Introduction

What exactly is binary logic? It is a set of rules for dealing with propositions that must be either true or false. So, such questions are also known as true-false teller questions. In binary logic problems, people answer the question in two or three different statements. These people are divided into three categories:

1. Truth-teller: One who speaks the truth, come what may.

2. Liar: One who states falsehood, come what may.

3. Alternator: One who speaks the truth or false depending on his will and mood. And this person always alternates between the truth and the lie. If the first statement of this person is true, then the second will be false, the third will be true, and so on.

   Similarly, if the first statement made by this person is false, the second statement will be true, the third one will be false, and so on.

Approach to Handle Binary Logic Problems

Binary logic problems are all about making some assumptions. These assumptions may give rise to some contradictions which indicate that our assumptions are wrong. If for any assumption, there is no contradiction, then that is the solution for the given binary problem.

Types of Questions

Two types of questions can be asked from binary logic of logical reasoning section.

1. **Type 1:** Two statements by each of the three persons are found in these types of questions. One of the statements has to be true and another has to be false.

2. **Type 2:** Two and more types of persons are found in these types of questions. One person always speaks the truth and the other person always tells a lie.

Example 1:

Raveena, Kareena, and Priyanka are three girls who replied to the question, "Who among you is an actress" in the following manner:

Raveena:
    a) I am an actress.
    b) Kareena is a dentist.
    c) I am an alternator.

Kareena:
    a) Priyanka is a pilot.
    b) Raveena is not an actress.
    c) I am a liar.

Priyanka:
    a) I am not dentist.
    b) Kareena is not a dentist.
    c) Raveena is a liar.

It is also known that exactly one among the girls is an actress, one is a dentist, and one is a pilot.

Further, one always speaks the truth, one always lies, and one alternates between the truth and the lie

Approaches to Solve Binary Logic Problems

Approach 1

Depending on the statements made by the speakers, we can derive the following conclusions:

1. **I am a liar**

   a) **Truth-teller:** Consider if a truth-teller says, "I am a Liar", which is a lie as a truth-teller can only say, "I am a truth-teller". Hence, this can be concluded that the person who said "I am a liar" is not the truth-teller.

   b) **Liar:** Similarly, if a liar says that he/she is a liar then that statement will be true but the liar will always speak a lie. No statement made by him/her can be true. So, it can be concluded that this statement cannot be made by a liar.

   c) **Alternator:** An alternator is the only person who can make this statement. He/she can alternate between the truth and the lie. Since he/she is not a liar but he/she still makes a false statement, the alternator is the only person who can make the statement, "I am a liar". The statement in itself will be a lie. This gives us another hint that the next statement given by the same person will always be true.

2. **I am not a truth-teller**

   a) **Truth-teller:** A truth-teller can never make this statement because if he/she makes this statement then it will be a lie which contradicts the fact that a truth-teller always speaks the truth.

   b) **Liar:** If the liar says, "I am not a truth-teller", then it will be the truth for him/her which again contradicts the fact that a liar always lies. Hence, a liar cannot make this statement.

   c) **Alternator:** If the alternator says, "I am not a truth-teller", he/she can say either the truth or the lie. This statement will be a true statement for him/her, which gives another hint that the next statement given by the same person will always be a lie.

3. **I am an alternator**

   a) **Truth-teller:** A truth-teller cannot make the statement as this statement will be a lie for him/her which conflicts with the fact of the truth-teller.

   b) **Liar:** A liar can make this statement as this statement will be a lie for him/her.

   c) **Alternator:** An alternator can also make this statement, and if this is the truth then his/her next statement will be a lie. This statement can only be made by a liar or an alternator.

4. **I am not an alternator**

   a) **Truth-teller:** A truth-teller can make this statement as this cannot conflict with the fact of the truth-teller.

   b) **Liar:** A liar cannot make this statement as this statement conflicts with the fact of the liar.

   c) **Alternator:** An alternator can make this statement and this statement will be a lie for him/her and the next statement will be the truth. This statement can only be made by a truth-teller or an alternator.

Summary of Above Explanations

Statement	Made by	Truth or lie
I am a liar	Alternator	Lie
I am not a truth-teller	Alternator	Truth
I am an alternator	Liar or alternator	Lie for the liar, truth for the alternator
I am not an alternator	Truth-teller or alternator	Lie for the alternator, truth for the truth-teller

Explanations of the examples:

Kareena makes the statement, "I am a liar", which implies that Kareena is the alternator.

Raveena makes the statement, "I am an alternator", which means that she can either be a liar or an alternator.

Now, since Kareena is an alternator, Raveena is definitely the liar and the third person, i.e. Priyanka is a truth-teller.

Since Kareena is the alternator, the statement just before or after the statement, "I am a liar" is true, this implies that Raveena is not an actress.

Also, as Priyanka is a truth-teller, according to her statements, Kareena is not a dentist and she herself is not a dentist, thus Raveena is the dentist.

Now, Kareena's first statement is a lie (she is an alternator, so the order of Kareena's statement will be (a) - false, (b) - true, (c) - false), this means Priyanka is not a pilot, which leaves with the only option for Priyanka as actress and Kareena will be a pilot.

So, Priyanka is an Actress.

Approach 2

Assumption-iteration method

This approach is used when the first approach fails. Here, we would assume the first person to be the truth-teller and depending on his/her statements we would determine proper results.

Logical Connectives

Logical connectives are basically a word or group of words that joins two or more prepositions together to form a connective preposition. Some logical connectives are if, only if, when, whenever, unless, etc. These types of sentences consist of two parts:

1. Cause
2. Effect

Usually, the cause is present after the connectives.

Some examples are as follows:

1. If you want to be an actor, you have to work hard.

   Cause – You want to be an actor.

   Effect – You have to work hard.

2. If I will go on a world tour, I must visit France

   Cause – I will go on a world tour.

   Effect – I must visit France.

   Note: Consider Cause as m and Effect as n

Rack Your Brain

1. P and Q belong to different categories among truth-tellers, liars, and alternators. They made the following statements.

   P: I am not an alternator.

      Q's father's name is Shivam.

   Q: My father's name is not Shivam. Only one between two of us is an alternator.

   How many true statements have been made by P and Q together?

   (A) One

   (B) Two

   (C) three

   (D) Either (B) or (C)

Types of Logical Connectives

1. Not (negation)
2. Either, or (disjunction)
3. And (conjunction)
4. If-then (material implication)

- **Negation (not):** Negation is the opposite of a statement. For example,
  - **Statement:** It is raining.
  - **Negation:** It is *not* raining.

- **Disjunction (either, or):** When two statements are connected using *or*, at least one of them is true. For example,
  - Either m or n:
  - Hence, m alone is true;
  - n alone is true;
  - Both are true;

In such a situation, the valid inference is if m did not happen, then n must happen

And if n did not happen, then m must happen.

- **Conjunction (and):** When two statements are connected using and, both statements have to be true. For example,
  m and n; m should be true as well as n should be true.

  Material implication (if, then): If m, then n (m → n):

It is read as m implies n. It means that if m happened, it also concluded that n also happened.

In such a situation, the only valid inference is 'If ~ n, then ~ m', if n did not happen, then m did not happen.

Logical Connectives Summary Table

Connective	Implication	Negation	Examples*	
			Statement	**Conclusions**
If m then n	m → n −n → −m	m and −n	If I learn at Unacademy, I will get good results.	I didn't get good results → I didn't learn at Unacademy.
Whenever m then n	m → n −n → − m	m and −n	Whenever I sing, my dog sleeps.	My dog is not sleeping → I am not singing.
Either m or n	−m → n −n → m	−m and −n	I will either study at IIM or FMS.	I am not studying at FMS → I am studying at IIM.
Unless m then n	−m → n −n → m	−m and −n	Unless you have a photographic memory, repetition is vital.	I don't have a photographic memory → I will have to repeat.
Only if m then n	n → m −m → − n	n and −m	Only if you work hard, you will succeed.	You succeeded → you must have worked hard.

*The examples are just to understand the concepts.

Also, note the following implications:

−(m and n) = −m or −n

−(m or n) = −m and −n

Rack Your Brain

2. I will eat ice-cream or chocolate today. I ate chocolate today. Which of the following is true if I ate?
   (A) I didn't eat ice-cream today.
   (B) I ate ice-cream and chocolate both, today.
   (C) None of these.
   (D) Cannot say.

Example 2:

Direction for Questions 1 to 3: Each question below consists of a main statement followed by four answer choices. From the answer choices, select the one that logically follows the main statement.

1. If I can read, then I can understand the book.

   (A) I can read; hence, I can understand the book.
   (B) I cannot understand the book implies that I cannot read.
   (C) I can read; hence, I cannot understand the book.
   (D) Both (A) and (B).

   Solution: (D)
   If I can read, then I can understand the book. The statement is of the form.

If p, then q.
Here,
p = I can read and
q = I can understand the book

The implications are:
(i) $p \rightarrow q$
(ii) $-q \rightarrow -p$
According to (i), choice (A), and according to (ii), choice (B) is correct.
Hence, option (D) is correct.

2. If the review is good, then I watch a series.

(A) I watch a series means the review is good.
(B) The review is good; hence, I do not watch a series.
(C) I did not watch a series though the review was good.
(D) I did not watch a series implies that the review was not good.

Solution: (D)

If the review is good, then I watch a series. The statement is of the form, if p then q.
Here, p = review is good.
q = I watch a series
The implications are:
(i) $p \rightarrow q$
(ii) $-q \rightarrow -p$
According to (ii), choice (D) is correct.
Hence, option (D) is correct.

3. Whenever there is a will, there will be a way.

(A) There is a way; hence, there is a will.
(B) There is a will; hence, there will be a way.
(C) There is no way, implies that there is no will.
(D) Both (B) and (C).

Solution: (D)

Whenever there is a will, there will be a way. The statement is of the form of 'whenever m then n'.
Here,
m = There is a will.
n = There will be a way.
The implications are:
(i) $m \rightarrow n$
(ii) $-n \rightarrow -m$
According to (i), option (B) is correct and according to (ii), option (C) is correct.
Hence, option (D) is correct.

Direction Test

This topic deals with the questions in which directions or distances have to be found. The questions based on directions require the candidates to identify the direction of the individual or shadow from a set of statements.

There are four main directions, i.e. North, South, East, and West. The word NEWS comes from North, East, West, and South.

Also, there are four sub-directions as shown:
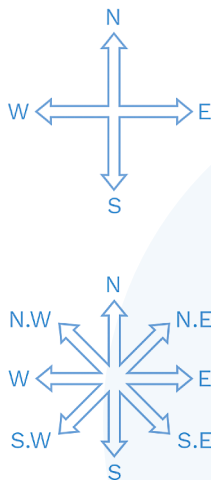
- North-East (NE)
- North-West (NW)
- South-East (SE)
- South-West (SW)

Clockwise and Anti-Clockwise Movement

- **Clockwise movement:** The movements which follow the direction of the hands of a clock are known as clockwise movements.

Clock wise movement

- **Anti-clockwise movement:** Anti-clockwise movement is just opposite the clockwise movement.

Anti-clockwise movement
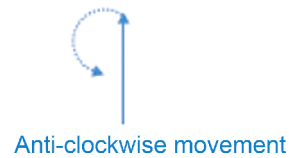
Tricks to remember

Clockwise movement = right turn

Anti-clockwise movement = left turn

There are seven types of questions asked in the examination from directions sense

Type 1: Movements with Respect to Directions

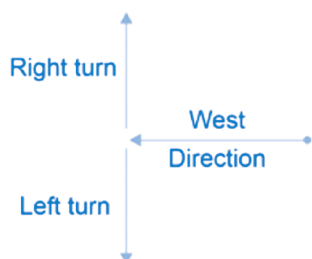- Right and left turns while moving in the North direction
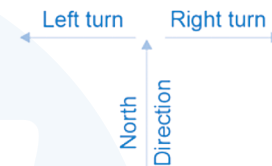
- Right and left turns while moving in the South direction.
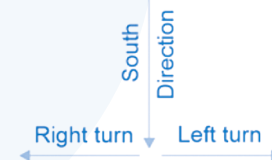
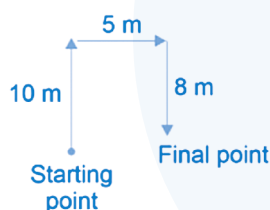- Right and left turns while moving in the East direction.

East Direction

Left turn
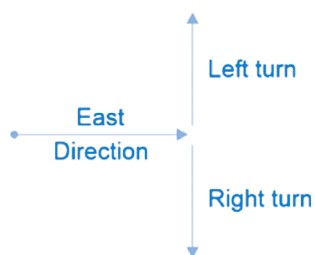
Right turn

- Right and left turns while moving in the West direction.
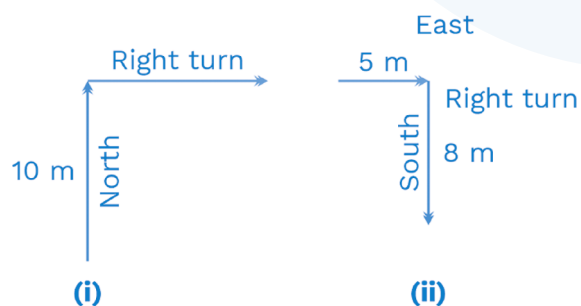
Right turn

West Direction

Left turn

Example 3:

1. Arnab starts walking towards North and walks 10 m. Then he turns towards his right and walks 5 m. He again turns towards his right and walks 8 m. In which direction is Arnab moving now?

5 m

10 m   8 m

Starting point   Final point

Stepwise explanation

Right turn   East

5 m   Right turn

10 m   North   South   8 m

(i)   (ii)

As it is clearly seen, Arnab is moving towards the South direction.
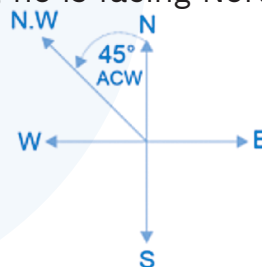
Type 2: Degree-Based

1. Naman is facing West. First, he turns 90° in the clockwise direction, then he turns 45° in the anti-clockwise direction and finally, he turns 45° in the clockwise direction. Now, which direction is he facing?

(A) North-East
(B) North
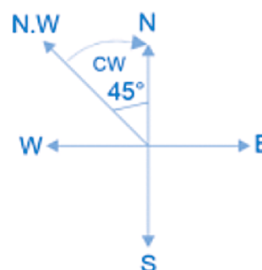(C) North-West
(D) East

Solution: (B)

i) According to the question he turns 90° in the clockwise direction.

Now, he is facing North.

N
90° C.W
W   E
S
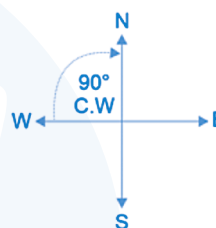
ii) Then, he turns 45° anticlockwise.

Now, he is facing North-West

N.W   N
45° ACW
W   E
S

iii) Finally, he turns 45° clockwise (CW).

Finally, he is facing the North direction.

N.W   N
CW 45°
W   E
S

Rack Your Brain

3. Dheeraj is facing towards West. He turns 270° in the clockwise direction and then 90° in anti-clockwise direction and then 45° in clockwise direction and then 135° in anti-clock wise direction. Which direction is he facing now?
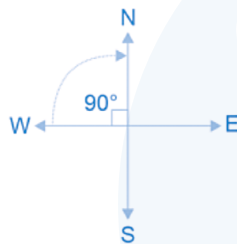
Short trick

Let's consider all the clockwise movements to be (+) and all the anti-clockwise movements be (−).
Now, let's calculate them.
+90° − 45° + 45°
= + 90°

As it is known that Naman is facing West so, rotate him 90° in the clockwise direction.
So, Naman is facing the North direction.

Hence, option (B) is correct.

Type 3: Direction with Respect to Distance

In this type of question, follow the instructions and answer accordingly.

1. Ayushi walked 8 km towards South from her house and then she turned towards her left and walked 5 km. Again, she turned towards her left and walked 8 km. Finally, she turned to her right and walked 6 km. Now in which direction and at what distance is she from her house?

(A) 14 km, East
(B) 11 km, East
(C) 14 km, West
(D) 11 km, West

Solution: (B)
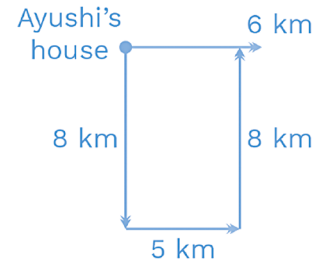
As it is seen in the figure, Ayushi is in the East direction from her house and the distance between her house and her final position = 5 + 6 = 11 km.

Hence, option (B) is correct.

Rack Your Brain

4. From an intersection, there are four ways in North, West, South, and East direction which go towards a temple, a coffee house, a college, and Vanni's hostel not in any particular order. Vanni's walks from her hostel towards the intersection and notices that she would walk away from the coffee house if she takes a right turn. If she follows the straight path, she would reach the college. If her hostel is in South then in which direction would the temple be?

To find the minimum or shortest distance.
Pythagoras theorem: According to this theorem, the square of the hypotenuse is always equal to the sum of the squares of the other two sides of the right-angled triangle.
In △ ABC,
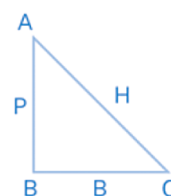
H = Hypotenuse
P = Perpendicular
B = Base

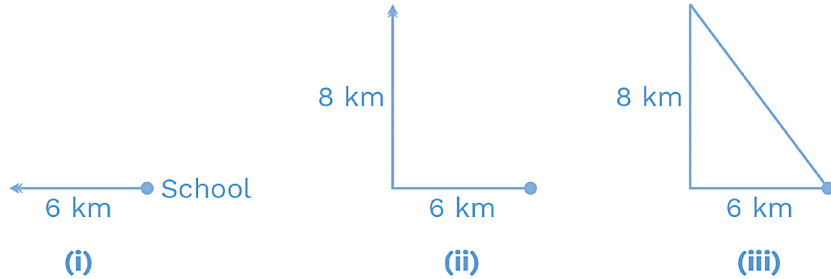$H^2 = P^2 + B^2$

Note: This theorem is used to find the shortest distance.

Example 4:

Dhiraj, starting from his school, goes 6 km in the West, then he turns right and goes 8 km. What minimum distance will be covered by him to come back to his school?

(i) (ii) (iii)

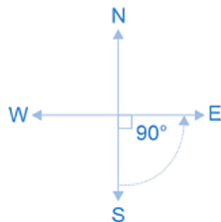Minimum distance $= \sqrt{8^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100} = 10$ km

Hence, the answer is 10 km.

Type 4: Illusion-Based Questions

To understand the illusion-based questions, let us take a simple example.
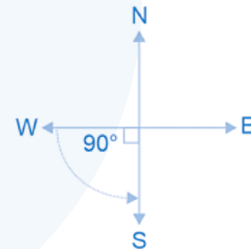
1. If South becomes East, East becomes North, and so on, what will West become?
   (A) East
   (B) West
   (C) North
   (D) South

Solution: (D)

How much do you need to rotate the South to make it the East? It is 90° anti-clockwise movement.
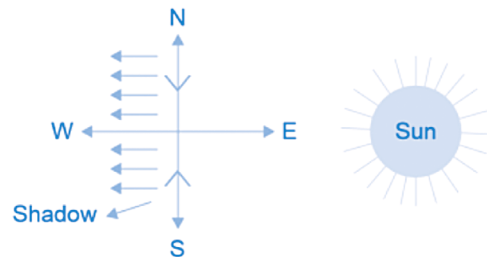
Now, according to the question, rotate West 90° anti-clockwise to get the answer.

So, West became South.
Hence, option (D) is correct.

Type 5: Shadow-Based:

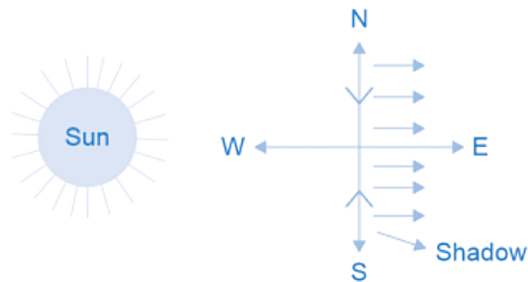Shadow will always fall opposite the sun.

In the morning, if a man is facing North, his shadow will always fall towards his left-hand side.
In the morning, if a man is facing South, his shadow will always fall towards his right-hand side.
In evening

In the evening, if a man is facing North, his shadow will always fall towards his right-hand side.
In the evening, if a man is facing South, his shadow will always fall towards his left-hand side.

Note: At 12:00 noon, the rays of the sun are vertically downwards; hence, there will be no shadow.

1. In the morning, two friends Dheeraj and Arjit were talking to each other face to face. If at this time the shadow of Arjit fell exactly to the left of Dheeraj, then in which direction was Arjit facing?
   (A) East
   (B) West
   (C) North
   (D) South

Solution: (D)
In the morning, if a man is facing North, his shadow will always fall towards his left-hand side.
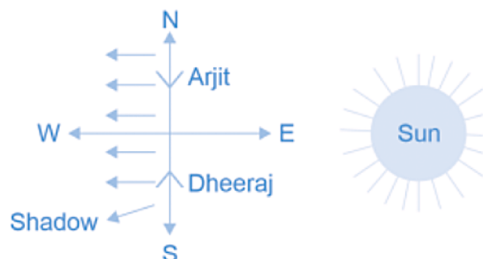
According to the question, the shadow of Arjit fell exactly to the left of Dheeraj. So, Dheeraj is facing North and Arjit is facing South.

Hence, option (D) is correct.

Type 6: Yoga/Exercise-Based
In this type of question, a person performs yoga with his/her head down and legs up.

Normal Position   Yoga Position
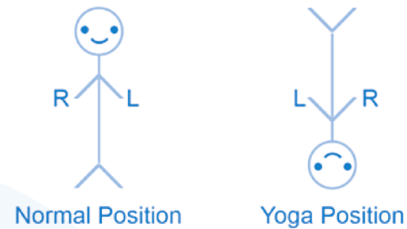
It is difficult to attempt these types of questions with imagination.

Let's take a simple example to understand it better.

- Person facing East with his head up and legs down (normal position).
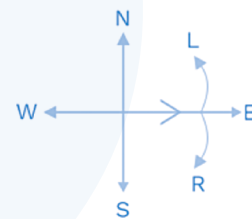
- Person facing East with his head down and legs up.
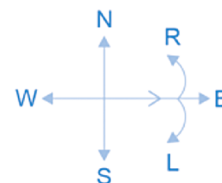
1. In the morning, Pavi was performing yoga with his head down and legs up. If at this time his face is towards North then in which direction would his left hand be?
   (A) East
   (B) West
   (C) North
   (D) South

Solution: (A)

Normal Position

Yoga Position (with the given condition)

From the figure above, it can be clearly seen that Pavi's left hand was towards East while performing Yoga as per the given conditions.

Short trick
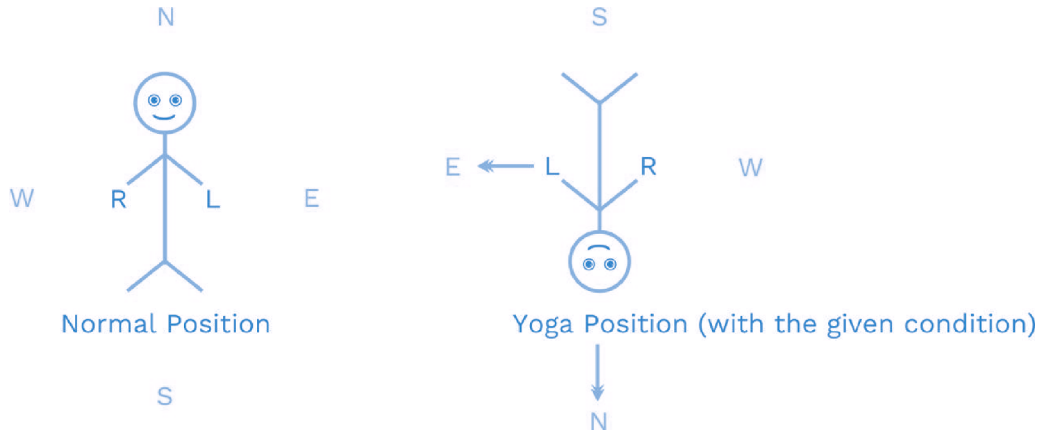
In the usual position, our head points to North and the left-hand points to the East. In the yoga position, the head goes down. But as per the conditions given, the head still points to North, which means, it is similar to the normal position. So, the left hand will be pointing to the East only.

Hence, option (A) is correct.

Type 7: Coding Form

Instructions: Each of the following questions is based on the following information:

(A) A @ B means A is to the East of B.
(B) A $ B means A is to the North of B.
(C) A – B means A is to the South of B.
(D) A # B means A is to the West of B.

1. According to M $ N # O $ Q, Q is in which direction with respect to N?
    Solution: South-East
    According to M $ N # O $ Q

Hence, Q is in the South-East of N.

Level of Difficulty – 1

1. Sushil ran 18 m towards East. Then he turned towards his right and ran 9 m. Then he turned to his left and ran 5 m. He again turned to his left and ran 4 m. Finally, he turned to his right and ran continuously. Now, in which direction is he facing?
(A) East
(B) West
(C) North
(D) South

2. Aashima starts her journey from her house to the North direction. After walking 10 km she turns towards her left. Then after walking 6 km, she turns to her right. After walking for 8 km more, she again turns towards her right. Then after walking 10 km, she turns to her left, and finally after walking for 5 km she turns towards her right. Now, in which direction is Aashima facing?
(A) East
(B) West
(C) North
(D) South

3. Raju turns to his left after walking 13 m straight and walks 8 m. Again, he turns to his left and walks 16 m, and finally if he turns to his right and walks 11 m. Now, he is moving towards East, then towards which direction did he start walking?
(A) East
(B) West
(C) North
(D) South

4. Rizwan starts walking from his house to reach school. After walking 20 m, he turns towards his right. Then after walking 10 m, he turns towards his left, and finally after taking two consecutive right turns of 5 m and 8 m, respectively, he is moving towards the South-East to reach his school. Then, from which direction, did he start his journey?
(A) East
(B) West
(C) North-West
(D) South-East

5. Swapnil is facing the North-East direction. First, she turns 135° in the clockwise direction. Then she turns 45° in the clockwise direction. Then she turns 90° in the anti-clockwise direction and finally, she turns 90° in the clockwise direction. Now, which direction is she facing?
(A) South-West
(B) North-West
(C) South-East
(D) North-East

6. Three persons Ally, Bhavesh, and Chandan gave these statements:
 i) Ally said, either Manchester or Liverpool won the match.
 ii) Bhavesh said, Manchester won.
 iii) Chandan said, neither Manchester nor Liverpool won the match.
 iv) Of these, only one person is wrong.
Who won the match?
(A) Manchester
(B) Liverpool
(C) Data inadequate
(D) None of these

7. Mr. James, an NYPD cop, busted three goons namely, Austin, Bob, and Charlie on the suspicion of extortion from the mayor's daughter. He interrogated them one by one and recorded the following statements:
 • Austin: I am Innocent
 • Bob: I am Innocent
 • Charlie: Bob is the guilty one
Who is the extortionist among the three persons, if only one of the statements will be true?

(A) Austin
(B) Bob
(C) Charlie
(D) None of these

8. Whenever it is crowded around me, I wear a mask.
   (A) It is crowded around me implies I am wearing a mask.
   (B) I did not wear a mask implies it was not crowded around me.
   (C) It is crowded around me but I did not wear a mask.
   (D) Both (A) and (B).

9. Team India will win, only if Sachin is playing.
   (A) Sachin is playing, hence Team India will win.
   (B) Team India will not win implies that the Sachin has not been played.
   (C) Team India will win though Sachin is not playing.
   (D) Team India will win implies Sachin is playing.

10. If Ravi can walk, then he can reach his destination.
    (A) Ravi can walk hence he can reach his destination.
    (B) Ravi cannot reach his destination implies he cannot walk.
    (C) Ravi can walk hence he cannot reach his destination.
    (D) Both (A) and (B).

Directions for Questions 11 to 15

One day, Amrita started her journey from her house. After walking 6 km to the North, she reaches the ice-cream parlour, and then she turns 90° in clockwise direction and walked 9 km to reach her coaching centre. After studying for 2 hours, she turns to her right and walks 2 km to have lunch in the lunch centre. After lunch, she turns 90° in the anti-clockwise direction and walks 4 km to reach her school. After school, she turns 90° in the clockwise direction and walks 8 km to reach the hospital.

11. In which direction is Amrita facing now?
    (A) East
    (B) West
    (C) North
    (D) South

12. The coaching centre is in which direction with respect to Amrita's home?
    (A) North
    (B) North-East
    (C) South
    (D) South-West

13. In the morning, if Amrita leaves school to the hospital and in the meantime, her friend Sultan moves to school from the hospital, they have a conversation for a while. Then, where will be Sultan's shadow at the same time?
    (A) On the right hand of Amrita
    (B) On the left hand of Amrita
    (C) Both (A) and (D)
    (D) On the left hand of Sultan

14. Find the distance between Amrita's home and the lunch centre.
    (A) $\sqrt{97}$ km
    (B) $\sqrt{95}$ km
    (C) $3\sqrt{13}$ km
    (D) $4\sqrt{6}$ km

15. In which direction is Amrita's home with respect to the hospital?
    (A) North
    (B) North-East
    (C) North-West
    (D) South

Directions for Questions 1 and 2: Read the question below carefully and choose the correct answer for the questions that follow.

Aman, Bimal, and Cherry participated in an 800-m race and one of them won the race. They belong to three different communities: Xoxo, Yoyo, and Zozo. Xoxo always speaks the truth, Yoyo always lies and Zozo tells the truth and lies alternately. Each of Aman, Bimal, and Cherry belongs to one category. After the race, they gave these statements.

Aman:

Statement (I): I would have won the race if Cherry had not obstructed me at the last moment.

Statement (II): Cherry always speaks the truth.

Bimal:

Statement (I): Aman won the race.

Statement (II): Cherry is not a Yoyo.

Cherry:

Statement (I): I hadn't obstructed Aman at the last moment.

Statement (II): Bimal won the race.

1. Cherry belongs to which community?
   (A) Xoxo
   (B) Yoyo
   (C) Zozo
   (D) Either (B) or (C)

2. Who won the race?
   (A) Aman
   (B) Bimal
   (C) Cherry
   (D) Data inadequate

Directions for Questions 3 to 5: Read the question below very carefully and choose the correct answer for the questions that follow.

Five persons namely, A, B, C, D, and E are living on different floors of a five-floor building. The bottommost floor is numbered first, the floor above it second, and so on till the topmost floor which is numbered fifth. Those who live on an even-numbered floor always speak the truth, while those who live on an odd-numbered floor always lie. Two persons are living between C and E. C neither lives on the topmost floor nor the bottommost floor.

Following statements were recorded from the residents of that building.

- A: I do not live below C.
- B: I live on an even-numbered floor.
- C: The one who lives on the floor which is immediately above D always lies.
- D: B lives below me.
- E: I always speak the truth.

3. Who among the following lives on the topmost floor?
   (A) E
   (B) B
   (C) D
   (D) A

4. Who among the following lives on the bottommost floor?
   (A) E
   (B) B
   (C) A
   (D) Cannot be determined

5. Which of the following options represents a group of liars?
   (A) A, B, and C
   (B) E, D, and B
   (C) A, E, and D
   (D) A, B, and E

6. Bimal walked 25 km towards the South. Then he turned left and walked 33 km. Then he turned left and walked 40 km. Then again, he turned right and walked 11 km. Finally, he turned right and walked 15 km. In which direction and at what distance is he from the starting point?
(A) 33 km West
(B) 44 km West
(C) 33 km East
(D) 44 km East

7. Sally is facing North. She decides to turn 270° in the clockwise direction and then turn 180° in the anti-clockwise direction. In which direction is she facing now?
(A) East
(B) North
(C) South
(D) West

8. Rajeev starts walking towards the East from his café. After walking 9 km he turns towards his right and walks 5 km. Then again, he turns to his right and walks 4 km, and finally he turns towards his left and walks 7 km to reach his house. Now, how far and in which direction is his cafe from his house?
(A) 13 km, North-West
(B) 11 km, North-West
(C) 13 km, North-East
(D) 11 km, South-West

9. If South-East becomes North, East becomes North-West, and so on. What will North become?
(A) North
(B) North-West
(C) South
(D) South-West

10. One morning after sunrise, Abhishek and Bhanu were standing on a lawn with their backs towards each other. Abhishek's shadow fell exactly towards his left-hand side. Which direction was Bhanu facing?
(A) East
(B) West

(C) North
(D) South

Directions for Questions 11 to 13
- 'P @ Q' means Q is 5 m East of P.
- 'P * Q' means P is 3 m West of Q.
- 'P # Q' means Q is 8 m North of P.
- 'P ! Q' means P is 4 m South of Q.

11. If the expression A @ B # C * D ! E is true, then what is the direction of E with respect to B?
(A) North
(B) South
(C) North-East
(D) South-West

12. If the expression 'L ! M * N @ O * P' is true, what is the shortest distance between L and O?
(A) $4\sqrt{5}$ m
(B) $3\sqrt{2}$ m
(C) 4 m
(D) $5\sqrt{4}$ m

13. If the expression 'R # S * T ! U # V' is true, what is the direction of S with respect to V?
(A) North
(B) South
(C) North-East
(D) South-West

14. Anuja is facing South-West. She decides to turn 45° clockwise, then she turns 135° anti-clockwise and then again turns to 90° anti-clockwise. Which direction is she facing now?
(A) East
(B) North-East
(C) South
(D) South-East

15. In the evening, Salman and Shahrukh were standing in a park with their backs towards each other. Shahrukh's shadow fell exactly toward Salman's right-hand side. In which direction was Shahrukh facing?

(A) East
(B) West
(C) North
(D) South

16. Brijesh either goes to sing or does not go to the dance.
    I.   Brijesh went to the dance.
    II. Brijesh did not go to the dance.
    III. Brijesh went to sing.
    IV. Brijesh did not go to sing.
    (A) (I) and (III)
    (B) (III) and (II)
    (C) (II) and (IV)
    (D) (IV) and (II)
    (E) All the given pairs are correct.

Level of Difficulty – 2

Directions for Questions 1 to 4: Read the following information to answer the questions given below it.

Nine persons viz., A, B, C, D, E, F, G, H, and K were born in the same year starting from January to August. Two of them were twins, while the rest were born in different months. Those who were born in the months having 31 days always speak the truth while the rest of them always lies. Two statements were recorded from each of those nine persons, and they are as follows:

Note: Some of the words representing numbers are written in coded form.

- I was born after April. G always speaks the truth.
- A is the twin brother of D. Only one of the three persons younger than H is a liar.
- E is younger than K. E and K were not born in consecutive months.
- I was born in February. K is the oldest person.
- D was born in the month having less than 31 days. #3T persons were born between B and H.
- Twins were born in one of the months before May. At least #5J persons are older than D.
- I was born after March. Of all the nine persons, #3T are liars.
- Five persons are older than me. I was born in May.
- D is a liar. A and D were born in the same month.

1. Three of the following are alike in a certain way. Find the odd one out.
   (A) F
   (B) C
   (C) K
   (D) B

2. Who among the following was born in July?
   (A) K
   (B) H
   (C) D
   (D) None of these

3. Three of the following are alike in a certain way. Find the odd one out.
   (A) F
   (B) G
   (C) C
   (D) B

4. What is the sum of the days of the months in which the following people were born, B, A, D, and H?
   (A) 89
   (B) 90
   (C) 92
   (D) 120

Directions for Questions 5 and 6: Read the question below carefully and choose the correct answer for the questions that follow.

A person starts walking from shop C towards shop D, which is 13 m to the West of shop C. He then takes a right turn and walks 18 m to reach shop A. From shop A, he takes a left turn and walks 23 m to reach shop E. He again takes a left turn and walks 15 m to reach shop B.

5. In which direction is the person now heading?
(A) South
(B) East
(C) North
(D) North-West

6. Shop C is in which direction with respect to shop E?
(A) South-East
(B) North
(C) North-East
(D) West

7. Aman is 15 m North of Chanu. Chanu is 4 m East of Deepak. Deepak is 18 m South of Bhavesh. Bhavesh is 7 m West of Eliana. Eliana is 13 m East of Farha. Farha is 11 m South of Gaurav. What is the direction of Farha with respect to Chanu?
(A) South
(B) North-West
(C) South-West
(D) East

Directions for Questions 8 to 10: Read the question below carefully and choose the correct answer for the questions that follow.

Ramaiya started walking in the East direction from point S. After walking 18 m he took a left turn and walked 9 m to reach point T. From point T, he walked 12 m in the South direction to reach point L. From point L, he took a right turn and walked 5 m to reach point X. Now, he started walking in the East direction and walked 8 m to reach point Z. From point Z, he takes a left turn and walks 11 m to reach point B. Finally, he takes a right turn and walks 13 m to reach his final destination.

8. What is the approximate shortest distance between the final point and L?
(A) 12 m
(B) 16 m
(C) 19 m
(D) 25 m

9. In which direction is point S with respect to point Z?
(A) North-West
(B) North-East
(C) South-East
(D) South-West

10. What is the approximate shortest distance between points S and X?
(A) 11 m
(B) 13 m
(C) 15 m
(D) 18 m

11. Adam is 12 m south of Mani. Rohan is 8 m north of Rashmi. Ashok is 10 m west of Rashmi. Katya is 17 m north of Ashok. Adam is 6 m east of Nikhil. Chandu is 15 m north of Nikhil. Brat is 14 m west of Rohan. Katya is east of Chandu and the distance between them is half of the distance between Nikhil and Adam. Three of the following four are alike in a certain way, so form a group. Find the one that does not belong to that group?
(A) Adam-Rohan
(B) Brat-Chandu
(C) Rashmi-Adam
(D) Nikhil-Mani

Directions for Questions 12 to 15: Read the question below carefully and choose the correct answer for the questions that follow.

In a sports event in a school, the judges selected four winners depending on their performance up to the final, and then each winner was given a small box containing three coins. The winner, i.e., the one who was ranked first was given a box with three gold coins. The runner-up's box contained two gold coins and one silver coin. The second runner-up's box had one gold coin and two silver coins. The third runner-up's box had three silver coins. Now, each box had a label indicating the number of gold coins in it but all labels were wrong. Each of the

four winners would show the label and then would draw two coins from the box given to him or her one by one without seeing it. Thereafter, he or she was required to determine the type of third coin, i.e., gold or silver. If he or she could determine it correctly, rank as per the number of gold coins in the box would be his or hers, otherwise, he or she was made to change rank with the fifth finalist. Among the winners:

i) Amit took out two gold coins from his box and compared them with the label on the box so he could determine the type of the third coin correctly.

ii) Bholu took out one gold and one silver coin from her box and could also correctly determine the type of the third type of coin compared with the label on the box.

iii) Charu took out 2 silver coins from her box. But after comparing with the label, she realised that she could not determine what type her third coin was.

iv) Disha was the fourth winner but the coins withdrawn by her and the label on her box are unknown.

v) None of the players knew about other players' box labels and coins withdrawn by them except for their own.

12. What was the label on Amit's box indicating?
    (A) Two gold coins
    (B) Three gold coins
    (C) One or two gold coins
    (D) Two or three gold coins

13. If the labels on every box were to be true, then according to the label on Disha's box, how many silver coins were in it?

14. How many gold coins were there in Bholu's and Charu's boxes together?

15. How many silver coins were there in Amit's and Disha's boxes together?

Level of Difficulty – 2

1. (A)
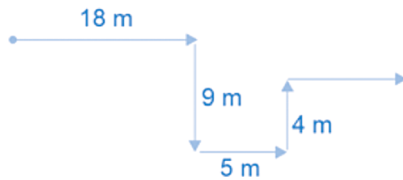
As it is clearly seen, Sushil is facing in the East direction.

Short trick

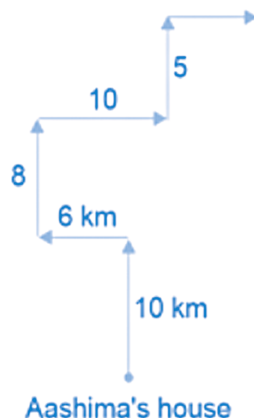This approach will work only if the direction was asked, not the distance.

Each right (R) and left (L) will lead to the same direction, from where one starts. So, cancel it.
Hence, in the above solution, there is no right and no left.
Hence, Sushil is facing in the East direction.
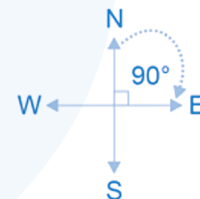Hence, option (A) is correct.

2. (A)

As it can be seen, Aashima is facing the East direction.

Short trick

Each right (R) and left (L) will lead to the same direction where they started.
So, cancel it.
Now, only one right (R) is left as it is seen from the above diagram. As it is known that Aashima starts her journey to the North. So, to know her final direction, turn her 90° to the right, i.e., in a clockwise direction.
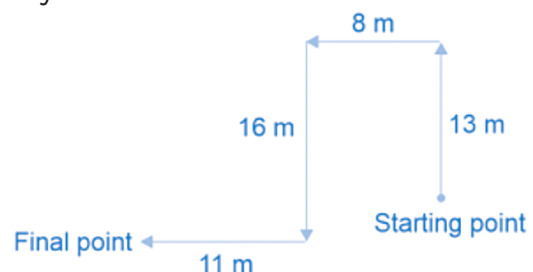

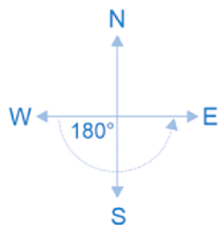Hence, Aashima is now facing East.
Hence, option (A) is correct.

3. (D)

Let's assume Raju starts walking towards the North direction. Then according to the given statements, the following journey would be:
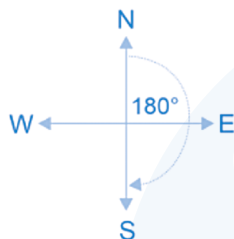
According to the diagram, Raju starts moving towards the West but in the given statement he is moving towards the East.

Now, rotate Raju to 180° clockwise or anticlockwise to satisfy the statement, and also rotate the diagram to 180° clockwise or anti-clockwise to find the direction from which he started walking.

So, it is clear that Raju started walking towards the South direction.
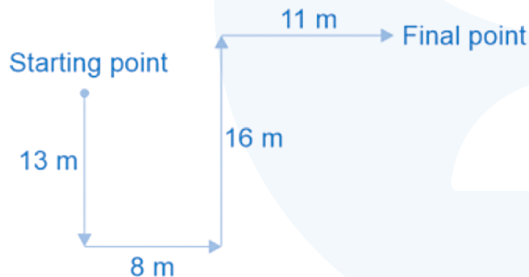
Short trick

Each right (R) and left (L) will lead to the same direction where one started.
So, cancel it.
Now, only one left (L) is left but this question is just opposite to the previous
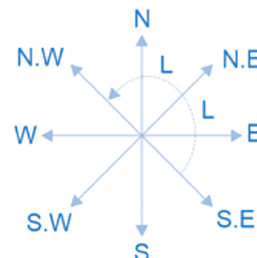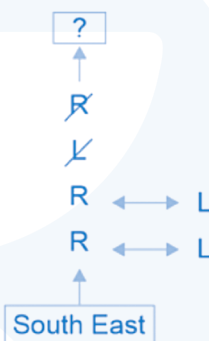
question as Raju moves from bottom to top.
So, change all left to right and vice-versa. Now, it is known that Raju's final direction is East. So, turn him 90° right, i.e., in a clockwise direction.
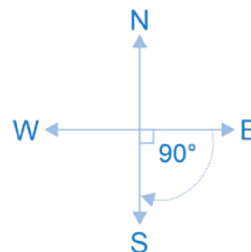
Raju starts walking towards the South. Hence, option (D) is correct.

4. **(C)**

So, Rizwan started his journey towards the North-West direction.
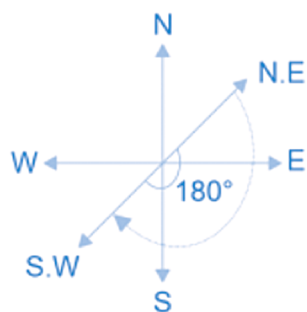Hence, option (C) is correct.

5. **(A)**
Let's consider all the clockwise movements be (+) and all the anti-clockwise movements be (−).
Now, calculate them
$\Rightarrow 135° + 45° − 90° + 90°$
$\Rightarrow 180°$
As it is known, Swapnil is facing the North-East direction. So, we have to rotate her 180° in a clockwise direction.
Hence, Swapnil is facing in the South-West direction.

Hence, option (A) is correct.

6. **(A)**

As it is given that only one person is wrong. So, the other two persons are telling the truth.

Now, assume that Manchester won the match, so the statements of Ally and Bhavesh are true as they satisfy our condition that two of them are truth-tellers. Hence, Manchester wins the match.

If you assume that Liverpool won the match, the statements of Bhavesh and Chandan become false which is violating the given condition.

Hence, option (A) is correct.

7. **(A)**

Let's assume Bob as the extortionist. So, it can be seen that statement of Austin is correct.

But the statement given by Bob is wrong. The statement given by Charlie is also correct as he is pointing towards Bob as the extortionist. So, in this condition, two statements are correct which violates the given condition.

Now, assume Austin as the extortionist, then it can be seen that except Bob's statement, remaining two statements become false.

So, Austin is the extortionist.

Hence, option (A) is correct.

8. **(D)**

Whenever it is crowded around me, I wear a mask.

The statement is of the form 'whenever p then q'.

Here, p = It is crowded around me and q = I wear a mask.

The implications are:

(I) p → q

(II) −q → −p

According to (I), choice (A), and according to (II), choice (B) is correct.

Hence, option (D) is correct.

9. **(D)**

Team India will win, only if Sachin is playing.

The statement is of the form 'only if p then q'.

Here,

p = Team India will win

q = Sachin is playing.

The implications are:

(I) p → q

(II) −q → −p

According to (I), choice (D) is correct.

Hence, option (D) is correct.

10. **(D)**

If Ravi can walk, then Ravi can reach his destination.

The statement is of the form, 'If m, then n'

Here,

m = Ravi can walk

n = Ravi can reach his destination

The implications are:

(I) m → n

(II) −n → −m

According to (I), choice (A) and according to (II), option (B) is correct.

Hence, option (D) is correct.

11. (D)

Making a diagram from the above information.

From the above diagram, it can be inferred that Amrita is facing the South direction.
Hence, option (D) is correct.

12. (B)

From the diagram created earlier, the coaching is in the North-East of Amrita's home.
Hence, option (B) is correct.

13. (C)

Note that, in the morning, if a person moves to the North, then his/her shadow will be on his/her left-hand side. Whereas, if a person moves to the South, then his/her shadow will be on her/his right-hand side.
So, according to the question and the diagram shown above, Sultan's shadow will be on his left-hand side, and that of Amrita, on her right-hand side.
Hence, option (C) is correct.

14. (A)

Consider the diagram drawn earlier.

With the help of Pythagoras' theorem, we can find the distance between Amrita's home to centre.

Distance $= \sqrt{9^2 + 4^2} = \sqrt{81 + 16} = \sqrt{97}$ km

Hence, option (A) is correct.

15. (C)

As per the diagram, Amrita's house is in the North-West direction of the hospital.
Hence, option (C) is correct.

1. (C)

Case 1: Assume Bimal is a truth-teller, so he is from Xoxo. Then Aman won the race and Cherry is Zozo (alternator) which implies Aman is a liar (Yoyo).

Case 2: Assume Aman is a truth-teller, so he is from Xoxo but according to Aman, Cherry always speaks the truth. That was not possible.

Case 3: Assume Cherry is a truth-teller, so he is from Xoxo. Now, Bimal is a winner and Cherry hadn't obstructed Aman at the last moment. Then Aman and Bimal both became alternators. This was impossible.

It means there can be two possible cases.

Floor	Person (Case 1)	Person (Case 2)
5 (liar)	E	
4 (truth)		C
3 (liar)		
2 (truth)	C	
1 (liar)		E

It means C lives on an even-numbered floor. So, C must be telling the truth.
Therefore, let us start with his statement.
The one who lives on the floor, which is immediately above D, always lies.
It means D must be living on an even-numbered floor. So,

Floor	Person (Case 1)	Person (Case 2)
5 (liar)	E	
4 (truth)	D	C
3 (liar)		
2 (truth)	C	D
1 (liar)		E

So, D must be telling the truth. Therefore, let us proceed with his statement. B lives below D. So, Case 2 will be eliminated.

So, only Case 1 is correct, i.e., Cherry is from Zozo.
Hence, option (C) is correct.

2. (A)

As explained earlier, only Case 1 is correct.
So, Aman won the race.
Hence, option (A) is correct.

3. (A)

According to the information given in the question, two persons are living between C and E. C neither lives on the topmost floor nor the bottommost floor.

Floor	Person (Case 1)
5 (liar)	E
4 (truth)	D
3 (liar)	B/A
2 (truth)	C
1 (liar)	A/B

According to A, he does not live below C. But since he is a liar (living on an odd-numbered floor), it means A must be living below C.

So, we have our final solution as,

Floor	Person (Case 1)
5 (liar)	E
4 (truth)	D
3 (liar)	B
2 (truth)	C
1 (liar)	A

Hence, E lives on the topmost floor.
Hence, option (A) is correct.

4. **(C)**
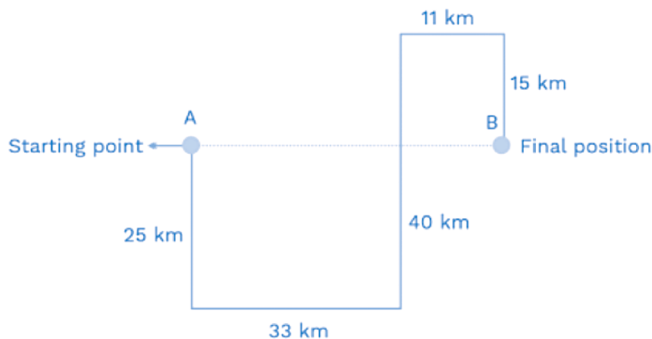As explained earlier, A lives on the bottommost floor.
Hence, option (C) is correct.

5. **(D)**
As explained earlier, A, B, and E are the three liars.
Hence, option (D) is correct.

6. **(D)**

Let A be the initial position and B be the final position.
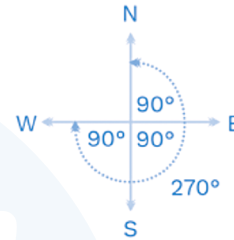So, the required distance = AB
= 33 + 11 = 44 km
From the above diagram, B (final position) is in the East direction from A (initial position).
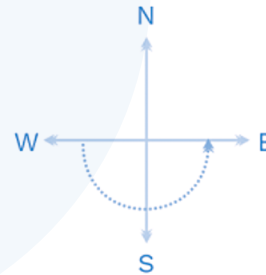∴ 44 km, East.
Hence, option (D) is correct.

7. **(A)**
Sally is facing north. She decides to turn 270° clockwise which means towards her right.

Further, she will turn 180° in the anticlockwise direction, which means towards her left.

Hence, Sally's final direction is towards the East.

Short trick
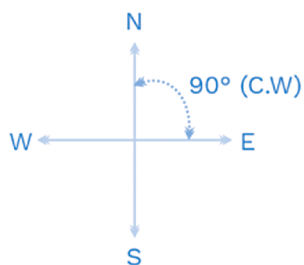Sally is facing the North direction.
Let's take clockwise direction movement (+) and anti-clockwise direction movement (−).
Now, calculate them
= + 270° (CW) − 180° (ACW)
= + 90° (CW)
Now, move 90° clockwise (CW) to Sally

Now, she is facing East

Learning outcome: In this type of question, always use the short trick.
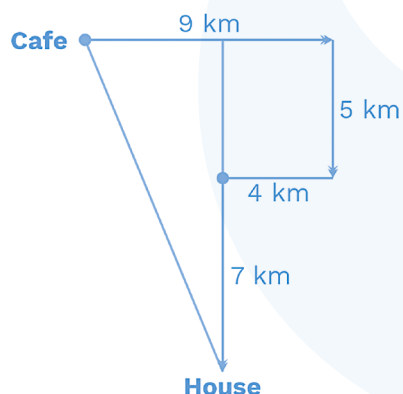
Hence, option (A) is correct.

8. (A)

To find the distance between his house and cafe, using Pythagoras theorem.

Required distance $= \sqrt{(9-4)^2 + (5+7)^2}$
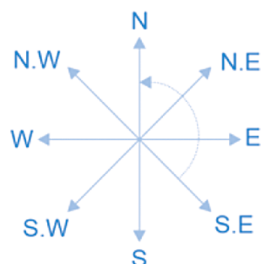
$= \sqrt{(5)^2 + (12)^2} = \sqrt{25+144} = \sqrt{169} = 13$ km

Now, as it is seen in the above figure, Rajeev's cafe is in North-West direction of his house.
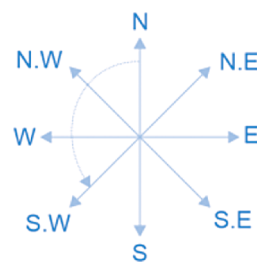
Hence, option (A) is correct.

9. (D)

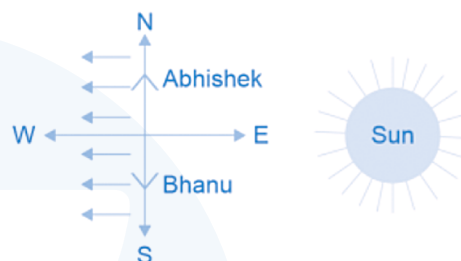Rotate South-East to 135° anti-clockwise to reach North.

Now, according to the question,

Rotate North to 135° anti-clockwise. So, North becomes South-West.

Hence, option (D) is correct.

10. (D)

In the morning, if a man is facing North, his shadow falls towards his left-hand side.

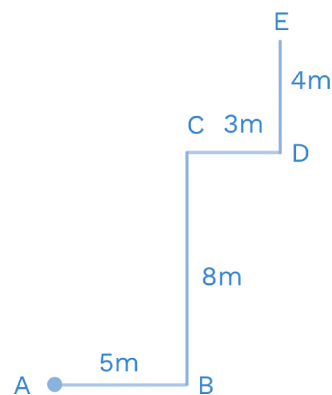According to the question, Abhishek's shadow fell exactly towards left-hand side.

Hence, Abhishek is facing North.

Now, with the help of the diagram, it is clear that Bhanu is facing South.

Hence, option (D) is correct.

11. (C)

After solving the expression A @ B # C * D ! E, the diagram can be made as shown below:
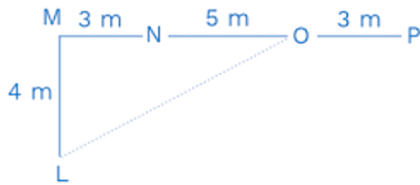
It can be seen that E is in North-East with respect to B.

Hence, option (C) is correct.

12. (A)

After solving the expression 'L ! M * N @ O * P' and making a diagram.

M —3 m— N —5 m— O —3 m— P
L (4 m from M)

To find the shortest distance, use the Pythagoras' theorem.
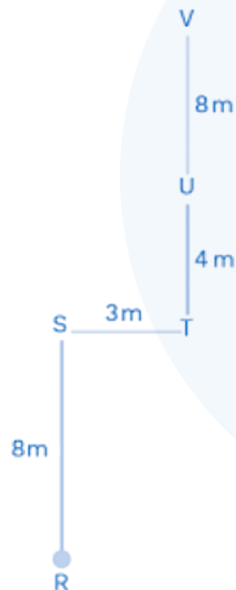
$LO^2 = LM^2 + MO^2$

$LO = \sqrt{(4)^2 + (8)^2} = \sqrt{16 + 64} = \sqrt{80}$

$= 4\sqrt{5}\,m$

Hence, option (A) is correct.

13. (D)

After solving the expression 'R # S * T ! U # V' and making a diagram.

V
|
8 m
|
U
|
4 m
|
S —3m— T
|
8m
|
R

It can be seen that S is South-West with respect to V.

Hence, option (D) is correct.

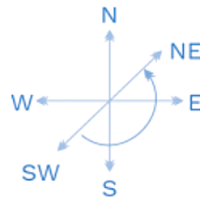**14. (B)**

Consider all the clockwise movements be (+) and all the anti-clock wise movements be (−).

Now, calculate them

= + 45° − 135° − 90° = − 180°

As it is known that, Anuja is facing South-West, rotate her 180° in anti-clockwise direction.
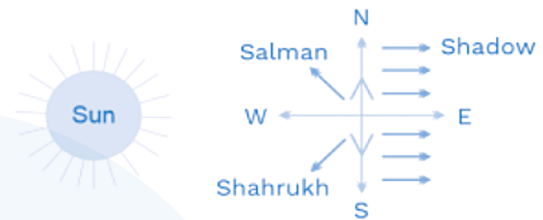
N
NE
W — E
SW
S

Hence, Anuja is facing in the North-East direction now.

Hence, option (B) is correct.

15. (D)

In the evening, if a man is facing North, his shadow falls towards his right-hand side.

Sun

N
Salman — Shadow
W — E
Shahrukh
S

According to the question, Shahrukh's shadow falls exactly on Salman's right-hand side.

So, Salman is facing the North.

Hence, Shahrukh faces South.

Hence, option (D) is correct.

16. (E)

Let's identify the given two events with the letters X and Y, as shown below.

X: Brijesh goes to sing.

Y: Brijesh does not go to the dance.

As per the given statement, there is an 'either or' relationship between the given two events. So, if X happens, Y doesn't happen, and vice-versa.

So, if Y happens (i.e. Brijesh does not go to the dance), X will not happen (i.e., Brijesh does not go to sing).

or

So, if Y doesn't happen (i.e., Brijesh goes to the dance), X will happen (i.e., Brijesh goes to sing).

So, in the simple words, we can conclude the following:

If he sings, he goes to dance.

If he doesn't sing, he doesn't go to dance.

and vice-versa.

So, all the given pairs depict the correct relation between the events.

Hence, option (E) is correct.

1. (B)

i) According to H, five persons are older than him, and he was born in May. It means twins were born before him (according to him). It also means that there are only three people younger than him (assuming that he is telling truth).

ii) According to F, twins were born before May.

iii) So, the statements made by H and F are consistent. It means, both of them are either lying or telling the truth.

iv) According to B, one of the three persons younger than H is a liar.

vi) So, all three i.e., B, H, and F are either telling the truth or lying. ...(i)

vii) Similarly, statements of K and E are consistent, as according to both of them, D is a liar.

viii) Also, according to both B and K, A and D are twins.

ix) So, all three, i.e. B, K, and E are either telling the truth or lying. ...(ii)

x) From (i) and (ii), we can say that the five persons viz., B, F, H, K, and E are either lying or telling the truth.

xi) But since there are only three such months viz., February, April, and June, which have 30 or fewer days, the total number of liars cannot be more than four, which means B, F, H, K, and E are telling the truth.

xii) Hence, the other four persons viz. A, D, C, and G must be the liars.

So, we have,

Case 1:

Months	Persons
January (31)	
February (28/29)	A, D
(March (31)	
April (30)	
May (31)	H
June (30)	
July (31)	
August (31)	

(Because K is a truth-teller).

(Because H is a truth-teller).

Case 2:

Months	Column 1
January (31)	
February (28/29)	
March (31)	
April (30)	A, D
May (31)	H
June (30)	
July (31)	
August (31)	

(Because K is a truth-teller). (Because H is a truth-teller) .

But D, a liar said: I was born in February. It means A and D must have been born in April or June only. So, case 1 will be eliminated.

But B, the truth-teller has said: Only one of the three persons younger than H is a liar. So A and D can't be born in June.

G, the liar said: I was born after March. So G was definitely born in February. Hence, the remaining liar C was born in June. Hence,

Months	Persons
January (31)	
February (28/29)	G
March (31)	
April (30)	A, D
May (31)	H
June (30)	C
July (31)	
August (31)	

C, the liar said: E is younger than K. E and K were not born in consecutive months. It means E is senior to K and must have been born in July, while K must have been born in the consecutive month of August.
Hence,

Months	Persons
January (31)	
February (28/29)	G
March (31)	
April (30)	A, D
May (31)	H
June (30)	C
July (31)	E
August (31)	K

E, the truth-teller said: #3T persons were born between B and H. So, we can say that, #3T = two/four.

F, the truth-teller said: At least #5J persons are older than D. So, #5J = three.

G, the liar said: Of all the nine persons, #3T are liars. But since there are four liars in the group, and G is a liar, #3T cannot be the code for four. It means #3T is the code for two.

So, we have our final solution as,

Months	Persons
January (31)	F
February (28/29)	G
March (31)	B
April (30)	A, D
May (31)	H
June (30)	C
July (31)	E
August (31)	K

Now, we are asked to find the odd one out from F, C, K, and B.
Out of the four persons, all except C were born in a month having 31 days (i.e., they were truth-tellers).
Hence, option (B) is correct.

2. **(D)**
    As explained earlier, E was born in July. Hence, option (D) is correct.

3. **(C)**
    We can first check if we can identify the odd one based on the grouping of truthful or liar. But that doesn't work here.

Now, we can say that Except for C, the other three were born in successive months.
Hence, C is the odd one out.
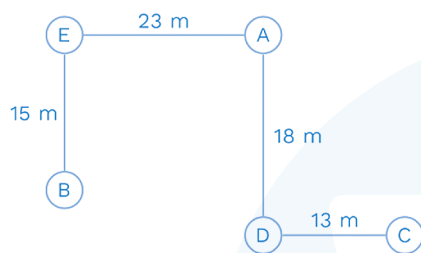Hence, option (C) is correct.

4. (C)
B – March
A, D – April
H – May
So, the total days of these 3 months = 31 + 30 + 31 = 92
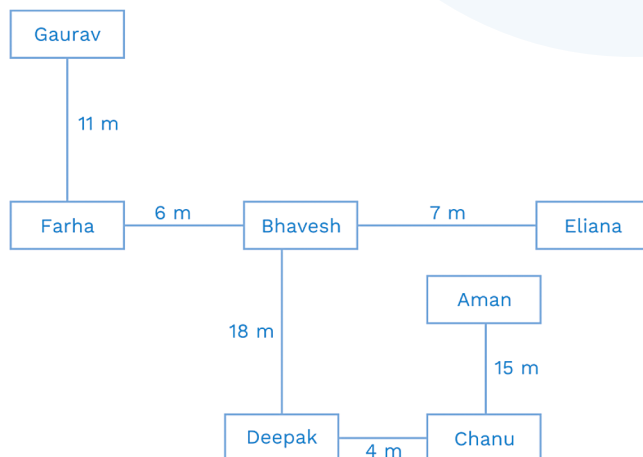Hence, option (C) is correct.

5. (A)

Clearly, the person is now heading towards the South direction.
Hence, option (A) is correct.

6. (A)
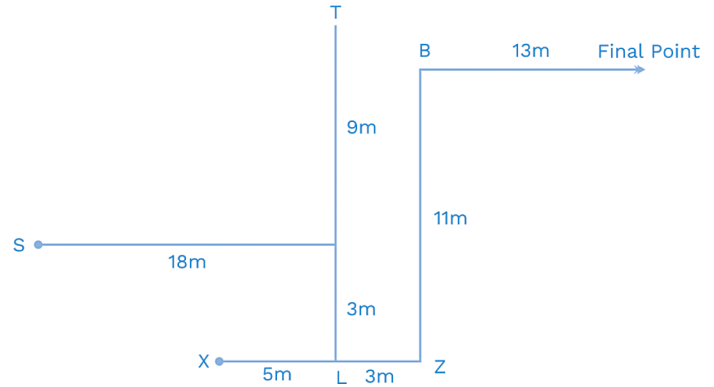By looking at the diagram, we can say that shop C is in South–East direction with respect to shop E.
Hence, option (A) is correct.

7. (B)

Clearly, the direction of Farha with respect to Chanu is North-West.
Hence, option (B) is correct.

8. (C)

Shortest distance between the final point and L
$$= \sqrt{16^2 + 11^2} = \sqrt{377} = 19.41 \text{ (approx.)}$$
Hence, option (C) is correct.

9. (A)
By looking at the diagram, we can say that point S is in North-west with respect to point Z.
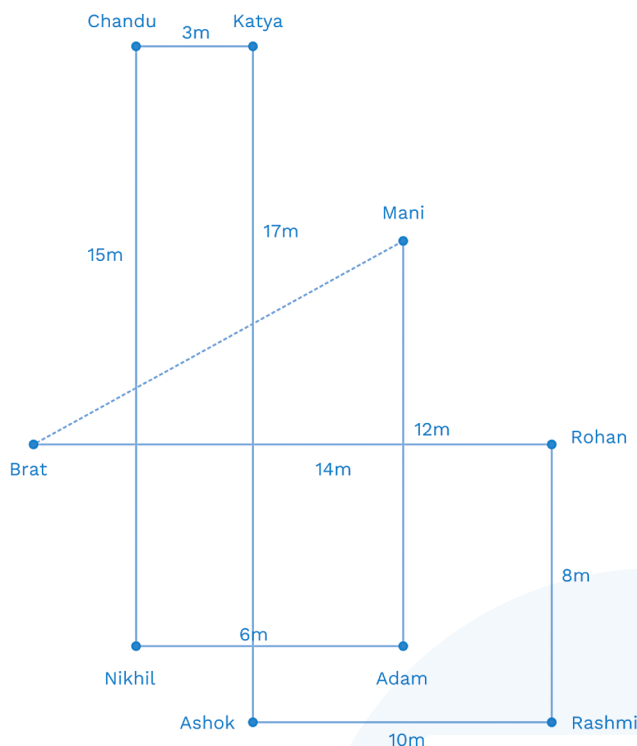Hence, option (A) is correct.

10. (B)
By looking at the diagram, we can say that the shortest distance between point S and point X.
$$\sqrt{3^2 + 13^2} = \sqrt{9 + 169} = \sqrt{178} = 13.342 \text{ (approx.)}$$
Hence, option (B) is correct.

11. (C)
According to the information given in the question, the diagram will be

In all the options, except (C), the second person in the pair is in the North-East direction of the first person in that pair. Hence, option (C) is correct.

12. **(A)**

a) Amit took out two gold coins from his box and comparing his pick with the label on the box he had determined the type of the third coin correctly.

   i) Amit had taken out two gold coins, so in his box, there must have been either three or two gold coins.

   ii) But the labels were all wrong. So if the label read two gold and one silver, Amit knew there were three gold coins in the box. If the label read three gold 0 silver, there was actually two gold and one silver.

   iii) Any other label (like 0 gold three silver or one gold two silver) would not allow Amit to judge properly the correct content of the box. But because he could correctly judge, it implies Amit got a box with the label either two gold one silver, or three gold.

b) Bholu took out 1 gold and 1 silver coin from her box and comparing her pick with the label on the box could also correctly determine the type of the third coin.

   i) Bholu's box must have had two gold one silver or one gold two silver.

   ii) But the labels were all wrong. So if the label read two gold and one silver, Bholu knew there was 1 gold and two silver in the box, and vice versa.

   iii) Any other label (like three gold 0 silver or 0 gold three silver) would not allow Bholu to judge properly the correct content of the box. But because she could correctly judge, it implies Bholu got a box with label either two gold one silver or one gold two silver.

c) Charu took out two silver coins from her box. But after comparing with the label, she could not determine what type her third coin was.

   i) So Charu's box must have had one gold two silver or 0 gold three silver.

   ii) But because she could not determine, the label of the box of Charu was either three gold or two gold and one silver.

Tabulating the deductions, we can judge:

	Picked	Label Possibility 1	Label Possibility 2	Actual Coins	Actual Label on the Box
Amit	2g	3g, 0s	2g, 1s	3g	2g, 1s
Bholu	1g, 1s	2g, 1s	1g, 2s	2g and 1s	1g, 2s
Charu	2s	3g, 0s	2g, 1s	3s	3g, 0s
Disha				1g and 2s	0g, 3s

So, the label on Amit's box should have been two gold and one silver. Hence Disha must have got by default the left-over possibilities.
Hence, option (A) is correct.

13. 3

As explained earlier, there were 3 silver coins in Disha's box.
Hence, the correct answer is 3.

14. 2

As explained earlier, there were two gold coins in Bholu's and Charu's boxes put together
Hence, the correct answer is 2.

15. 2

As explained earlier, there were 2 silver coins in Amit's and Disha's boxes put together.
Hence, the correct answer is 2.

Rack Your Brain

1. P's first statement is 'I am not an alternator'.
As explained in the concepts,
A truth-teller can make this statement as this cannot conflict with the fact of the truth-teller.
A liar cannot make this statement as this statement conflicts with the fact of the liar.
An alternator can make this statement and this statement will be a lie for him/her and the next statement will be the truth.
So, this statement can only be made by a truth-teller or an alternator.
So, P will be a truth-teller or an alternator.

Case 1: Let P be a truth-teller.

So, Q's first statement will be a lie (as it contradicts what P said). Now, if we consider Q an alternator, then his second statement must be true, and it doesn't contradict any of the facts. Hence, in that case, P's two statements and Q's one statement are correct.

Now, if we consider Q a liar, both of his statements will be lies, and that also does not contradict the facts. Hence, in that case, P's two statements and Q's 0 statement are correct.

Case 2: Let P be an alternator.

So, his first statement will be a lie, hence the second one should be true. Hence, Q's first statement will be a lie. Now, Q's second statement cannot be true, as in that case, Q will also become an alternator, and there will be two alternators now, which contradicts that second statement of Q.

If we consider Q a liar, then his second statement will become true (as P has been considered an alternator). But, a liar cannot speak any true statements.

So, Case 2 is not possible.

Hence, from Case 1, there can be a maximum of three statements true from P and Q together.

Hence, option (D) is correct.

Rack Your Brain

2. It is given that I will eat ice cream or chocolate today. Please note that this is not an 'either-or' statement. So, if I ate chocolate today then I might have eaten ice cream as well. So, nothing can be concluded surely. Hence, option (D) is correct.

Rack Your Brain

3. Dheeraj is facing towards West. He turns 270° in the clockwise direction and then 90° in anti-clockwise direction and then 45° in the clockwise direction and then 135° in the anti-clockwise direction.
So, Dheeraj is now facing North.

Rack Your Brain

4. Vanni walks from her hostel towards the intersection and notices that she would walk away from the coffee house if she takes a right turn. This means that the Coffee house should be towards her left. Also, if she follows the straight path, she would reach the college, so the temple must be on her right, as shown below:
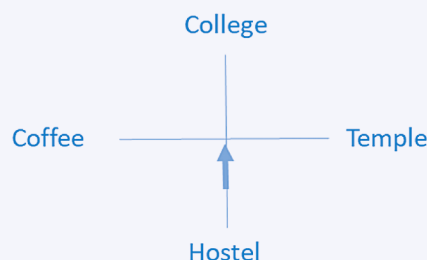
Hence, the temple is in East direction.