

Binary Logic

These question types are called binary logic questions simply because each question contains two logic streams that have to be matched, in order to get to the correct answer. Mainly, there are two types of questions as below:

BINARY LOGIC QUESTION—PATTERNS

Type 1

In this question type, three persons speak two statements each—one of which is true, the other is false.

The two logic streams to be considered are:

1. The logic of the Statements, i.e., the logic of what is said within the statements.
2. The logic of the Basic Conditions, i.e., the logic of the fact that if one sentence is taken as true, the other will be false automatically.

The process of solving these questions is best illustrated through an example.

 Gauri Islands is the name of an island. The inhabitants of this island always answer any question with two sentences. One of which is always true and the other always false.

Milly, Silly and Dilly are the three daughters of the chief whip of this island. Out of them, two are minor and one is of a marriageable age. You have been caught as an intruder on the island and you have two options given by the chief whip: identify his daughter who is of marriageable age. If you do so, you can have the privilege of marrying her and becoming the new chief whip in the future. On the other hand, if you cannot, you will be executed. Only Silly has dentures in her teeth. On questioning the three daughters, these are the answers you get:

Milly: “I am shorter than Silly. The girl of marriageable age has dentures in her teeth.”

Silly: “I am shorter than Milly. Dilly is the one who is of a marriageable age.”

Dilly: The girl of marriageable age is amongst the three of us. I am of a marriageable age.”

Who is the girl of marriageable age?

(a) Milly (b) Dolly

(c) Silly (d) Can't say

 In the above question, you should see that, the first statement of Dilly has to be correct (By Logic of the statement—If you evaluate what the statement is saying, it is clear that it has to be true. It can be easily understood that the girl of marriageable age is amongst the three of the girls.)

In this case, if this statement is true, then Dilly's second statement is automatically false. Further, since Dilly's second statement is false, Silly's second statement will also be false. (By evaluating the sentence logic—as both these statements are saying the same thing.) Hence, Silly's first statement will be true (Basic Condition logic) and hence further, Milly's first statement will be false (It is saying the opposite of Silly's true first statement—Statement Logic). Hence, Milly's second statement has to be true. Hence, Silly has to be the one of marriageable age.

PRACTICE EXERCISES

Type 1

Direction On an island 'Mola-Moola' the inhabitants always answer any question with two sentences—one of which is always true and the other always false.

Read the question below very carefully and choose the correct answer for the questions that follow:

The commissioner of the island discovers that smuggling is rampant there. You have been hired as a private detective in order to determine the identity of the culprits and also to know more about the next heist on the basis of a plane. You question three suspects as to when the plane is expected and what it looks like. This is what they have to say:

Subhash: It arrives at 11:00 p.m. The colour of the plane is only red.

Rubhash: It arrives at 11:00 p.m. The colour of the plane is only yellow.

Bibhash: I know at what time the ship arrives. Rubhash is lying about the time of arrival.

1. At what time does the plane arrive?

(a) 6 p.m.

(b) 11 p.m.

(c) Can't say

(d) Won't arrive

2. What is the colour of the plane?

(a) Can't say

(b) Red

(c) Yellow

(d) Both red and yellow

Suddenly, a murder takes place on the island. It is imperative that you locate the person who is the murderer. On further investigation, you find that the murderer has to be a person who has been to the chief whip's house within the last five days (today is Friday). By careful questioning, you narrow the possibilities down to three people. This is what they have to say.

Rani: "I went to the Chief Whip's house. It was before Monday."

Vani: "Rani did not go to the Chief Whip's house. I have not gone to the Chief Whip's house in the last five days either".

Siwani: “Rani did not go to the Chief Whip’s house. I am not the murderer.”

3. Who is the murderer?

(a) Siwani

(b) Rani

(c) Vani

(d) Can’t say

In the village of Rampur, all inhabitants always answer any question with two sentences, one of which is always true, the other is always false.

While visiting the village, Gauri meets three inhabitants—Rajesh, Mahesh and Ramesh near the village square. One of them is wearing a suit. Knowing that they were there to resolve a dispute over the ownership of some land, you ask them—“Who got the land?” They answer as follows:

Rajesh: “I got the land. Ramesh is wearing the suit.”

Mahesh: “I am wearing the suit. I got the land.”

Ramesh: “I got the land. I am not wearing the suit.”

4. Who is wearing the suit?

(a) Rajesh

(b) Mahesh

(c) Ramesh

(d) None of these

5. Who got the land?

(a) Rajesh

(b) Can’t say

(c) Ramesh

(d) Mahesh

On waking up the next morning, you find that your brand new watch has been stolen. The suspects are the same trio you met the previous day. You question them (knowing that only one of them is guilty). And they reply as follows:

Rajesh: “Mahesh did not do it. I did not do it.”

Mahesh: “I did not do it. Ramesh did not do it.”

Ramesh: “I did not do it. I do not know who did it.”

6. Who stole the watch?

(a) Can’t say

(b) Ramesh

(c) Mahesh

(d) Rajesh

In a small island called Neverneverland, the people always answer any question with two sentences—one of which is always right and the other is false.

Perhaps due to this peculiar habit, there’s been a high rate of suicides on the island. As a doctor, you have to identify potentially suicidal people and counsel them. You know that all people who are suicidal feel that life is futile. On questioning three inhabitants, these are the answers you get:

Anuj: “Himansu is suicidal. I am not suicidal.”

Himansu: “I do not want to die. Akshay does not want to die.”

Akshay: “Life is futile. I am suicidal.”

7. Who among the three is suicidal?

(a) Anuj and Himansu

(b) Himansu

(c) Himansu and Akshay

(d) Akshay

8. Which of them is lying about another person's tendencies?

(a) Akshay

(b) Himansu

(c) Anuj and Himansu

(d) None of them is lying about another person's tendencies

Going around the village, you come across three people. One of them is a dentist, one a barrister and one a professor. You want to know who is who.

Peter says, "I am not a professor. Shina is not a professor."

Matt says, "Peter is not a barrister. Shina is a professor."

Shina says, "Peter is not a dentist. I am not a professor."

9. Which of the following is true?

(a) Shina is the professor

(b) Peter is the dentist

(c) Matt is the barrister.

(d) None of these

Further, you come across three women, one of whom is an excellent singer. You start questioning them, when you notice that Minaxi is wearing a flower in her hair.

Madhuri says, "I am not the singer. The singer wears a flower in her hair."

Minaxi says, "I am the singer. The singer is amongst us."

Jaya says, "Madhuri is the singer. Minaxi is not the singer."

10. Who is the singer?

(a) Madhuri

(b) Minaxi

(c) Jaya

(d) None of these

You want to expand your horizons and decide to go to the village of "Where is Who", which is further inside. You come to the border of "Kya Kya" and see a fork. One leads left and the other right. There are no other roads. You ask the inhabitants:

Maroof says, "I do not speak to strangers. I am new to these parts."

Nafish says, "Take the road to the right. I am married to Ayesha."

Ayesha says, "I am not Nafish's wife. Maroof is not new to these parts."

11. Which of the following is true?

(a) The road to the right leads to "Where is Who".

(b) The road to the left leads to "Where is Who".

- (c) Nafish is married to Ayesha.
- (d) None of these.

On moving further, you come across another small village of Patina, whose inhabitants answer all questions with two sentences—one of which is true and the other always false.

I asked Shahrukh, Amitabh and Abhishek, “Did it snow last night?” and I got the following replies:

Shahrukh: Yes, it snowed last night. Moreover, Amitabh fell sick last night.

Amitabh: Yes, it snowed last night. But then I never lie.

Abhishek: No, it did not snow last night. But Shahrukh got married yesterday.

12. Which of the following statements is true?

- (a) It did not snow last night.
- (b) Amitabh fell sick last night
- (c) Shahrukh got married yesterday
- (d) None of these.

Rophas Khopas is a small land locked country in the Vindhyan forest range, with a distinct dress, culture, food habits, national language, national dance, a national bird, and a national animal. The inhabitants speak in two sentences—one of which is true and the other false.

I asked Shiva, Monu and Vijay, the three important citizens of Rophas Khopas, “What is the national language of Rophas Khopas?” and I got the following replies:

Shiva: “French is our national language. Hundred percent of our citizens are literate.”

Monu: Latin is our national language. We have a very poor literacy rate in the country.

Vijay: We have a very poor literacy rate in the country. Our national language is Bhasha Khopas.

13. The national language of Rophas Khopas is

- (a) French
- (b) Latin
- (c) Bhasha Khopas
- (d) Cannot be ascertained

14. With reference to question 13 above, the rate of literacy in Rophas Khopas is

- (a) Very poor
- (b) Good
- (c) 100%
- (d) Cannot be ascertained

I asked Shiva, Monu and Vijay, “What is your national dress?” and I got the following replies:

Shiva: Our national dress is Pathani suit. People wear the national dress on very special occasions only.

Monu: Our national dress is Sari. People wear the national dress on very special occasions only.

Vijay: Our national dress is suit boot. But no one is ever permitted to wear the national dress.

15. The national dress of Rophas Khopas is

- (a) Pathani suit

- (b) Sari
- (c) Suit Boot
- (d) Cannot be ascertained

I asked Shiva, Monu and Vijay, “What is your national food?” and I got the following replies:

Shiva: Our national food is *sabudana khichdi*. Most of our people are hale and hearty.

Monu: Our people are not hale and hearty at all. Our national food is *makki ki roti*.

Vijay: Most of our people are hale and hearty. Our national food is *rice kee kheer*.

16. The national food of Rophas Khopas is:

- (a) *sabudana khichdi*
- (b) *makki ki roti*
- (c) *rice kee kheer*
- (d) Cannot be ascertained

17. With reference to Question 16 above, in Rophas Khopas:

- (a) people are not hale and hearty.
- (b) some people are hale and hearty.
- (c) most people are hale and hearty.
- (d) cannot be ascertained.

I asked Shiva, Monu and Vijay, “What is your national bird?” and got the following replies:

Shiva: Our national bird is cackatoo. We are a peace loving country.

Monu: Our national bird is sparrow. We are a peace loving country.

Vijay: Our national bird is owl. But we worship the sparrow.

18. The national bird of Rophas Khopas is

- (a) Sparrow
- (b) Cackatoo
- (c) Owl
- (d) Cannot be ascertained.

I asked Shiva, Monu and Vijay, “What is your national animal?” and I got following replies:

Shiva: Our national bird is kangaroo. We have thick growth of vegetation all over.

Monu: Our national bird is donkey. We have thick growth of vegetation all over.

Vijay: Ours is a mountainous country with almost no vegetation. Our national animal is koala.

19. The national animal of Rophas Khopas is

- (a) Kangaroo
- (b) Donkey
- (c) Koala
- (d) Cannot be ascertained.

I asked Shiva, Monu and Vijay, “What is your national dance?” and got the following replies:

Shiva: Samba is our national dance. We do not like or appreciate cricket.

Monu: Salsa is our national dance. We are great lovers of aggressive cricket.

Vijay: Disco is our national dance. We are great lovers of aggressive cricket.

20. The national dance of Rophas Khopas is

- (a) Samba
- (b) Salsa
- (c) Disco
- (d) Cannot be ascertained.

21. With reference to Question 20 above, people of Rophas Khopas:

- (a) do not like or appreciate cricket.
- (b) like and appreciate cricket.
- (c) are great lovers of aggressive cricket.
- (d) Cannot be ascertained.

In the parliament of the Ravindra Rami, all members have a peculiar habit. Of any two sentences they speak, one is false and the other is true. You record the statements of three sitting members: Rozor, Sam, and Michael.

Rozor: The President claims he is the President. I am the President.

Sam: I am the President. Rozor is the President.

Michael: I am the President. Sam knows who is the President.

Answer the following questions based on these recorded statements.

22. The real President can be determined from

- (a) Sam's and Rozor's statements alone.
- (b) Sam's and Michael's statements alone.
- (c) Michael's and Rozor's statements alone.
- (d) None of the above.

23. If Rozor's first statement is false, which of the following cannot be President?

- (a) Sam
- (b) Rozor
- (c) Michael
- (d) Rozor's first statement cannot be false.

24. Who is the President?

- (a) Sam
- (b) Rozor
- (c) Michael
- (d) Can't be determined

25. Whose first statement is true?

- (a) Sam and Michael
- (b) Michael and Rozor

- (c) Sam and Rozor
 - (d) Can't be determined
26. Whose first statement is false?
- (a) Sam
 - (b) Rozor
 - (c) Michael
 - (d) Sam and Michael

You move on. Next, you are asked to solve the mystery of who murdered Manmohan, the most influential resident of the village. You question three suspects:

Ali says, "It was me who killed Manmohan. It was Saif."

Saif says, "It was me who killed Manmohan. It was Ramu."

Ramu says, "It was not me who killed Manmohan. It was not Ali."

27. Who murdered Manmohan?
- (a) Ali
 - (b) Saif
 - (c) Ramu
 - (d) Such a situation is not possible

Type 2

In this type of questions, we have two types of people: those who always speak the truth, and those who always lie. These questions are also classified as Binary Logic questions since they are solved on the basis of two logical streams that run parallel to each other, viz: Basic Condition Logic (BCL) and Logic of the Statements (LoS).

The Basic Condition Logic flows from the fact that if a person always speaks the truth, then whatever statement he says must be true. However, in some cases, a clash might arise between the Basic Condition Logic and the Statement Logic, if it can be seen that the statement is obviously false.

The best way to understand this question type is by looking at an example:

You meet three inhabitants—Rohit, Mohit and Sohiti—standing together. You ask Rohit "Are you a type X or type Y?" He mumbles something, which you cannot catch, so you ask Mohit, "What did Rohit say?" Mohit replies "Rohit said that he is type Y." You look at Sohiti and he says, "Do not believe Mohit, he is lying."

Which of the following is true?

1. Rohit is a type X.
2. Mohit is a type Y.
3. Sohiti is a type Y.
4. All of these.

By BCL, Sohiti could be Type X or Type Y:

If Sohiti is Type Y, his statement must be false. That means Mohit is not lying. Hence, Mohit should be Type X and hence his statement must be true, i.e., Rohit must have said that he is Type Y.

However, if you look at Rohit, he could not have made this statement in either case.

If we assume that Rohit is Type X, he would only speak the truth and he would then say that he is Type X, not that he is Type Y.

On the other hand, if we were to assume that Rohit is a Type Y, he would only speak false. But then he could not have said that he is Type Y, since that statement would be true.

Directions for Questions 1 to 4: The following questions are based on an island called Gutar Goc on which there are only two kinds of inhabitants:

Type X: people who always speak the truth; and

Type Y: people who always lie.

1. You go to the island and see a group of three people—Arun, Bakshi and Calvin. You ask Arun, “How many type X’s are there amongst you?” Unfortunately, Arun’s reply is drowned by some noise and you ask Bakshi, “What did Arun say?” Bakshi says, “Arun said that there is one type X among us.” However, Calvin immediately says, “ Don’t believe Bakshi, he is lying.”

Which of the following is true?

- (a) Bakshi is a type X
 - (b) Arun is a type Y.
 - (c) Calvin is a type X
 - (d) None of these
2. You are very intrigued. You decide to find out more. You question two other persons—Manoj and Hemant. Manoj says, “At least one of us is a type Y.”

Which of the following is true?

- (a) Manoj is type X.
 - (b) Hemant is a type X.
 - (c) Both (a) and (b)
 - (d) None of these
3. You are further intrigued and decide to continue further on into the island of Gutar Goo. Coming across a group of three persons—Raju, Golu, and Suyash—you hear them make two statements:

Raju: “All of us are type Y’s”.

Golu: “Exactly one of us is a type X.”

Which of the following is true?

- (a) Raju is type Y
 - (b) Golu is a type X.
 - (c) Suyash is a type Y
 - (d) All of these
4. By now you have had just a bit too much of the island—however, on the insistence of your friend Bakshi, you continue further. You meet two persons—Suyash and Divyansh. Suyash

says, “I am a type Y. But Divyansh isn’t.”

Who is type X?

- (a) Suyash
- (b) Divyansh
- (c) Indeterminate
- (d) None of these

Directions for Questions 5 to 10: Read the following paragraph and answer the questions that follow.

There are two types of inhabitants in Tatabalery—A type and B type. The A type of inhabitants always speak the truth and the B type of inhabitants always lie.

5. Rocky says, “I always lie.” Which type of an inhabitant is he?
 - (a) A
 - (b) B
 - (c) Either A or B
 - (d) The given statement is infeasible.
6. Peter says, “According to Rocky. I always speak the truth.” Which of the following is a correct conclusion?
 - (a) Peter has to be of type A
 - (b) Peter has to be of type B
 - (c) Rocky has to be of type A.
 - (d) Rocky has to be of type B.
7. Booker says. “Shane and I are of the same type.” Which of the following is a correct conclusion?
 - (a) Booker and Shane are necessarily of the same type.
 - (b) Shane has to be of type A.
 - (c) Booker and Shane cannot be of the same type.
 - (d) The given statement is infeasible.
8. Ramu says “Basu and I are of different types.” Which of the following is a correct conclusion?
 - (a) Ramu and Basu are of Type B and Type A respectively.
 - (b) Ramu and Basu cannot be of the same type.
 - (c) Basu has to be of Type B.
 - (d) Shyam has to be of Type B.
9. Shane says, “Booker and I are of different types.” Which of the following is a correct conclusion?
 - (a) Shane and Booker are of Type B and Type A respectively.
 - (b) Shane and Booker cannot be of the same type.
 - (c) Booker has to be of Type B.

- (d) None of these
10. Booker says, “At least one person among Shane and I always lies.” What types are Booker and Shane respectively?
- (a) B, A
(b) B, B
(c) A, B
(d) It is not possible to deduce.

Directions for Questions 10 to 12: Refer to the passage below and answer questions given below it.

The inhabitants of the Island of Dreams have very bright and interesting lives. Just as we earthlings have continuity in our daily lives, the inhabitants of the Island of Dreams have continuity in both their waking lives, as well as their dreams. As a result, the inhabitants of the Island of Dreams have great difficulty in knowing whether they are awake or asleep at a given time. However, the inhabitants can be classified into two broad types—Awakers and Asleepers.

An awaker is characterised by the fact that everything they believe while they are awake is true, and everything they believe while they are asleep is false. An Asleeper on the other hand, has the characteristic that everything he believes while asleep is true, and everything he believes while awake is false.

11. The Island has a President, a Prime Minister and an Entertainment Minister. At one point, the Entertainment Minister believed that his bosses were of different types. Twelve hours later, he changed his state (from sleeping to waking or from waking to sleeping), and he then believed that the President was an Awaker and the Prime Minister was an Asleeper. What type is the President?
- (a) Awaker
(b) Asleeper
(c) Could be either of the two types
(d) Data inconsistent
12. With reference to Question 11, what type is the Prime Minister?
- (a) Awaker
(b) Asleeper
(c) Could be either of the two types
(d) Data inconsistent
13. At one time, an inhabitant believed that he was both asleep and awake, what was he really?
- (a) Awaker
(b) Asleeper
(c) Could be either of the two types
(d) Data inconsistent

Directions On the Island of Who Went Where, there are only two kinds of people. **Type No** are those who, when they ask a question, must always get a ‘No’ for an answer and **Type Yes** are those who

must always get a 'Yes' for an answer to every question they ask. Based on this, answer Questions 14 to 16.

14. Victor and Trish are married. Victor asks you: "Are both of us of the type No?" You can conclude that
- (a) It is impossible for him to have asked such a question.
 - (b) Victor is a No.
 - (c) Trish is a No.
 - (d) His type cannot be identified.
15. Jay, Ajay and Vijay all approach you. Jay asks "Are at least two of us of the type No?" You can infer that
- (a) Jay is a No.
 - (b) Jay is a Yes.
 - (c) None of them is No.
 - (d) Cannot be determined.
16. Abhay, Lokesh, and Rituraj approach you. Abhay asks, "Is it true that neither Lokesh nor Rituraj can be Yes?" You can infer that
- (a) Both Lokesh and Rituraj are Nos.
 - (b) Abhay is a No.
 - (c) Abhay is a Yes.
 - (d) None of the above.

Answer Key

Type 1

- | | | | |
|---------|---------|---------|---------|
| 1. (b) | 2. (a) | 3. (b) | 4. (b) |
| 5. (a) | 6. (b) | 7. (a) | 8. (d) |
| 9. (d) | 10. (c) | 11. (a) | 12. (c) |
| 13. (a) | 14. (a) | 15. (c) | 16. (b) |
| 17. (c) | 18. (d) | 19. (c) | 20. (a) |
| 21. (c) | 22. (a) | 23. (d) | 24. (a) |
| 25. (c) | 26. (c) | 27. (d) | |

Type 2

- | | | | |
|--------|--------|--------|--------|
| 1. (c) | 2. (a) | 3. (d) | 4. (c) |
|--------|--------|--------|--------|

5. (d)	6. (c)	7. (b)	8. (c)
9. (c)	10. (c)	11. (b)	12. (a)
13. (d)	14. (b)	15. (d)	16. (d)
