

Logical connectives

Concepts to remember:

Logical connectives

The set of rules to determine the conclusion (implications) and the negations for any logical connective are as follows:

Category	Sample Statements	Conclusion	Negation
A	If X, Y Every time X, Y Whenever X, Y	• $X \Rightarrow Y$ • $Y \Rightarrow X'$	• $X \& Y'$ • $Y' \& X$
B	Either X or Y Unless X, Y	• $X' \Rightarrow Y$ • $Y' \Rightarrow X$	• $X' \& Y'$ • $Y' \& X'$
C	Only if X, Y	• $X' \Rightarrow Y'$ • $Y \Rightarrow X$	• $X' \& Y$ • $Y \& X'$

$$\bullet (A \hat{=} B)' = A' \hat{=} B'$$

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Syllogism

Conclusion from the two given premises can be derived from the given set of rules.

- There should be exactly three terms (in premises and conclusion put together).
- If both the premises are negative, then no conclusion is possible.
- If both the premises are particular, then no conclusion is possible.
- The middle term must be distributed at least once.
- If one of the premises is negative, then the conclusion has to be negative.
- If one of the premises is particular, then the conclusion has to be particular.
- A term that is not distributed in the premises cannot be distributed in the conclusion.

Venn diagram

Questions based on Venn diagrams can be solved by forming and solving simultaneous equations. If there are n variables (without any constraints on the values they can take), in the equations, there should be n equations to solve for the variables.

Drills

- For the following statements, determine the category that they fall into and list out the possible implications.
 - Whenever my father goes on a business trip, I get a gift.
 - Only if Vijay clears all his arrear papers his parents will give him money to start a business.
 - Raja's parents will buy him a bicycle if he gets the first rank.
 - I will buy a car or a house.
- For the following logical connectives, determine the category that they fall into and list out the possible negations.
 - Rajiv will get the first rank or win the dance competition.
 - If it rains, I will play chess.
 - Deepak will get a distinction only if he passes in all his subjects.
- For the following questions, determine the category that they fall into and list out the possible implications.
 - If I get a promotion, my salary will go up or I will get a car.
 - If it rains, there will be water logging of the roads and there will be a traffic jam.
- Find out the conclusion for the following statements (Using either of the two methods)

c.	1. All Heroes are Actors	2. Some Actors are Villains
d.	1. Some students are cricket players	2. Some students are not hockey players
e.	1. Some Angels are good natured	2. All Angels are Gods

- Draw diagrams (circles to represent each set) indicating the relation between them.
 - Men, Doctors and Fathers
 - Actors, Dancers and Singer
 - Cricketers, Batsmen, Bowlers and All-rounders
- In a certain locality in Delhi, there are 1000 families. A survey indicated that 300 subscribe to The Hindustan Times daily and 250 subscribe to The Statesman daily. Of these two categories, 100 subscribe to both. Find the number of families that do not subscribe to any of these newspapers?
- In a school having 120 students, every student plays at least one of the three games cricket, hockey and basketball of which 100 students play cricket, 50 students play hockey and 60 students play basketball. 30 students play both cricket and hockey, 35 play both hockey and basketball and 45 play both basketball and cricket.
 - What is the number of students who play at least two games?
 - What is the number of students who play at most one game?
 - What is the number of students playing all the three game?
 - What is the number of students playing cricket and basketball alone?

Concept review questions

Directions for Questions 1 to 3: Which of the given options (in the given order) logically follows the given statement?

- I get mouth ulcers whenever examinations are around the corner.
 - Examinations are around the corner
 - Examinations are not around the corner
 - I have got mouth ulcers
 - I do not have mouth ulcers

a. CA b. BD c. DB d. BC
- The current Indian Cricket team will be considered as one of the best only if it wins a World Cup.
 - The current Indian cricket team won the World Cup.
 - The current Indian cricket team did not win the World Cup.
 - The current Indian team is not considered to be one of the best.
 - The current Indian team is considered to be one of the best.

a. DA b. BC c. Both a & b d. None of these
- I get fond memories every time I see my childhood photographs.
 - I get fond memories.
 - I saw my childhood photographs.
 - I didn't see my childhood photographs.
 - I didn't have fond memories

a. CD b. DC c. AB d. None of these
- 100 students appeared for two examinations. 60 of them passed the first, 50 of them passed the second and 30 of them passed both. How many students failed in both the exams?

a. 10 b. 15 c. 40 d. 20

Directions for Questions 5 & 6: In each question below there are given two statements followed by two conclusions numbered I and II. You have to take the two given statements to be true even if they seem to be at variance from commonly known facts and then decide which of the given conclusions logically follows from the two given statements. Read both the statements and mark the answer as below:

- a) If only conclusion I follows
b) If only conclusion II follows
c) If both I and II follows
d) If neither I nor II follows

5. Statements

I: All cars are bikes.
II: All bikes are trains.

Conclusions

I: No train is a car.
II: No bike is a car.

6. Statements

I: No chocolate is a toffee.
II: All sweets are toffees.

Conclusions

I: No chocolate is a sweet.
II: Some chocolates are sweets.

Directions for Questions 7 to 9: For the following questions, select the implication that can be derived from the statement given in the question.

7. If there is an earthquake, there will be a massive destruction and a huge loss of lives.
a. An earthquake occurred implies there will be a massive destruction or a huge loss of lives.
b. There was a massive destruction and loss of lives, hence an earthquake should have occurred.
c. If there are no losses of lives, no earthquake had occurred
d. More than one of the above.
8. India will become a super power only if it can stop bribery.
a. India has stopped bribery, hence, it will become a super power.
b. India has not stopped bribery and so will not become a super power.
c. India has become a super power, so, it must have stopped bribery.
d. More than one of the above.
9. If it is monsoon season, there will be heavy wind or rainfall.
a. There was no heavy wind hence, it is not monsoon season.
b. There was no rainfall hence, it is not monsoon season.
c. There was no heavy wind hence, it is monsoon season.
d. As there is neither heavy wind nor rainfall, it is not monsoon season.
10. How many numbers in the first two hundred natural numbers will be divisible by 6 or 8?
a. 50 b. 58 c. 66 d. None of these

Directions for Questions 11 to 14: Choose the alternative in which the third statement can be logically deduced using both the preceding two.

11. (A) Some painters are artists. Some artists are crazy. Some painters are crazy.
(B) Some heroes are villains. All villains are bad. Some heroes are bad.

(C) Some men are humans. Some humans are bad. Some men are bad.
(D) Some teachers are didactic. All didactic persons are boring. Some boring persons are not teachers.

a. B and C b. C and D c. B and D d. B only

12. (A) All young scientists are open - minded. No open - minded men are superstitious. No young people are superstitious.
(B) Some soldiers are famous. Some soldiers are intelligent. Some soldiers are either intelligent or famous.
(C) All men are married. Some men are educated. Some educated are married.
(D) Many books are rocks. Some rocks are clips. Some clips are rocks.

a. A only b. B only c. C only d. D only

13. (A) All sincere people are good-natured.
(B) Some good-natured people are not sincere.
(C) Some sincere people are good-natured.
(D) All sincere people are fat.
(E) All fat people are good-natured.
(F) Some good-natured people are sincere.
a. ACD b. FAC c. BCF d. DEA

14. (A) Some lazy people are not labourers.
(B) No one who is lazy is a labourer.
(C) All labourers are hard working.
(D) Some labourers are not lazy.
(E) No one who is hard working is lazy.
(F) Some lazy persons are labourers.
a. CEB b. BCA c. DFC d. ACB

Directions for Questions 15 and 16: Which of the given options provides the best logical conclusion for the given statements?

15. Statements
I: No war is fair.
II: Some love is fair.
Conclusion
a. No war is expensive b. Some war is expensive
c. All love is war d. Some love is not war
16. Statements
I: Some blogs are books.
II: Some blogs are not mails.
Conclusion
a. Some books are mails b. Some books are not mails
c. All mails are books d. None of the above

Directions for Questions 17 to 20: At a management institute (where students can choose more than one subject), out of 300 students, 55 did not choose any of marketing, finance or systems, 110 choose marketing, 130 choose finance and 140 choose systems. 45 students choose marketing and finance, 50 choose marketing and systems and 60 choose finance and systems.

17. The number of students who choose all three subjects is
a. 20 b. 36 c. 60 d. 55
18. The number of students who choose exactly one subject is
a. 180 b. 65 c. 75 d. 130
19. The number of students who choose at least two subjects is
a. 100 b. 115 c. 56 d. 70
20. The number of students who choose finance and systems only is
a. 32 b. 40 c. 37 d. 45