

Scientific Foundations of Logic

Logic · Practice Test · 25 Questions

1. Which law of classical logic states that for any proposition, either that proposition is true or its negation is true?

- A) Law of Identity
- B) Law of Non-Contradiction
- C) Law of Excluded Middle
- D) Law of Sufficient Reason

2. In propositional logic, what is the result of a 'conjunction' (AND) operation if both inputs are false?

- A) True
- B) False
- C) Null
- D) Undefined

3. Who is credited with developing the first formal system of deductive reasoning known as the syllogism?

- A) Aristotle
- B) Plato
- C) Euclid
- D) Pythagoras

4. What term describes a logical argument where the conclusion necessarily follows from the premises?

- A) Inductive
- B) Abductive
- C) Valid
- D) Heuristic

5. In Boolean algebra, which logical operator is equivalent to the 'NOR' gate if followed by a 'NOT' gate?

- A) AND
- B) OR
- C) XOR
- D) NAND

6. Which 19th-century mathematician introduced the binary system as the foundation for modern logical algebra?

- A) Alan Turing
- B) George Boole
- C) Charles Babbage
- D) Ada Lovelace

7. What is the name of the logical fallacy that assumes a conclusion is true simply because it has not been proven false?

- A) Ad Hominem
- B) Argumentum ad Ignorantiam
- C) Post Hoc Ergo Propter Hoc
- D) Straw Man

8. In predicate logic, what symbol represents the 'universal quantifier'?

- A) ?
- B) ?
- C) ?
- D) ?

9. Which theorem by Kurt Gödel proves that any consistent formal system capable of arithmetic contains unprovable statements?

- A) Incompleteness Theorem
- B) Completeness Theorem
- C) Compactness Theorem
- D) Fixed-point Theorem

10. What type of logic allows for truth values between 0 and 1, representing degrees of truth?

- A) Binary Logic
- B) Fuzzy Logic
- C) Propositional Logic
- D) Predicate Logic

11. Which logical connective produces a true value only if both input values are identical?

- A) XNOR
- B) XOR
- C) NAND
- D) NOR

12. In formal logic, what is the inverse of the implication 'If P, then Q'?

- A) If Q, then P
- B) If not P, then not Q
- C) If not Q, then not P
- D) P if and only if Q

13. Which logical principle asserts that 'A is A'?

- A) Law of Identity
- B) Law of Non-Contradiction
- C) Law of Excluded Middle
- D) Double Negation

14. What is the logical equivalent of 'P OR Q' in terms of implication?

- A) If P, then Q
- B) If not P, then Q
- C) If Q, then P
- D) If P, then not Q

15. Which logical operator returns true only if the inputs are different?

- A) AND
- B) OR
- C) XOR
- D) NAND

16. In a truth table for 'If P, then Q', what is the result when P is false and Q is true?

- A) True
- B) False
- C) Indeterminate
- D) Contradictory

17. Which mathematician and logician is known for his work on the 'Principia Mathematica'?

- A) Bertrand Russell
- B) Gottlob Frege
- C) David Hilbert
- D) Alfred Tarski

18. What does the logical term 'tautology' refer to?

- A) A statement that is always false
- B) A statement that is always true
- C) A circular argument
- D) A premise based on opinion

19. In classical logic, what is the 'Law of Non-Contradiction' formally defined as?

- A) Not (P and Not P)
- B) P or Not P
- C) If P, then P
- D) P equals P

20. What is the primary difference between deductive and inductive reasoning?

- A) Deduction moves from specific to general
- B) Induction moves from general to specific
- C) Deduction guarantees truth if premises are true
- D) Induction guarantees truth if premises are true

21. Which branch of logic deals with the properties of sets and their memberships?

- A) Propositional Logic
- B) Set Theory
- C) Modal Logic
- D) Temporal Logic

22. In modal logic, what does the 'diamond' symbol ($\Diamond$) typically represent?

- A) Necessity
- B) Possibility
- C) Obligation
- D) Permission

23. What is a 'contingent' proposition in logic?

- A) A statement that is always true
- B) A statement that is always false
- C) A statement that can be true or false depending on the situation
- D) A statement that is self-contradictory

24. Which logician developed the concept of the 'Turing Machine' to model algorithmic computation?

- A) Alan Turing
- B) John von Neumann
- C) Claude Shannon
- D) Kurt Gödel

25. What is the logical negation of the statement 'All cats are mammals'?

- A) No cats are mammals
- B) Some cats are not mammals
- C) All mammals are cats
- D) Some mammals are not cats