

1. If A is any statement, then which of the following is not a contradiction?
 - a) $A \wedge \neg A$
 - b) $A \vee F$
 - c) $A \wedge F$
 - d) None of mentioned
2. $\neg (A \vee q) \wedge (A \wedge q)$ is a _____
 - a) Tautology
 - b) Contradiction
 - c) Contingency
 - d) None of the mentioned
3. $(A \vee \neg A) \vee (q \vee T)$ is a _____
 - a) Tautology
 - b) Contradiction
 - c) Contingency
 - d) None of the mentioned
4. $A \wedge \neg(A \vee (A \wedge T))$ is always _____
 - a) True
 - b) False
5. $(A \vee F) \vee (A \vee T)$ is always _____
 - a) True
 - b) False
6. $A \rightarrow (A \vee q)$ is a _____
 - a) Tautology
 - b) Contradiction
 - c) Contingency
 - d) None of the mentioned
7. $\sim A \vee \sim B$ is logically equivalent to?
 - a) $\sim A \rightarrow \sim B$
 - b) $\sim A \wedge \sim B$
 - c) $A \rightarrow \sim B$
 - d) $B \vee A$
8. $\neg (p \leftrightarrow q)$ is logically equivalent to _____
 - a) $p \leftrightarrow \neg q$
 - b) $\neg p \leftrightarrow q$
 - c) $\neg p \leftrightarrow \neg q$
 - d) $\neg q \leftrightarrow \neg p$
9. **What is/are the meaning of a biconditional statement when there are two statements p and q?**
 - A. p if and only if q
 - B. q if and only if p
 - C. Both A and B
 - D. None of the above

10. Prove or disprove that $(p \rightarrow q) \rightarrow r$ and $p \rightarrow (q \rightarrow r)$ are equivalent.
11. Prove that the proposition if it is not hot, then it is hot is equivalent to it is hot.
12. Explain why the negation of Al and Bill are absent is not Al and Bill are present.
13. Determine whether the statements in (a) and (b) are logically equivalent. a. Bob is both a math and computer science major and Ann is a math major, but Ann is not both a math and computer science major. b. It is not the case that both Bob and Ann are both math and computer science majors, but it is the case that Ann is a math major and Bob is both a math and computer science major.
14. Give some example of law of double negation.
15. Write negations for each of the following statements: a. If my car is in the repair shop, then I cannot get to class. b. If Sara lives in Athens, then she lives in Greece.
16. Give the converse, the contrapositive, and the inverse of these conditional statements.

If it rains today, then I will drive to work. b) If $|x| = x$, then $x \geq 0$.

If n is greater than 3, then n^2 is greater than 9.

Write the converse of its inverse, the converse of its converse, and the converse of its contrapositive and inverse of its inverse, the inverse of its converse, and the inverse of its contrapositive.

17. Are these system specifications consistent? "The router can send packets to the edge system only if it supports the new address space. For the router to support the new address space it is necessary that the latest software release be installed. The router can send packets to the edge system if the latest software release is installed. The router does not support the new address space."

write the negation of the following statement. (Don't translate like It is not true that .)

18. It is Thursday and it is cold.
19. I will go to the play or read a book, but not both.
20. If it is rainy, then we go to the movies.
21. Explain why the negation of Al and Bill are absent is not Al and Bill are present.
22. Using c for it is cold and d for it is dry, write It is neither cold nor dry in symbols.
23. Using c for it is cold and r for it is rainy, write It is rainy if it is not cold in symbols.
24. Using c for it is cold and w for it is windy, write To be windy it is necessary that it be cold in symbols.
25. Using c for it is cold, r for it is rainy, and w for it is windy, write It is rainy only if it is windy and cold in symbols.
50. Express $r \vee d$ in English, where r is it is rainy and d is it is dry.
26. On the island of knights and knaves you encounter two people, A and B. Person A says B is a knave. Person B says We are both knights. Determine whether each person is a knight or a knave.
27. On the island of knights and knaves you encounter two people, A and B. Person A says B is a knave. Person B says At least one of us is a knight. Determine whether each person is a knight or a knave.