CHAPTER – 11
CONNECTIVES

There have been some questions coming in entrance exams based on logical statements and logical connectives. A proper understanding of some basics in Logic will make answering such questions very easy. These questions can be answered easily and very quickly on the basis of some of the basics that we will look at in the following sections. Also, please note that these basics are useful not just for questions asked in CAT but are useful for other varieties of questions that you may come across in other entrance exams as well.

In Logic, we deal with statements that are essentially sentences in the English language. However, in Logic we are not interested in or worried about the factual correctness of the sentence. We are interested only in the Logical "truthfulness" of the statements.

For example, consider the statement:

"If the sun rises in the west, then the moon rises in the north."

Here, we are not concerned with whether the sun rises in the east or west or with the direction in which the moon rises. We will only look at whether the moon will rise in the north or not depending on whether the part of the statement "The sun rises in the west" is true or not. If we are given that the sun rises in the west (which, incidentally, is factually incorrect), we can then conclude that the moon rises in the north (which again does not concern with the direction in which the moon actually rises).

We can represent statements in Logic using symbols like p, q, etc, the way we represent variables/unknowns in Algebra using symbols like x, y, z, etc.

Statements like "I will go for a movie", "It is a sunny day", etc are called simple statements. When two or more such simple statements are connected together to form a single statement, such a statement is called a compound statement.

The simple statements are combined using logical connectives to form compound statements. We should know some of the important logical operators/connectives to be able to effectively tackle questions that involve compound statements and logical operations on compound statements.

Negation ("NOT")

Any statement can be negated by using the words "not" or "no." In layman's language, negation is like the opposite of a statement.

For example, the negation of the statement "It is raining" is "It is NOT raining." The negation of the statement "He will pass the exam" is "He will not pass the exam." This is equivalent to saying "He will fail in the exam." So, when you are looking at negating the given statement, you should keep in mind the English equivalents of the statements also.

Having defined simple statements, we shall now study about a few common operators (also called connectives) that can be used to combine (or operate upon) two or more simple statements and arrive at more complicated or compound statements.

Logical Connective OR

Two or more statements can be connected using the connective OR. The following is an example using OR.

It is raining or I will go to my friend's house.

The same statement can also be written as:

Either it is raining or I will go to my friend's house.

Both the statements above mean the same. The additional word "either" does not change the meaning of the statement.

When two (or more) statements are connected using OR, at least one of them is true.

Suppose we have a statement "Either p or q", since at least one of the two statements p, q must be true, we have p alone is true or q alone is true or both are true.

This is the interpretation to be given to an OR statement (irrespective of the meaning of the sentence as per English language).

For example, the statement "Either I will go for a movie or I will go to my friend's house" means

I will go for a movie
     or
I will go to a friend's house
     or
I will go both for a movie and to a friend's house.

Let us take the statement "Either he is dead or he is alive." This statement means

He is alive
   or
He is dead
   or
He is both alive and dead.

In this case, the possibility "He is both alive and dead" does not make sense if we look at the meaning in English language because a person cannot be dead and alive at the same time. However, as discussed earlier, we will not be concerned about the meaning of the statements.

Hence, we will always interpret the statement "(Either) p or q" as "p alone is true or q alone is true or both are true" (unless otherwise explicitly stated that both are not true at the same time). In other words, in a statement "p or q", we can say that at least one of the two statements is true.

Given "p or q", we get four different possibilities that follow:

(i) Given "p or q", we are then told "p is true":

Since we need at least one of the two statements p or q to be true and here we already know that p is true, we cannot conclude anything about q, that is, we cannot conclude whether q is true or false – both possibilities exist.

(ii) Given "p or q", we are then told "q is true":
Since we need at least one of the two statements p or q to be true and here we already know that q is true, we cannot conclude anything about p, that is, we cannot conclude whether p is true or false – both possibilities exist.

(iii) Given "p or q", we are then told "p is NOT true":
Since we need at least one of the two statements p or q to be true and here we already know that p is not true, q **has** to be true so that at least one of the two statements will then be true. So, here we **can** conclude that <u>q is true.</u>

(iv) Given "p or q", we are then told "q is NOT true":
Since we need at least one of the two statements p or q to be true and here we already know that q is not true, p **has** to be true so that at least one of the two statements will then be true. So, here we **can** conclude that <u>p is true.</u>

There is one particular category of questions that has appeared in CAT for three years in a row. These questions are based on the concepts that we looked at in the previous section. We will take two or three examples to understand these questions.

The directions of the questions asked were as follows:

"Each question has a main statement followed by four statements labelled a, b, c and d. Choose the ordered pair of statements where the first statement implies the second, and the two statements are logically consistent with the main statement."

Eg. 1: Either the elephant is big or the lion is cruel.
a. The elephant is big.
b. The elephant is not big.
c. The lion is cruel.
d. The lion is not cruel.

(A) ac   (B) db
(C) bc   (D) ad

Explanation:

The main statement has two simple statements "The elephant is big" and "The lion is cruel" connected by "OR." Let us call these two statements p and q respectively for the purpose of our discussion. Then the main statement can be represented as "p OR q."

First, let us look at each choice and understand the logic discussed above. Once we do that, we will also see how to answer such questions in a much shorter time.

At least one of these two statements has to be true in any ordered pair we look at. As per the discussion we had above, from among the choices, if we have an ordered pair where the first part of the ordered pair in the choice is one of the two statements true, then we cannot conclude anything about the second part of the ordered pair. However, if the first part of the ordered pair in the choice is not true, then the second part should contain the second statement as given in the main statement (that is, the second statement has to be "true").

Take choice (A) for the above question. The first statement is a which says "The elephant is big." This is p (as we denoted above) which is given in the main statement. Since p is true, we cannot conclude whether q is true or not, i.e., q may be true or it may be false. So, we cannot have any statement following A which can be concluded from a and is consistent with the main statement. Hence, this cannot be the answer choice.

Take choice (B). The first statement is d which says "The lion is not cruel." This is the negation of statement q, that is to say, "Not q" is the first of the two statements in the choice. Since q is negated, p must be true (for at least one of the two statements to be true). But the second statement in this choice is "The elephant is not big" which is "Negation p." Hence, this is not the correct choice.

Take choice (C). The first statement is b which is "The elephant is not big," that is, Negation p. Since p is negated, q must be true (for at least one of the two statements to be true). The second statement in the choice is C which is "The lion is cruel," that is, q. Thus, in this choice, we have Negation p followed by q. So, this is the correct answer choice.

Let us also take a look at choice (D). The first statement in this choice is a, which is "The lion is big," that is p is true. Since the first statement is true, we cannot conclude anything about statement q.

Approach in the exam

In an exam, for these types of questions, we do not need to go from the answer choices and check each and every one of them. We can directly identify the correct combinations of statements that will satisfy the directions given.
We know that if the first statement out of the two statements in the choice is either p or q (that is one of the two statements given in the question), then we cannot draw any conclusion.

We also know that if p or q is negated, then the other statement should definitely be true. So, "Negation p followed by q" and "Negation q followed by p" will be correct combination of statements. Hence, we directly check out for NOT p ➜ q or NOT q ➜ p in the answer choices.

In the above example, we should look for bc or da.

Logical Connective AND

Two or more statements can be connected using the connective AND. The following is an example using AND.

It is raining **and** I will go to my friend's house.

The two statements connected by **and** have to be true for the compound statement to be true. In general, if we have a statement "p and q", then we can conclude that p should be true as well as q, that is, both the statements should be true. Even if one of the two statements is false, the compound statement is false.

Negation of compound statements formed with OR, AND

A compound statement formed with OR or AND can be negated in the following manner:
"Negation (p OR q)" is the same as "Negation p AND Negation q."

"Negation (p AND q)" is the same as "Negation p OR Negation q."

As can be seen in the above example, when a compound statement consisting of two simple statements (connected with OR or AND) is negated, the result will consist of each of the individual statements negated. In addition to that, the following will also have to be observed:

OR will become AND

AND will become OR

Logical connective IF-THEN

This is a very important connective. This is represented by p ➔ q (and is read as "p implies q"). This means that if we know that p has occurred, q has to occur or must have occurred. For example, the statement "If it is raining, then I wear a raincoat" means that if we know that it is raining, we can conclude that I must be wearing a raincoat.

The statement "p implies q" is called an implication statement. The term on the left hand side in p ➔ q is called the "antecedent" and the term q is called the "consequent".
Let us look at the following cases when we are given that p ➔ q.

(i)   Given that p ➔ q, we are then told that q has occurred. Can we conclude that p must have occurred?

      We cannot conclude that p must have occurred. This is because while whenever p occurs, q will definitely occur, q may occur even otherwise, that is, even without the occurrence of p. So, both p and Negation p are possible and hence, we cannot conclude anything when we know that q has occurred.

(ii) Given that p ➔ q, we are then told that p has not occurred. Can we conclude that q will also not occur?

      We cannot conclude that q will not occur. This is because while whenever p occurs, q will definitely occur, q may occur even when p does not occur (as discussed above). So, both q and Negation q are possible, and hence we cannot conclude anything when we know that p has not occurred.

(iii) Given that p ➔ q, we are then told that q has not occurred. Can we conclude that p must not have occurred?

      We can conclude that p must not have occurred. This is because had p occurred, q would have occurred. But we know that q has not occurred, so p must not have occurred. So, we can conclude that "Negation p" follows "Negation q."

      So, if we are given that p ➔ q, then "Negation q ➔ Negation p." This is a very important relationship. We can express it in words as

      "In an implication statement, negation of the right hand side will always imply the negation of the left hand side."

We can summarise the above three points as follows:

p ➔ q	Given
q ➔ p q ➔ Negation p	Cannot be concluded Cannot be concluded
Negation p ➔ Negation q Negation p ➔ q	Cannot be concluded Cannot be concluded
Negation q ➔ Negation p	Is always true

In certain CAT papers, there were questions on "if – then" concepts discussed above – questions similar to those on Either – or that we looked at above. Let us take an example and understand these questions. The directions are the same as that we looked at above:

"Each question has a main statement followed by four statements labelled a, b, c and d. Choose the ordered pair of statements where the first statement implies the second, and the two statements are logically consistent with the main statement."

Eg. 2 : If the elephant is big, then the lion is cruel.
    a.   The elephant is big.
    b.   The elephant is not big.
    c.   The lion is cruel.
    d.   The lion is not cruel.

(A) ca   (B) bd
(C) bc   (D) db

Explanation:

The main statement has two simple statements "The elephant is big" and "The lion is cruel" connected by "IF – THEN." Let us call these two statements p and q respectively for the purpose of our discussion. Then the main statement can be represented as "p implies q" or "p➔q".

First, let us look at each choice and understand the logic discussed above. Once we do that, we will also see how to answer such questions in a much shorter time.

Take choice (A). In terms of p and q, this can be represented as q➔p. As per the table above, we know that this cannot be concluded, given p➔q. Hence, this is not the correct answer.

Take choice (B). In terms of p and q, this can be represented as "Negation p ➔ Negation q". Again, as per the table above, we know that this cannot be concluded, given p➔q. Hence, this is not the correct answer.

Take choice (C). In terms of p and q, this can be represented as "Negation p ➔ q", As per the table above, we know that this cannot be concluded, given p➔q. Hence, this is not the correct answer.

Since we eliminated three answer choices, the fourth has to be the correct answer. Let us take choice (D) and look at it. In terms of p and q, it can be represented as "Negation q ➔ Negation p". As per the table above, we know that this can definitely be concluded. Hence, this is the correct answer choice.

Other forms of IF-THEN

There are different types of statements which can be reduced to or represented as p➔q. Let us look at these statements in descriptive form and the representation by using "➔" sign.

Sl.no.	Statement	Representation using ➔	Also equivalent to	Remarks
1.	If p, then q	p ➔ q	Neg. q ➔ Neg. p	Already discussed above
2.	q, if p	p ➔ q	Neg. q ➔ Neg. p	Identical to 1 above
3.	When p, then q Whenever p, then q	p ➔ q	Neg. q ➔ Neg. p	Identical to "if p, then q"
4.	q, when p q, whenever p	p ➔ q	Neg. q ➔ Neg. p	Same as 3 above
5.	Every time p, q	p ➔ q	Neg. q ➔ Neg. p	Same as "If p, then q"
6	q, every time p	p ➔ q	Neg. q ➔ Neg. p	Same as 5 above
7.	q, only if p	q ➔ p	Neg. p ➔ Neg. q	
8.	Unless p, q	Negation p ➔ q	Neg. q ➔ p	
9.	q, unless p	Negation p ➔ q	Neg. q ➔ p	Same as 8 above
10.	p, otherwise q	Negation p ➔ q	Neg. q ➔ p	Same as "Unless p, q"

Another model of questions:

There is one particular model of questions that appeared in the XAT exam in the recent past. These questions are based on the logic that has been discussed above. We will take an example and see how to solve such questions.

Directions: Each question below consists of a main statement followed by four statements. From the choices, select the one that is logically consistent with the main statement.

(Please note that the directions, instead of asking you to find out the choice that is "logically consistent with the main statement", may ask you to find out the choice that is "logically equivalent to the main statement" or "Which of the following statements is true?")

Approach in the exam

In an exam, for these types of questions, we do not need to go from the answer choices and check each and every one of them. We can directly identify the combinations of statements that will satisfy the directions given.
Given that p ➔ q, we know that "Negation q ➔ Negation p". Hence, the two correct combinations are p ➔ q (because this is the given statement itself) and "Negation q ➔Negation p."

So, in the above example, we should look for ac or db. Hence, the correct answer is choice (D).

Eg. 3: If it is raining, then I will go for a movie or I will visit my friend's house.

(A) It is not raining, means that I will not go for a movie or I will not visit my friend's house.
(B) It is not raining, means that I will not go for a movie and I will not visit my friend's house.
(C) I will not go for a movie or I will not visit my friend's house, means that it is not raining.
(D) I will not go for a movie and I will not visit my friend's house, means that it is not raining.

Explanation:

Solving this question involves the application of simple concepts/rules about IF—THEN, OR, AND and NEGATION which we have already looked at.

Let us use symbols like p, q to denote the simple statements in the main statement given and represent the main statement as well as the choices with these symbols connected with logical connectives like OR, NOT and IF.

Let us denote

"It is raining"	by p
"I will go for a movie"	by q
and "I will visit my friend's house"	by r

Then, the main statement will read as
   p ➔ q OR r

The choices can be represented as:

(A) Negation p ➔ Negation q OR Negation r
(B) Negation p ➔ Negation q AND Negation r
(C) Negation q OR Negation r ➔ Negation p
(D) Negation q AND Negation r ➔ Negation p

Let us take the main statement p ➔ q OR r. We know that in any implication statement, the negation of the right hand side will imply the negation of the left hand side. That is, we can write

   Negation (q OR r) ➔ Negation p

We also know that negation of a compound statement formed by two simple statements combined by an OR will be equal to the negation of the two individual statements combined by an AND. By applying this principle to the left hand side of the above statements, we have

   Negation q AND Negation r ➔ Negation p

This, we find is the same as choice (D). Hence, choice (D) is the correct answer.

Exercise – 11(a)

Directions for questions 1 to 20: Each question has a main statement followed by four statements labelled a, b, c and d. Choose the ordered pair of statements where the first statement implies the second, and the two statements are logically consistent with the main statement.

1. Either the mouse is of Logitech make or it is of HP make.
   (a) The mouse is of Logitech make.
   (b) The mouse is not of HP make.
   (c) The mouse is not of Logitech make.
   (d) The mouse is of HP make.
   (A) ab   (B) ba   (C) dc   (D) ad

2. I will buy either a Honda City or a Lancer.
   (a) I have bought a Honda City.
   (b) I have not bought a Lancer.
   (c) I have bought a Lancer.
   (d) I have not bought a Honda City.
   (A) ab and cd   (B) ac alone
   (C) dc alone   (D) ba and dc

3. Either the naxalites are crazy or the police have gone berserk.
   (a) The police have gone berserk.
   (b) The naxalites are not crazy.
   (c) The police have not gone berserk.
   (d) The naxalites are crazy.
   (A) ad and cb   (B) dc and ba
   (C) ab and cd   (D) cd and ba

4. Either the state is reeling under drought or it is affected by a famine.
   (a) The state is reeling under drought.
   (b) The state is affected by famine.
   (c) The state is not reeling under drought.
   (d) The state is not affected by famine.
   (A) cb   (B) da
   (C) ba   (D) Both (A) and (B)

5. Either the pen is big or the pencil is small.
   (a) The pen is big.
   (b) The pen is not big.
   (c) The pencil is small.
   (d) The pencil is not small.
   (A) ac   (B) db   (C) bc   (D) ad

6. Either the program has a bug or the computer has a virus.
   (a) The program does not have a bug.
   (b) The computer has a virus.
   (c) The computer does not have a virus.
   (d) The program has a bug.
   (A) ca alone   (B) cd alone
   (C) dc and ba   (D) cd and ab

7. Either the chair is made of plastic or it is made of wood.
   (a) The chair is made of wood.
   (b) The chair is not made of plastic.
   (c) The chair is not made of wood.
   (d) The chair is made of plastic.
   (A) ba   (B) dc   (C) cb   (D) ad

8. Either the mouse is not working or the keyboard is not working.
   (a) The mouse is not working.
   (b) The keyboard is working.
   (c) The keyboard is not working.
   (d) The mouse is working.
   (A) cd   (B) ba   (C) bd   (D) ac

9. Either the elephant is not big or the lion is cruel.
   (a) The elephant is big.
   (b) The elephant is not big.
   (c) The lion is cruel.
   (d) The lion is not cruel.
   (A) cd   (B) ca   (C) cb   (D) ac

10. Either the elephant is big or the lion is not cruel.
    (a) The elephant is big.
    (b) The elephant is not big.
    (c) The lion is cruel.
    (d) The lion is not cruel.
    (A) ac   (B) ca   (C) cb   (D) ad

11. If the leviathan is big, then the dinosaur is gentle.
    (a) The leviathan is big.
    (b) The leviathan is not big.
    (c) The dinosaur is gentle.
    (d) The dinosaur is not gentle.
    (A) ca   (B) bd   (C) bc   (D) db

12. If the elephant is big, then the lion is cruel.
    (a) The elephant is big.
    (b) The elephant is not big.
    (c) The lion is cruel.
    (d) The lion is not cruel.
    (A) ca   (B) bd   (C) bc   (D) db

13. Whenever the elephant feels hungry, it eats the lion.
    (a) The elephant was not hungry.
    (b) The elephant was hungry.
    (c) The elephant ate the lion.
    (d) The elephant did not eat the lion.
    (A) cb   (B) bd   (C) da   (D) db

14. If the kangaroo walks, then the monkey jumps.
    (a) The kangaroo did not walk.
    (b) The monkey did not jump.
    (c) The kangaroo walked.
    (d) The monkey jumped.
    (A) ca and db   (B) bc and ba
    (C) ac and bd   (D) ba and cd

15. If the zebra is striped, then the tiger is not striped.
    (a) The zebra is not striped.
    (b) The tiger is not striped.
    (c) The zebra is striped.
    (d) The tiger is striped.
    (A) cb and da   (B) ba and cd
    (C) Only cb   (D) Only ba

16. The island is beautiful, if the water is clear.
    (a) The island is not beautiful.
    (b) The water is clear.
    (c) The island is beautiful.
    (d) The water is not clear.
    (A) ca   (B) ad   (C) cb   (D) da

17. The cheetah drinks Coke, only if the bear drinks Pepsi.
    (a) The cheetah drinks Coke.
    (b) The cheetah does not drink Coke.
    (c) The bear does not drink Pepsi.
    (d) The bear drinks Pepsi.
    (A) cd   (B) dc   (C) bc   (D) ad

18. Unless you catch the thief, the robberies will not stop.
    (a) The thief has been caught.
    (b) The robberies have stopped.
    (c) The thief has not been caught.
    (d) The robberies have not stopped.
    (A) cd   (B) ab   (C) bc   (D) da

19. Unless the gangster is arrested, the hostages will be killed.
    (a) The hostages will be killed.
    (b) The gangster is arrested.
    (c) The hostages will not be killed.
    (d) The gangster is not arrested.
    (A) ad   (B) cd   (C) cb   (D) ba

20. The minister is not re-elected, if the Chief Minister is not re-elected.
    (a) The minister is re-elected.
    (b) The minister is not re-elected.
    (c) The Chief Minister is not re-elected.
    (d) The Chief Minister is re-elected.
    (A) ca   (B) bd   (C) bc   (D) ad

Directions for questions 21 to 25: Each question below consists of a main statement followed by four numbered statements. From the numbered statements select the one that logically follows the main statement.

21. If it is a holiday, then I will go to the ground or I will go to the temple.
    (A) It was not a holiday, implies that I did not go to the ground or I did not go to the temple.
    (B) It was a holiday and I did not go to the temple means that I went to the ground.
    (C) I did not go to the ground but I had been to the temple means that it is a holiday.
    (D) None of these.

22. Whenever I purchase a shirt, either it is on offer or I have money to buy it.
    (A) I had money to buy a shirt or it was on offer means I will purchase it.
    (B) I do not have money to buy the shirt and it was not on offer means I did not purchase it.
    (C) I did not purchase a shirt means neither it was on offer nor I had the money to buy it.
    (D) I purchased a shirt and it was on offer implies I did not have money to buy it.

23. If Ravi is an officer or an assistant, then he is eligible for promotion.
    (A) Ravi is an officer implies he is eligible for promotion.
    (B) Ravi is an assistant implies he is eligible for promotion.
    (C) Ravi is not eligible for promotion means he is neither an assistant nor an officer.
    (D) All of the above.

24. Whenever India wins the match, either Sachin scores a ton or Ashwin bowls off-spin.
    (A) Neither Sachin scored a ton nor Ashwin bowled off-spin implies India did not win the match.
    (B) India won the match and Sachin scored a ton means Ashwin did not bowl off-spin.
    (C) India won the match and Sachin did not score a ton means Ashwin bowled off-spin.
    (D) More than one of the above

25. Unless a student gets qualifying marks in the exam, he will neither get the job nor be offered admission.
    (A) A student got qualifying marks means either he got the job or he was offered admission.
    (B) A student got the job or he was admitted means the student got the qualifying marks.
    (C) A student got the job but did not get admitted means the student got the qualifying marks.
    (D) More than one of the above

Directions for questions 26 to 30: Each question below consists of a statement followed by four numbered statements. Select the one that logically negates the main statement.

26. Divya eats sweets, if she is not hungry.
    (A) Divya did not eat sweets, though she was hungry.
    (B) Divya was hungry and she ate sweets.
    (C) Divya did not eat sweets, though she was not hungry.
    (D) Divya ate sweets though she was not hungry.

27. India wins the match, whenever England bats first.
    (A) India won the match and England did not bat first.
    (B) India did not win the match and England did not bat first.
    (C) India did not win the match and England batted first
    (D) India won the match and England batted first.

28. Either the answer is right or the question is wrong.
    (A) The answer was not right and the question was wrong.
    (B) The question was not wrong and the answer was not right.
    (C) The answer was right and the question was not right.
    (D) The question was not wrong and the answer was right.

29. The man goes to the bank, only if he needs money and requires to update passbook.
    (A) The man did not go to the bank means he neither needed money nor required to update passbook.
    (B) The man went to the bank and he neither needed money nor required to update passbook.
    (C) The man needs money and also required to update passbook implies he did not go to the bank.
    (D) The man went to the bank implies he needed money and required to update passbook.

30. The strike will continue, unless there is a hike in wages of the employees.
    (A) The was a hike in wages of the employees but the strike did not continue.
    (B) The strike continued but there was no hike in the wages of the employees.
    (C) There was a hike in the salary of the employees but the strike continued.
    (D) The strike did not continue. Also, there was no hike in the salary of the employees.

Exercise – 11(b)

Directions for questions 1 to 10: Each question below consists of a main statement followed by some numbered statements. From the numbered statements, select the one that logically follows the main statement.

1. If it is a holiday, then I will go for a picnic or I will visit my uncle's house.
    (A) I will not go for a picnic or I will not visit my uncle's house, implies that it is not a holiday.
    (B) If it is not a holiday, then I will not go for a picnic and I will not visit my uncle's house.
    (C) I will not go for a picnic and I will not visit my uncle's house, implies that it is not a holiday.
    (D) If it is not a holiday, then I will not go for a picnic or I will not visit my uncle's house.

2. Whenever my mom scolds me, I either hide behind my dad or complain to my grandma.
    (A) If I complain to my grandma or I hide behind to my dad, then my mom must have scolded me.
    (B) If I did not complain to my grandma and I did not hide behind my dad, then my mom must not have scolded me.
    (C) If my mom does not scold me, I will neither hide behind my dad nor complain to my grandma.
    (D) Both (A) and (B)

3. Whenever it rains, I will either carry an umbrella or wear a raincoat.
    (A) It is not raining, means that I will neither carry an umbrella nor wear a raincoat.
    (B) I am carrying an umbrella or I am wearing a raincoat, implies that it is raining.
    (C) I am not carrying an umbrella or I am not wearing a raincoat, means that it is not raining.
    (D) If it is raining but I am not wearing a raincoat, means that I must be carrying an umbrella.

4. If it is very hot outside, then I will carry an onion with me and I will return home by lunch time.
    (A) I will not carry an onion with me or I will not return home by lunch time, means that it is not very hot outside.
    (B) It is not very hot outside means that I will not carry an onion with me and I will not return home by lunch time.
    (C) I will not carry an onion with me and I will return home by lunch time means that it is very hot outside.
    (D) I will carry an onion with me and I will return home by lunch time means that it is very hot outside.

5. Whenever Arpita's father is in town, she abstains from college and goes to her uncle's house.
    (A) If Arpita has not abstained from college or she has not gone to her uncle's house, it means that her father is not in town.
    (B) If Arpita has not abstained from college but her father is in town, then she will definitely go to her uncle's house.
    (C) If Arpita has abstained from college but she has not gone to her uncle's house, it means that her father is not in town.
    (D) Both (A) and (C) above.

6. If the tea is not hot, then I will not go to school and will not have dinner.
    (A) If I have gone to school or I have not had dinner, then the tea is not hot.
    (B) If I have gone to school and I had dinner, then the tea is hot.
    (C) If I have gone to school and I have not had dinner, then the tea is hot.
    (D) If I have gone to school or I have had dinner, then the tea is hot.

7. If Ramesh leaves his job, then he will join for an MBA course or for an MCA course.
    (A) Ramesh has joined neither an MBA course nor an MCA course, implies that he has not left his job.
    (B) Ramesh has not left his job, implies that he will not join an MBA course or he will not join an MCA course.
    (C) Ramesh has joined an MBA course or an MCA course, implies that he has not left his job.
    (D) Ramesh has not left his job, implies that he will not join an MBA course and he will not join an MCA course.

8. Unless we win the Assembly elections, we will lose the Rajya Sabha elections and the Presidential elections.
    (A) We have won the Assembly elections, it means that we will not lose either the Rajya Sabha elections or the Presidential elections.
    (B) We have not lost the Rajya Sabha elections or we have not lost the Presidential elections, means that we have won the Assembly elections.
    (C) We have not lost the Rajya Sabha elections and not lost the Presidential elections, means that we have won the Assembly elections.
    (D) Both (B) and (C).

9. If it is a Sunday, then on that day, there is no college and I go to Church.
    (A) If there is no college and I do not go to Church, then that day is a Sunday.
    (B) If there is college and I do not go to Church, then that day is not a Sunday.
    (C) If there is college or I do not go to Church, then that day is not a Sunday.
    (D) Both (B) and (C).

10. If it is not raining, then I will not go for a movie but I will visit my friend's house.
    (A) If it is raining, then I will go for a movie but I will not visit my friend's house.
    (B) If it is raining, then I will not go for a movie but I will not visit my friend's house.
    (C) If I go for a movie or I do not visit my friend's house, it means that it is raining.
    (D) If I will not go for a movie and I will visit my friend's house, it means that it is raining.

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11. Harish will get through the interview, if he is thorough with the basics.
   (A) Harish got through the interview, hence he was thorough with the basics.
   (B) Harish is not thorough with the basics, hence he will not get through the interview.
   (C) Harish did not get through the interview means he was not thorough with the basics.
   (D) Although he was not thorough with the basics, still Harish managed to get through the interview.

12. Either Pakistan or China will attack India, only if India supports Russia and the U.S.A.
   (A) Pakistan and China attacked India means India supported Russia and the U.S.A.
   (B) India neither supported Russia nor supported the U.S.A, means that only Pakistan attacked India.
   (C) India supported the U.S.A but not Russia, means that only China attacked India.
   (D) All of the above

13. I will neither talk to you nor play with you, unless you apologize to me.
   (A) I talked with you or played with you, means you apologized to me.
   (B) I did not apologize to you, means you neither talked with me nor played with me.
   (C) You apologized to me, means you neither talked nor played with me.
   (D) Both (A) and (B)

14. Either Rajeev is a genius or he cheated in the exam.
   a. Rajeev cheated in the exam.
   b. Rajeev is a genius.
   c. Rajeev is not a genius.
   d. Rajeev did not cheat in the exam.
   (A) Only ca   (B) Only bd
   (C) cd and ba   (D) db and ca

15. Unless the politican took money, he is not good enough.
   a. The politician is not good enough.
   b. The politician took money.
   c. The politician is good enough.
   d. The politician did not take money.
   (A) Only bc   (B) Only da
   (C) Only ab   (D) cb and da

16. Sravan will go to the movie, if his parents are not with him.
   (A) Sravan did not go to the movie and his parents are with him.
   (B) Sravan's parents are with him and he went to the movie.
   (C) Sravan did not go to the movie and his parents are not with him.
   (D) Sravan went to the movie and his parents are not with him.

17. Ramesh works very hard whenever there is an exam.
   (A) Ramesh worked very hard and there is no exam.
   (B) Ramesh did not work hard and there is no exam.
   (C) Ramesh did not work hard and there is an exam.
   (D) Both (B) and (C)

18. Either it is a Flying Saucer or the person is not telling the truth.
   (A) It is not a Flying Saucer and the person is not telling the truth.
   (B) The person is telling the truth and it is not a Flying Saucer.
   (C) It is a Flying Saucer and the person is telling the truth.
   (D) The person is not telling the truth and It is a Flying Saucer.

19. Sachin scores a century, unless he is paired with the Captain.
   (A) Sachin is paired with the Captain and he did not score a century.
   (B) Sachin scored a century and he is not paired with the Captain.
   (C) Sachin is paired with the Captain and he scored a century.
   (D) Sachin did not score a century and he is not paired with the Captain.

20. Bond will buy the car only if it is the costliest and fastest.
   (A) Bond did not buy the car and it is neither the fastest nor the costliest.
   (B) Bond bought the car and it is not the costliest or it is not the fastest.
   (C) The car is the fastest and costliest, and Bond did not buy it.
   (D) Bond bought the car and it is the fastest and costliest.

21. If the price of a good increases, then its consumption decreases.
   (a) The price of a good increased.
   (b) The price of a good did not increase.
   (c) The consumption of the good decreased.
   (d) The consumption of the good did not decrease.
   (A) cb   (B) ad   (C) ca   (D) db

22. The exam's difficulty level increases only if the number of applicants increases.
   (a) The exam's difficulty level increased.
   (b) The exam's difficulty level did not increase.
   (c) The number of applicants have increased.
   (d) The number of applicants have not increased.
   (A) ca   (B) db
   (C) ac   (D) both (B) and (C)

23. Whenever the hero needs money, he acts in a new movie
(a) The hero needed money
(b) The hero did not need money
(c) The hero acted in a new movie
(d) The hero did not act in a new movie
(A) ac   (B) ad   (C) ca   (D) bd

Directions for questions 24 and 25: Each question below consists of a main statement followed by four numbered statements, From the numbered statements, select the one that logically follows the main statement.

24. The chief guest will come on time, if the fog does not affect the flight timings. Only if the chief guest comes, then the meeting will be started.
The meeting started implies that
(A) The fog did not affect flight timings.
(B) The fog affected the flight timings.
(C) The chief guest did not come.
(D) None of these.

25. Unless coding is done, the software project cannot be completed. If the company does not meet the project completion deadline, the team working on it will be fired.
The team working in the project, is not fired implies
(A) The coding is done
(B) The software project was not completed.
(C) The company did not meet the project completion deadline.
(D) None of these

Directions for questions 26 to 30: Each question below consists of a statement followed by four numbered statements. Select the one that logically negates the main statement.

26. If you plant trees, there would be a decline in air pollution.
(A) You did not plant the trees and there was no decline in air pollution.
(B) You planted the trees and there is a decline in air pollution.

(C) You planted the trees and there is no decline in air pollution.
(D) None of these.

27. The responsibility is higher but it is manageable.
(A) The responsibility was not higher or it was not manageable.
(B) The responsibility was higher or it was not manageable.
(C) The responsibility was not higher or it was manageable.
(D) The responsibility was manageable or it was not higher.

28. Unless Ravi practises the study material, he cannot pass the qualifying exam.
(A) Ravi practised the study material but he did not pass the qualifying exam.
(B) Ravi did not practise the study material but passed in the qualifying exam.
(C) Ravi practised the study material and passed the qualifying exam.
(D) Ravi did not practise the study material and he did not pass the qualifying exam.

29. Meena either reads the novel or watches the movie.
(A) Meena read the novel and she did not watch the movie.
(B) Meena read the novel and she watched the movie.
(C) Meena did not read the novel and she watched the movie.
(D) Meena did not read the novel and she did not watch the movie.

30. Unless a party gets the majority, it cannot form a government.
(A) A party got the majority and did not form the government.
(B) A party did not get the majority but formed the government.
(C) A party got the majority and formed the government.
(D) A party did not get the majority and did not form the government.

Key

Exercise – 11(a)

1. B	6. D	11. D	16. B	21. B	26. D
2. D	7. A	12. D	17. D	22. B	27. C
3. D	8. B	13. C	18. A	23. D	28. B
4. D	9. D	14. D	19. C	24. D	29. B
5. C	10. B	15. A	20. D	25. D	30. D

Exercise – 11(b)

1. C	6. D	11. C	16. C	21. D	26. C
2. B	7. A	12. A	17. C	22. D	27. A
3. D	8. D	13. A	18. B	23. A	28. B
4. A	9. D	14. D	19. D	24. D	29. D
5. D	10. C	15. D	20. B	25. A	30. B