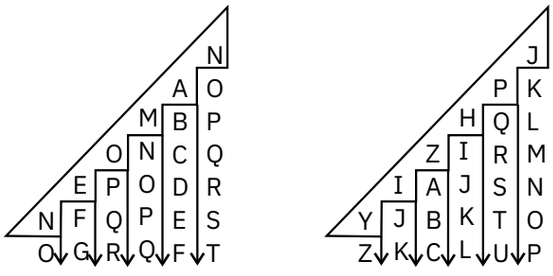
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | H | | | J | | | L | |
| +1↓S | -1↑I | | +1↓K | -1↑K | | +1↓I | -1↑M | |
| T | | | L | | | J | | |

Clearly, the letters in the word 'SIKKIM' are moved alternately one step forward and one step backward to obtain the letters of the code. So, in 'TRAINING', T will be coded as U, R as Q, A as B, I as H, N as O and so on. Thus, the code becomes UQBHOHOF. Hence, [2].

**Q :** If in a certain language 'NEOMAN' is coded as 'OGRQFT', which word will be coded as a 'ZKCLUP'?

1) YJBKTD 2) XIAJSN 3) YIZHPJ 4) YIAQKJ

**A** :




Hence, [3].

**Number Coding**

**Q** : If 'SPAIN' is coded as 68512 and 'FRANCE' is coded as 795243, then how is 'AFRICA' coded?

1) 578915 2) 579145 3) 579235 4) 579845

**A** : Looking at the common alphabets A and N we can see that A is coded as 5 and N is coded as 2. Clearly the alphabets are coded as shown:

| S | P | A | I | N | F | R | C | E |
|---|---|---|---|---|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 6 | 8 | 5 | 1 | 2 | 7 | 9 | 4 | 3 |

Since A is coded as 5, F as 7, R as 9, I as 1 and C as 4.

Hence, 'AFRICA' is coded as 579145. Hence, (2).

**Q** : If S = 38, Z = 52 and ACT = 48, then 'BAT' will be equal to:

1) 39 2) 41 3) 44 4) 46

**A** : In the given code A ≡ 2, B ≡ 4, C ≡ 6, .... Z ≡ 52

Now, ACT ≡ 48 ≡ 2 + 6 + 40 ≡ A + C + T

∴ BAT ≡ B + A + T ≡ 4 + 2 + 40 ≡ 46. Hence, (4).

**Q** : If 'MACHINE' is coded as 19-7-9-14-15-20-11, then how will you code DANGER?

1) 10-7-20-13-11-24 2) 10-7-20-16-11-24
3) 13-7-20-9-11-25 4) 13-7-20-10-11-25

**A** : Putting A ≡ 7, B ≡ 8, C ≡ 9 .... X ≡ 30, Y ≡ 31, Z ≡ 32 we have,

MACHINE ≡ 19-7-9-14-15-20-11

Similarly, DANGER 10-7-20-13-11-24. Hence, (1).

**Q :** In a certain code, '3456' is coded as 'ROPE', '95526' is coded as 'APPLE', then how is '54613' coded?

1) RPPEO 2) ROPEA 3) POEAR 4) PARED

**A :** Looking at the common numbers, 5 is coded as P and 6 is coded as E. Clearly then, the numbers are coded as follows:

| 3 | 4 | 5 | 6 | 1 | 2 |
|---|---|---|---|---|---|
| R | O | P | E | A | L |

Hence, '54613' is coded as 'POEAR'. Hence, (3).

**Numbers by Letters**

The numbers are coded as letters (or sometimes as symbols like *, #, etc). Mathematical Operations like addition, subtraction, multiplication or division are carried out on these coded numbers. Using basic number logic, one can decode the letters or symbols.

**Q :** In the mathematical addition below, each letter represents a different digit. What is the value of A?

$$\begin{array}{r} 2A \\ +\ B2 \\ \hline D\ 2C \end{array}$$

**A :** As two numbers of two digits are added, the maximum carry can be 1. So value of D must be 1. Also the addition 2 + B generates a carry that implies the value of B is 9 and there is carry over from the previous operation i.e., A + 2 = C. To generate a carry, value of A can be 8 or 9. But it cannot be 9 as in that case A and B will have same value.

Hence, A = 8. Also C = 0 and the operation is 28 + 92 = 120.

**Q :** In the multiplication between numbers 'PQ' and 'QP' below, each letter represents a different digit. What is the value of T?

$$\begin{array}{r} PQ \\ QP \\ QR \\ \hline SP\ QR \\ \hline ST\ RR \end{array}$$

1) 5 2) 4 3) 3 4) 2

**A :** $\because$ R + R = R, R has to be 0. As Q + Q gives the last digit as 0, Q = 5. ($\because$ Q$\neq$0 as R = 0)

Also Q × P i.e., 5 × P gives a units digit of R i.e., 0 and P5 × P gives a two digit number i.e, QR = 50.

∴ P is 2. ∴ The expression rewritten in number form is:

$$\begin{array}{r} 25 \\ 52 \\ \hline 50 \\ 12\ 50 \\ \hline 13\ 50 \end{array}$$

∴ T = 3. Hence, [3].

**Group Coding of Words / Numbers**

The question below gives a case of **Mixed Word Coding**.

In this type of question, three or four complete messages are given in the coded language and the code for a particular word is asked. To analyse such codes, any two messages bearing the common word are picked up. The common code word will mean that word.

**Q** : In a code language 'mok dan sil' means 'nice big house', 'fit kon dan', means 'house is good' and 'warm tir fit' means 'cost is high'. Which word stands for 'good' in that language?

**A** : In the first 2 codes, the common code word is 'dan' and the common word is 'house' so 'dan' stands for 'house'. In the last 2 codes, the common code word is 'fit' and the common word is 'is', so 'fit' stands for 'is'. Thus in the second code, 'kon' stands for 'good'.

The question below gives a case of **Mixed Number Coding**.

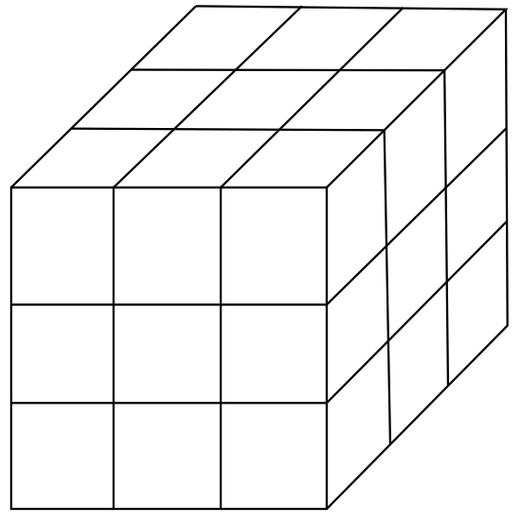
In this type of question, a few groups of numbers each coding a certain short message are given. Through a comparison of the given coded message, taking two at a time, it is required to find the number code for each word and then the code is formulated for the message given.

**Q** : In a certain code '247' means 'spread red carpet', '256' means 'dust one carpet' and '264' means 'one red carpet'. Which digit in that code means 'dust'?

**A** : In the first 2 codes, the common code digit is '2' and the common word is 'carpet', so '2' means 'carpet'. In the last 2 codes, the common code digit is '6' and the common word is 'one', so '6' means 'one'. Therefore, in the second code '5' means 'dust'.

**Teaser**

A cube can be cut into 27 smaller cubes of equal size by using 6 straight cuts as shown in the figure below. Is it possible to do so in less than 6 cuts, by re-arranging the pieces after each cut?



# CLASS EXERCISE

## Relationships

1. A man looks at a picture and says ”Her father’s sister’s son is my younger brother”. How is he related to the person in the picture?

2. There is a family of 3 generations, having 8 members. There are exactly 2 married couples in the family and the remaining 4 members are unmarried. Pat’s granddaughter, Killian, is an Engineering student. Laurie’s mother Cathy is a lawyer, while his maternal aunt Betty is a Banker. Carol’s son, Davy, is into shipping, while her son-in-law, Jeremy, runs a Fitness Academy with his son. What is Laurie’s profession?

3. A man points at a passing woman and says, “Her father’s sister’s father’s only son married my mother”. How are the two related?

   i)Aunt-Nephew ii) Uncle-Niece iii) Cousins
   iv) Siblings v) None of these

4. A is the son of B, who is the husband of C, who is the sister of D, who is the father of E, who is the brother of F, who is the daughter of G.

   i) How is A related to G?
   ii) Who is the paternal aunt of F?
   iii) What is the relationship between C and G?

**Answer questions 5 – 8 based on the following information:**

A family has 9 members in 3 generations, including 3 married couples. T is the grandson of L, who is married to the surgeon. N is the mother of O, while Q is the daughter-in-law of N. R, the Politician, is the father of S, who is the first cousin of T and P. P is the daughter of Q, the teacher. O is the sister of M. There is a male lawyer, a female engineer and three unmarried students, while the eldest member of the family is retired.

5. Who is the Engineer?

6. How many children does the lawyer have?

7. How is Q related to S?

8. What is M’s profession?

**Coding**

9. If six is coded as three, twelve is coded as six, and eighteen is coded as eight, how is nine coded?

   1) five  2) four  3) three  4) four and a half

10. If in a certain language "jaan tere naam" means "work is worship", "tere mere sapne" means "duty is deity" and "mere naam aur kaam" means "worship your deity today" then what word means "duty"?

    1) tere  2) mere  3) sapne  4) cannot be determined

11. Fill in the blanks:

a) AMITABH : IMATHBA : : SRIDEVI : _ _ _ _ _ _ _

b) REPUBLIC : SFQVCMJD : : DEMOCRAT : _ _ _ _ _ _ _ _

c) TANGO : SZMFN : : _ _ _ _ _ : ONKJZ

d) QATAR : RCWEW : : _ _ _ _ _ : ZGPIS

e) ORANGE : FFOZSN : : _ _ _ _ _ _ : FKQQVO

f) ZAMBIA : AHZABN : : _ _ _ _ _ _ : ZLZQBO

g) INDORE : _ _ _ _ _ _ : : RANCHI : ENAPUV

h) ZERO : AVIL : : FIFTY : _ _ _ _ _

i) PEPSI : 16516199 : : LIMCA : _ _ _ _ _ _ _ _

j) FLUTE : 3614444140025 : : BANJO : _ _ _ _ _ _ _ _ _ _ _ _

k) PERMUTATION : 152 : : COMBINATION :

l) LAFANGEY : 31615757 : : PARINDEY : _ _ _ _ _ _ _ _

12. Answer the following:

a) If KUMBLE is coded as BLEKUM , then ZAHEER will be coded as?

b) If LEANDER is coded as MFBOEFS, then MAHESH will be coded as?

c) If IBM is coded as HAL, then KBC will be coded as?

d) If DICTATOR is coded as BUPSEJDU , then MINISTER will be coded as?

e) If YAHOO is coded as ZCKST, then GOOGLE will be coded as?

f) If LIBERTY is coded as YVOREGL, then EQUALITY will be coded as?

g) If RAJNI is coded as IZQMR , then MITHUN will be coded as?

h) If CHENNAI is coded as 385141419 , then DELHI will be coded as?

i) If DEAF is coded as 1625136, then BLIND will be coded as?

j) If ALGEBRA is coded as 46, then GEOMETRY will be coded as?

**Answer questions 13 – 18 based on the information below:**

In a certain game, players have to form English words. Each word is awarded a score by summing up the squares of the numerical positions of all its letters in the alphabet. For example, the word KING would score 112 + 92 + 142 + 72 = 121 + 81 + 196 + 49 = 447 points, while the word CAB would score 9 + 1 + 4 = 14 points.

13. Which of the following words would score 170 points?
    1) ALE 2) LEAD 3) AM 4) both (1) and (3)

14. Which of the following words would score the minimum?
    1) BID 2) CAGED 3) CABBAGE 4) AID

15. Which of these words would score the least?
    1) GAME 2) FEEDBACK 3) FLAG 4) GLEE

16. If a person scored 78 points, what word did he play?
    1) ADDED 2) DEAF 3) CAGE 4) Cannot be determined

17. Which of the following three lettered words would score the highest?
    1) SPY 2) POX 3) ZAP 4) VOW

18. Which of the following pairs would not score an equal number of points?
    1) HEFTS & JEST 2) RELIC & CORE
    3) FADING & AGING 4) CANDLES & NAMES

**Logical Statements**

19. "Alexander died before Caesar". If the above statement is true, then which of the following follows?
    1) Alexander was born before Caesar 2) Caesar was born before Alexander died
    3) Alexander was born before Caesar died 4) Alexander died before Caesar was born
    5) Caesar died before Alexander was born

**Answer questions 20 – 25 based on the following information:**

Leonardo, Donatello, Rafael and Michaelangelo were the four famous artists of the European Renaissance. Relatively little is known about their personal lives, but a recent study unearthed the following information:

- Michaelangelo died before Donatello died.
- Donatello was born before Rafael was born.
- Leonardo died after Rafael, Donatello and Michaelangelo died.

20. Which of the following is definitely true?
    1) Rafael was born before Leonardo was born.
    2) Michaelangelo was born before Rafael died.
    3) Michaelangelo was born before Leonardo, Rafael and Donatello were born.
    4) Michaelangelo was born before Donatello died.

21. If Leonardo was born before Donatello was born, which of the following is definitely true?
    I. Leonardo lived longer than Donatello.
    II. Leonardo lived longer than Rafael.
    III. Leonardo lived longer than Michaelangelo.
    1) I only 2) II only 3) I and II only 4) II and III only

22. If Rafael died before Donatello died and Donatello died before Leonardo was born, which of the following is definitely true?
    1) Michaelangelo was not alive during Donatello's lifetime.
    2) Rafael was not alive during Leonardo's lifetime.
    3) Michaelangelo was not alive during Rafael's lifetime.
    4) Rafael was born and died during Michaelangelo's lifetime.

23. "Every king is brave". If this is true, which of the following is/are true?
    a) George is brave, so he must be a king
    b) Lear is not brave, so he cannot be a king
    c) James is a king, so he must be brave
    d) Richard is not a king, so he must not be brave
    1) a and d only 2) b and d only
    3) b and c only 4) a and c only

24. Tyson says "Usain will win, I can't beat him. But only Greene can finish between Usain and me". If he is correct, who will finish third in the race?
    1) Tyson 2) Greene
    3) Either (1) or (2) 4) Cannot be determined

25. Amy says "I will not go shopping if it rains". Choose the alternative(s) where the second statement follows logically from the first:

A) It did not rain. Amy went shopping.
B) Amy went shopping. It did not rain.
C) It rained. Amy didn't go shopping.
D) Amy didn't go shopping. It rained.

1) A and B only
2) A and C only
3) B and C only
4) B and D only
5) All of A, B, C and D

## Challengers

**DIRECTIONS for questions 1 to 7: Refer to the data below and answer the questions that follow.**

Damini and Kamini take part in a game show. Both of them stand on the centre square (F) of a line of 11 squares as shown below. The game show hostess, Rukmani, rolls a fair six-sided die and the two participants move according to the sequence of tosses.

| A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|

Damini moves one step left if the die shows an even number and one step right if it shows an odd number. Kamini, on the other hand, stays put (i.e. does not move) on the first roll of the die. After that, on every roll, she moves one step left if the sum of the results of the last two rolls is even and one step right if the sum is odd. The winner of the game is the one who reaches either end of the line (i.e. the squares marked A or K) first. (For example: if the first three rolls of the die result in 2, 3 and 5, Damini will move left, move right, move right and reach G, while Kamini will stay put, move right, move left and reach F)

1. If the sequence of rolls is 123123123123123..., who will win the game and after how many rolls?

   1) Damini, 11 2) Kamini, 12 3) Damini, 13 4) Kamini, 16

2. If the sequence of rolls is 123456123456..., who will win the game and after how many rolls?

   1) Damini, 5 2) Kamini, 5 3) Damini, 6 4) Kamini, 6

3. What is the minimum number of rolls in which a winner could emerge?

   1) 4 2) 5 3) 6 4) None of these

4. If the product of all the numbers rolled at the end of the game is 192, who will win the game?

   1) Damini 2) Kamini 3) Indeterminate 4) None of these

5. What is the minimum number of rolls which could result in a tie (i.e. both players reaching the 'finishing line' together)?

   1) 9 2) 12 3) 17 4) None of these

6. * If the sequence of rolls is 122333444455555...., who will win the game and after how many rolls?

   1) Kamini, 14 2) Damini, 15 3) Kamini, 16 4) Damini, 13

7. * If the sequence of rolls is 12233445566112...., who will win the game and after how many rolls?

   1) Kamini, 17 2) Damini, 10 3) Kamini, 21 4) None of these

# PRACTICE EXERCISE-1

**DIRECTIONS for questions 1 to 4: Refer to the data given below and answer the questions that follow:**

Prakash and Prashant are playing a game that involves four rounds. In each round, initially Prakash says a one-digit natural number (called number 'a'). Prashant transforms the number 'a' into a different natural number (called number 'b') subject to different rules in each round and says it aloud. Prakash then transforms the number 'b' into a third natural number (called number 'c') using the same rule that Prashant applied and says it aloud. Prashant then transforms the number 'c' into a fourth natural number (called number 'd') using the same rule and says it aloud. This process continues. The first person who says 100 or a number greater than 100 wins.

The following are the rules used for transforming the numbers in different rounds of the game:

| Round | Rule |
|---|---|
| Round 1 | Next prime number (i.e. if one person says the number 9 anytime, the other person will say next prime number i.e. 11) |
| Round 2 | A larger natural number less than or equal to double (i.e. if one person says the number 11 anytime, the other person will say any number between 12 and 22, both included) |
| Round 3 | A larger natural number with difference up-to 10 (i.e. if one person says the number 11 anytime, the other person will say any number between 12 and 21, both included) |
| Round 4 | A larger natural number less than or equal to three times (i.e. if one person says the number 11 anytime, the other person will say any number between 12 and 33, both included) |

Assume that both Prakash and Prashant are rational human beings. As a result, each of them wants to say a number greater than or equal to 100 at the earliest possible opportunity.

1. How many different numbers can Prakash initially say to ensure that he definitely wins Round 1?

2. How many different numbers can Prakash initially say to ensure that he definitely wins Round 2?

3. How many different numbers can Prakash initially say to ensure that he definitely wins Round 3?

4. How many different numbers can Prakash initially say to ensure that he definitely wins Round 4?

**DIRECTIONS for questions 5 to 8: Refer to the data and answer the following questions.**

Bungaland Intelligence Agency (BIA) has deputed a number of spies in the enemy territory to gather information on critical military installations of the enemy. The mission is being undertaken in complete secrecy. The spies are given numbers 1,2,3... Moreover, every spy is referred to by a unique code, which is known only to the central high command of BIA in the capital city of Port Arthur. The following are the rules for assigning the codes to the spies:

1] Spy number 1 is given the code A and the spy number 2 is given the code B.

2] For spy numbered N (N > 2):

a. If N can be expressed as "$N_1$ + $N_2$", where $N_1$ and $N_2$ are two numbers (not necessarily unique) such that the spies bearing numbers $N_1$ and $N_2$ both have one-letter codes (say $\alpha$ and $\beta$ respectively), then the code of the spy numbered N is '$\alpha\beta$'. For example, consider N = 3. Because 3 = 1 + 2 and the spies numbered 1 and 2 both have one-letter codes (A and B respectively), the code of the spy numbered 3 is 'AB'.

b. If N cannot be expressed as "$N_1$ + $N_2$", where $N_1$ and $N_2$ are two numbers (not necessarily unique) such that the spies bearing numbers $N_1$ and $N_2$ both have one-letter codes, the code of the spy numbered N is the next letter of the English alphabet. For example, code for the spy number 4 is BB and because 5 cannot be expressed as the sum of two numbers both having one-letter codes, the code for the spy numbered 5 is the next letter of the English alphabet i.e. C.

3] The codes of all the spies (that have codes having two-letter codes) are in alphabetical order. For example, AB is a valid code but BA is not.

4] BIA deployed the maximum possible number of spies 'X' in the enemy territory such that all the spies numbered 1 to X had been given one- or two-letter codes only, as per the above policy.

5. How many spies had been deployed by BIA in the enemy territory?

1) 52 2) 50 3) 76 4) 148

6. How many spies had been given two-letter codes?

1) 26 2) 50 3) 42 4) 36

7. How many spies with prime numbers had been deployed by BIA in the enemy territory?

1) 21 2) 15 3) 18 4) 10

8. How many spies could be given more than one code?

1) 0 2) 5 3) 16 4) 23

**DIRECTIONS for questions 9 to 16: Refer to the data and answer the following questions.**

John and Vic volunteer for a game on a TV show with the following rules:
A set of the first n natural numbers (where n is not less than 4) is taken.
All possible pairs are found which are of the form (i, j) (where $1 \le i < j \le n$)
Each such pair is written on a slip of paper and allotted to a volunteer.
{For example, if n = 4, there will be 6 volunteers with slips bearing (1, 2), (1, 3), (1, 4), (2, 3), (2, 4) and (3, 4)}
For a given volunteer, a "friend" is defined as one who has at least one number in common with him
For a given volunteer, a "stranger" is one who has no number in common with him.

9. If John gets the pair (3, 7), what is the minimum number of "friends" he could have?
   1) 5 2) 10 3) 6 4) 11

10. If Vic gets the pair (2, 5), what is the minimum number of "strangers" he could have?
   1) 2 2) 3 3) 4 4) 5

11. If n = p, how many "friends" does John have?
   1) p – 1 2) p – 2 3) 2(p – 1) 4) 2(p – 2)

12. If n = q, how many "strangers" does Vic have?
   1) $\frac{1}{2}(q^2 - 5q + 6)$ 2) (q)(q – 2)
   3) $(q^2 - 7q + 13)$ 4) $\frac{1}{2}(q^2 - 3q + 2)$

13. If n = r (≥ 10), and John and Vic are "friends", how many other people are "friends" of both John and Vic simultaneously?
   1) 2r – 6 2) r – 3 3) 2r – 5 4) r – 2

14. If n = s (≥ 10), and John and Vic are "friends", how many other people are "strangers" to both John and Vic?
   1) $\frac{1}{2}(s^2 - 5s + 6)$ 2) $\frac{1}{2}(s^2 - 7s + 12)$
   3) $s^2 - (s - 2)^2$ 4) None of these

15. * If n = t (≥ 10), and John and Vic are "strangers", how many other people are "strangers" to both John and Vic?
   1) $\frac{1}{2}(t^2 - 9t + 20)$ 2) $\frac{1}{2}(t^2 - 7t + 12)$
   3) $t^2 - (t - 4)^2$ 4) None of these

16. * If n = u (≥ 10), and John and Vic are "strangers", how many other people are "friends" to both John and Vic?

    1) $\frac{1}{2}(u^2 - 9u + 20)$
    2) $\frac{1}{2}(u^2 - 11u + 30)$
    3) u – 8
    4) None of these

**DIRECTIONS for questions 17 to 20: Choose the correct alternative.**

17. * John sees a name in the newspaper and remarks "This person's father's mother's only son's sister is my wife". How is the person in the picture related to John?

18. * Decode the following:

    a) DRAVID : WREZIW : : _ _ _ _ _ _ : HROOZP
    b) POTTER : 111277229 : : WEASLEY : _ _ _ _ _ _
    c) INCEPTION: KLECRRKMP : : TITANIC : _ _ _ _ _ _ _
    d) BACK : 66 : : FACE : _ _

19. In a certain language, "water is blue" is written as "hum aur woh", "sky and water" is written as "woh kaun hai" and "sky is red" is written as "hum hai don". How could "red water" be written in that language?

    1) woh hai
    2) don woh
    3) kaun don
    4) woh aur
    5) none of the above

20. * John will not clear the XAT if he doesn't study. If this is true, then which of the following follows?

    1) John studied, so he must have cleared the XAT
    2) John cleared the XAT, so he must have studied
    3) John did not clear the XAT, so he must not have studied
    4) None of the above

# LR-2.2 | LR-PRACTICE EXERCISES

## PRACTICE EXERCISE-1

**DIRECTIONS for questions 1 to 4: Refer to the data below and answer the questions that follow.**

Eight boxes – A, B, C, D, E, F, G and H – each of different sizes, are stacked one inside the other such that the smallest box is kept inside the second smallest box, which in turn is kept inside the third smallest box, and so on. The following information is known.

1] The number of boxes inside G is more than the number of boxes inside A.
2] The number of boxes outside H is more than the number of boxes outside B.
3] The number of boxes inside E is more than the number of boxes inside D.
4] The number of boxes outside C is more than the number of boxes outside F.
5] The number of boxes outside H is more than the number of boxes inside it.
6] The number of boxes inside D is more than the number of boxes outside it.
7] The number of boxes between D and H is equal to the number of boxes between D and B.
8] The number of boxes inside G is one more than the number of boxes outside A.

1. Which is the smallest box?

   1) C 2) H 3) A 4) D

2. Which is the fourth largest box?

   1) A 2) F 3) D 4) H

3. Which of the following is definitely not the second smallest box?

   1) H 2) A 3) F 4) G

4. Which of the following is definitely true?

   1) The number of boxes outside H is more than the number of boxes inside D.
   2) The number of boxes inside D is less than the number of boxes inside G.
   3) The number of boxes outside F is more than the number of boxes outside C.
   4) The number of boxes outside B is equal to the number of boxes inside H.

**DIRECTIONS for questions 5 to 8: Refer to the data and answer the questions that follow.**

Six students, named Ajay, Bharat, Chandan, Dinesh, Gaurav and Hitesh secured 10, 20, 30, 40, 50 and 60 marks in an examination (in no particular order). Names of their fathers were Ajit, Bhushan, Chandrakant, Dattaray, Gangadhar and Hari (in no particular order). Their surnames were Aggarwal, Bhatia, Chakraborty, Dey, Ganeriwala and Hirwani (in no particular order).
For this set, the naming convention to be used is "Name- Father's Name-Surname". For example, if William is the name of the student, Jefferson is the name of his father and Clinton is his surname, the student is referred to as "William-Jefferson-Clinton".
Additionally following points were known:

1] Name, father's name and Surname of all the students started with different initials.
2] Bharat is not the son of Chandrakant and Bharat's surname is not Dey.
3] The student whose surname is Hirwani scored 20 marks more than the student whose father is Dattatray, who in turn scored 20 marks more than Ajay.
4] The student whose surname is Ganeriwala scored 20 marks more than the student whose father is Gangadhar, who in turn scored 20 marks more than Bharat.
5] Gaurav scored 40 marks more than the student whose surname is Bhatia.
6] Dinesh scored 30 marks more than the student whose surname is Aggarwal.
7] Hitesh scored 10 marks more than Chandan while the student whose father is Bhushan scored 10 more than the student whose father is Ajit.

5. What is Hitesh's surname?
1) Dey 2) Hirwani 3) Chakraborty 4) Cannot be determined

6. How many marks did Bhushan's son score?
1) 20 2) 40 3) 60 4) 10

7. What is the full name of the student who scored 10 marks?
1) Ajay-Chandrakant-Bhatia 2) Chandan-Gangadhar-Dey
3) Bharat-Hari-Chakraborty 4) Cannot be determined

8. What is the name of Ajit's son?
1) Dinesh 2) Gaurav 3) Bharat 4) Chandan

**DIRECTIONS for questions 9 to 12: Refer to the data and answer the following questions.**

National Institute of Management, Ahmedabad has identical living quarters for all the professors working in the institute. Each block houses the living quarters for 9 professors. The following is the layout of the living quarters in one such block in the campus.

| | | |
|---|---|---|
| P1 | P2 | P3 |
| P4 | P5 | P6 |
| P7 | P8 | P9 |

Usual conventions of directions apply. That means P5 is to the south of P2, to the east of P4, to the west of P6 and to the north of P8. Similarly, P5 is to the South-East of P1, to the South-West of P3 and so on.

If two living quarters share a common wall, they are said to be neighbours of each other. But if the two living quarters are diagonally opposite, they are not neighbours of each other. For example, P2 and P5 are neighbours of each other but P1 and P5 are not the neighbours of each other.

This block houses 9 different professors, named Mishra, Sharma, Sinha, Sobti, Mukherjee, Swamy, Banerjee, Gokhale and Maheshwari.

The following points are also known:

1] Prof. Mishra is a neighbour of both Prof. Gokhale and Mukherjee. None of Prof. Mishra, Prof. Gokhale and Prof. Mukherjee is a neighbour of Prof. Banerjee.
2] Prof. Sharma and Prof. Maheshwari have equal number of neighbours.
3] Prof. Sinha has more neighbours than any other professor.
4] Prof. Banerjee has three neighbours.
5] Both Prof. Swamy and Prof. Sobti are the neighbours of Prof. Sinha.

9. How many neighbours does Prof. Gokhale have?

1) 2 2) 3 3) 4 4) Either 2 or 3

10. If Prof. Sharma lives in a living quarters located immediately to the west of Prof. Banerjee's living quarters and to the south of Prof. Gokhale's living quarters, who lives in a living quarters located immediately to the south of Prof. Swamy's living quarters?

    1) Prof. Mishra
    2) Prof. Gokhale
    3) Either Prof. Sharma or Prof. Maheshwari
    4) If Prof. Sharma lives in a living quarters immediately to the west of Prof. Banerjee's living quarters, that would contradict the information given in the question.

11. If Prof. Mishra is to the north of Prof. Mukherjee, who is to the South-West of Prof. Sinha?

    1) Prof. Sharma
    2) Prof. Mukherjee
    3) Prof. Maheshwari
    4) Either Prof. Sharma or Prof. Mukherjee or Prof. Maheshwari

12. The living quarters of how many professors can be uniquely determined using the information given?

    1) 0 2) 1 3) 2 4) 3

**DIRECTIONS for questions 13 to 16: Refer to the data and answer the following questions.**

Total 8 individuals, named A, B, C, D, E, F, G and H are seated along a square shaped table having two seats along each of the four edges. Exactly four among them are facing inwards while the remaining four are facing outwards. Two sides of the table have one person facing inside and the other person facing outside. One side of the table has both persons facing inside while the remaining side of the table has both persons facing outside. Following table gives details about the number of persons to the right/left of every person along the same side of the table and the number of persons whose faces and backs each individual can see in straight line.

| Name of the person | Number of persons to the right/left | | Number of persons whose face/back can be seen | |
|---|---|---|---|---|
| | Right | Left | Face | Back |
| A | 1 | 0 | 0 | 0 |
| B | 0 | 1 | 0 | 1 |
| C | 0 | 1 | 1 | 0 |
| D | 0 | 1 | 0 | 0 |
| E | 1 | 0 | 1 | 0 |
| F | 0 | 1 | 0 | 0 |
| G | 1 | 0 | 0 | 1 |
| H | 1 | 0 | 0 | 0 |

It is known that A and F are seated next to each other along the same side of the table.

13. Who among the following can be seated to the left of D along the same side of the table?
    1) H 2) B 3) A 4) E

14. If H and G are seated next to each other along the same side of the table, whose back can B see?
    1) D 2) F 3) C 4) None of these

15. Which of the following statement is definitely correct?
    1) B's neighbour along the same side of the table is facing inside
    2) C's neighbour along the same side of the table is facing outside
    3) G's neighbour along the same side of the table is facing outside
    4) D's neighbour along the same side of the table is facing inside

16. Consider the following two statements:
    Statement I: B and E are neighbours along the same side of the table.
    Statement II: G and H are neighbours along the same side of the table.
    What can be said about the two statements?
    1) Both I and II are definitely incorrect.
    2) Both I and II are definitely correct.
    3) Both I and II may be correct.
    4) Only one of I and II is correct.

## PRACTICE EXERCISE-2

**DIRECTIONS for questions 1 to 4: Refer to the data and answer the following questions.**

Andreas, Bjorn, Charles, Danz, Ernst and Freidrich are the six sportsmen selected as the German contingent for the upcoming Olympics. Before they leave for the tournament, the news agencies requested a group photo from them. So, all the six are seated next to each other and facing the same direction. Each of them is given individual ranks (ranging from 1 to 6) based on their height and strength. For example, in the strength category, the strongest person is ranked 1 and the weakest person is ranked 6. Similarly, in the height category, the tallest person is ranked 1 and the shortest person is ranked 6.

The following information is known regarding how they sat for the group photograph.

I. Freidrich was sitting to the immediate left of the person who was stronger than all other persons except one.
II. Ernst was sitting two places to the right of the second tallest person.
III. Danz was sitting two places to the left of the third weakest person.
IV. Charles was sitting two places to the left of the person who was the 3rd tallest amongst all.
V. The number of persons sitting between Bjorn and Freidrich is 2, which is same as the difference between their ranks in strength.
VI. Andreas is sitting three places to the left of the shortest person and two places to the right of the strongest person.
VII. The tallest and shortest persons are sitting next to each other.
VIII. The rankings in both height and strength are not the same for any individual.

1. Which of the following statements cannot be true about Freidrich?
   1) He is the 2nd shortest person.
   2) He is the 3rd strongest person.
   3) He is the 4th tallest person.
   4) He is the 2nd strongest person.

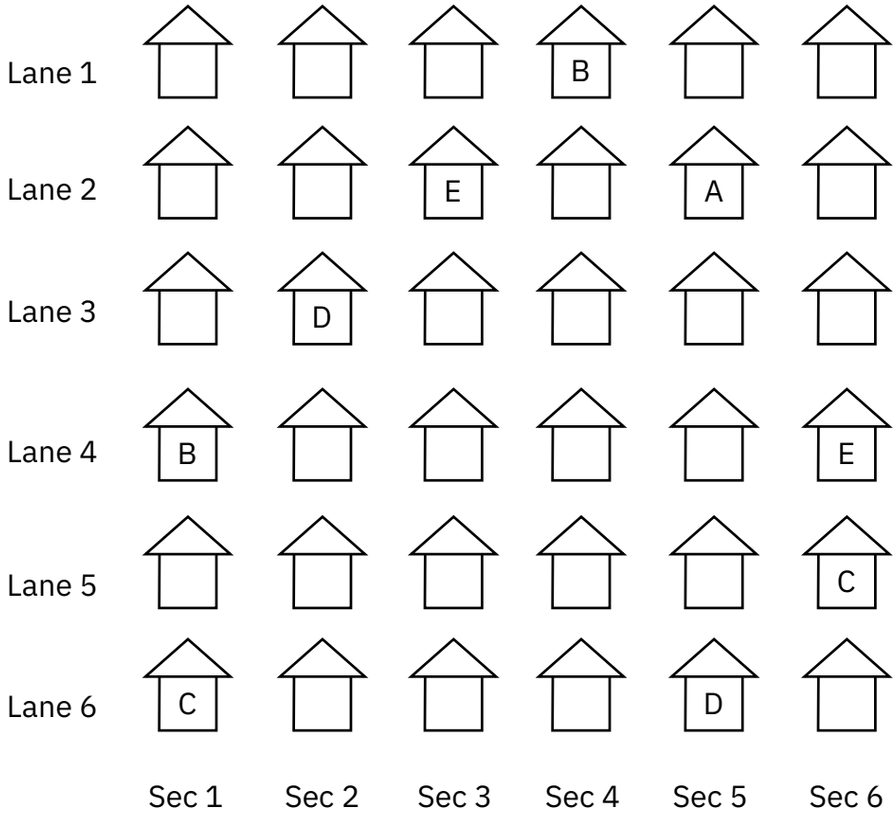
2. How many people are sitting between the shortest and the weakest persons (both of them excluded)?
   1) 1 2) 2 3) 3 4) 4

3. Who is sitting three places to the right of the strongest person?
   1) Andreas 2) Bjorn 3) Danz 4) Freidrich

4. Who is the weakest person?
   1) Freidrich 2) Danz 3) Bjorn 4) Ernst

**DIRECTIONS for questions 5 to 8: Refer to the data and answer the following questions.**

Six millionaires – Abigail, Bartholomew, Chloe, Darius, Enoch and Flavius – have purchased 6 bungalows each in Moraj Manor estate. The 36 bungalows are arranged in 6 lanes and 6 sectors. When someone purchases a particular bungalow, they put their initials on that bungalow. The estate looks something like this:




The following points are known about how they purchased their bungalows:

i. No one purchased more than one bungalow in a lane. Similarly, no one purchased more than one bungalow in a sector.

ii. Darius always purchased a bungalow immediately next to the one purchased by Abigail along a lane.

iii. Chloe always purchased a bungalow to the north of the one purchased by Flavius in sectors 2 to 5.

iv. Bartholomew purchased a bungalow to the east of the one purchased by Abigail in the odd-numbered lanes and to the west of the one purchased by Abigail in the even-numbered lanes.

v. Bartholomew and Darius purchased bungalows that are immediately next to each other along sectors 2, 3, 5 and 6.

5. The owners of how many bungalows cannot be uniquely determined?

6. In how many lanes does Bartholomew own a bungalow to the west of Darius?

7. In how many sectors do the bungalows of Abigail and Enoch have exactly one bungalow in between them?

8. In which lane number is the bungalows of Darius and Enoch farthest from each other (in comparison to other lanes)?

**DIRECTIONS for questions 9 to 12: Refer to the data given below and answer the questions that follow:**

Sanskriti is an annual classical music competition of students from four different National Institutes of Management (NIMs) at Ahmedabad, Bangalore, Calcutta and Lucknow. The following table shows the students from different NIMs, who are eligible to participate in Sanskriti and their specializations:

| | Finance | Marketing | Operations | HR |
|---|---|---|---|---|
| Ahmedabad | A1 | A2 | A3 | A4 |
| Bangalore | B1 | B2 | B3 | B4 |
| Calcutta | C1 | C2 | C3 | C4 |
| Lucknow | L1 | L2 | L3 | L4 |

For example, student named B2 from NIM Bangalore is eligible to participate in Sanskriti and his/her specialization is in Marketing.
From these students, four teams comprising three members each are to be formed and the remaining four members will be among the audience.

The following rules apply for the formation of the teams:

1] All the members of a team cannot be from the same NIM.

2] No team can have more than one member specializing in the same subject.

3] If a student specializing in Finance in a particular NIM is a member of any team, then the student from the same NIM specializing in Marketing must also participate.

4] At least one student from each NIM must be among the audience.

5] Students L3 and C4 are never together, either in the audience or in the same team.

9. If all the students specializing in Finance are participating, who among the following cannot participate?

1) C3 and L3 2) C3 and C4 3) L2 and L4 4) C3 and L4

10. If C3 and C4 are members of the same team, who among the following can be the third member?

    1) L3 2) C1 3) L1 4) L4

11. If each team comprises a student specializing in Finance and either a student specializing in Operations or a student specializing in HR, in how many ways can the four students in the audience be selected?

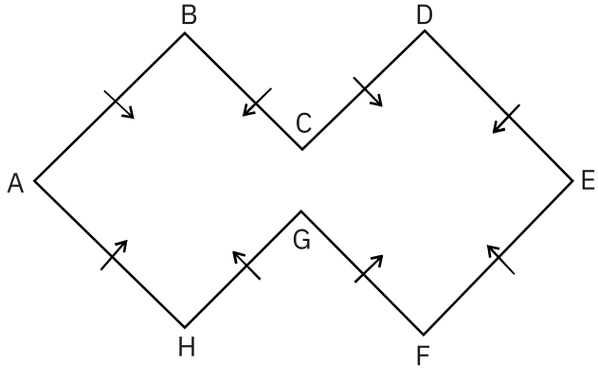
    1) 16 2) 12 3) 8 4) 6

12. Which of the following is definitely correct?

    1) Students specializing in Finance and Marketing from exactly one NIM do not participate.
    2) Students specializing in Operations and HR from exactly one NIM do not participate.
    3) Exactly three students specializing in Finance do not participate.
    4) None of these

**DIRECTIONS for questions 13 to 16: Refer to the data given below and answer the questions that follow:**

P, Q, R, S, T, U, V and W are sitting around a uniquely-shaped table as shown below, all facing inwards. The persons sitting along edges AB & GH, HA & BC, CD & EF and DE & FG are said to be facing each other. The persons sitting along edges HA & FG, GH & EF, DE & BC and AB & CD are said to be facing in the same direction.




The following information is also known.
- V is sitting to the immediate left of S.
- W is two places to the right of T.
- R and W are facing each other.
- V and T are facing each other.
- U and Q are facing the same direction.
- P and Q are facing opposite directions.
- U and S are facing each other.

13. Which of the following pairs of individuals are facing in opposite directions?
    1) P-T 2) Q-S 3) Q-W 4) R-S

14. Who is sitting two places to the left of Q?
    1) P 2) U 3) Either P or U 4) Either P or T

15. Who among the following cannot sit along the edge DE?
    1) P 2) S 3) Q 4) T

16. Which of the following pairs of individuals are definitely sitting adjacent to each other?
    1) P-T 2) U-W 3) R-U 4) Q-R