

## DPP 02

## Data Science &amp; Artificial Intelligence

## Artificial Intelligence

## Searching Algorithm

- Q1** What is adversarial search primarily used for?
- (A) Optimizing database queries
  - (B) Solving puzzles like Sudoku
  - (C) Games involving two or more players
  - (D) Pathfinding in robotics
- Q2** Which of the following is an example of a deterministic adversarial game?
- (A) Poker
  - (B) Chess
  - (C) Backgammon
  - (D) Scrabble
- Q3** What is the primary objective of the Minimax algorithm in game theory?
- (A) To minimize the player's maximum possible loss
  - (B) To maximize the player's minimum possible gain
  - (C) To find the shortest path to victory
  - (D) Both A and B
- Q4** Which logic is commonly used in AI for knowledge representation and reasoning?
- (A) Fuzzy logic
  - (B) Propositional logic
  - (C) Quantum logic
  - (D) Syllogistic logic
- Q5** In propositional calculus, what does the logical connective " $\wedge$ " represent?
- (A) OR
  - (B) AND
  - (C) NOT
  - (D) IF
- Q6** What distinguishes predicate calculus from propositional calculus?
- (A) Use of symbols like AND, OR, NOT
  - (B) Ability to express relations among variables
  - (C) Usage in computer programming
  - (D) Dependency on truth values
- Q7** First-order logic is a form of predicate logic where:
- (A) There are no quantifiers
  - (B) Only universal quantifiers are used
  - (C) Quantifiers can be applied to variables, not predicates
  - (D) Quantifiers can be applied to predicates
- Q8** Modal logic extends classical logic by including:
- (A) Fuzzy values
  - (B) Probability distributions
  - (C) Modalities like necessity and possibility
  - (D) Temporal sequences
- Q9** In a truth table, the statement  $P \rightarrow Q$  is false when:
- (A) P is true and Q is true
  - (B) P is false and Q is true
  - (C) P is true and Q is false
  - (D) Both P and Q are false
- Q10** In adversarial search, the heuristic evaluation function is primarily used to:
- (A) Determine the exact outcome of the game.
  - (B) Estimate the desirability of a game state.



- (C) Reduce the number of players in the game.  
(D) Calculate the exact number of possible moves.
- Q11** What problem does the alpha-beta pruning technique address in the minimax algorithm?  
(A) Reducing the search space  
(B) Solving two-player games  
(C) Improving the heuristic function  
(D) Creating game trees
- Q12** Which of the following is NOT a valid rule of inference in propositional calculus?  
(A) Modus ponens  
(B) Modus tollens  
(C) Hypothetical syllogism  
(D) Circular reasoning
- Q13** In predicate calculus, what does the universal quantifier ( $\forall$ ) signify?  
(A) At least one                      (B) Exactly one  
(C) All                                      (D) None
- Q14** Which of these is a characteristic of first-order logic?  
(A) It allows quantification over individuals but not over predicates or functions.  
(B) It does not support the use of functions.  
(C) It only allows existential quantifiers.  
(D) It is less expressive than propositional logic.
- Q15** In modal logic, the "necessity" operator is represented by:  
(A)  $\diamond$                                       (B)  $\square$   
(C)  $\vee$                                       (D)  $\wedge$
- Q16** In a truth table, the expression NOT (P AND Q) is equivalent to:  
(A) NOT P AND NOT Q  
(B) NOT P OR NOT Q  
(C) P OR Q  
(D) P AND Q
- Q17** In a zero-sum game framework commonly used in adversarial search, the sum of the gains and losses of all players is:  
(A) Always positive  
(B) Always negative  
(C) Always zero  
(D) Variable
- Q18** In the context of the Minimax algorithm, what is a 'terminal state'?  
(A) A state where the game ends with a win, loss, or draw  
(B) The initial state of the game  
(C) Any state where a player has to make a decision  
(D) The state with the highest utility for the first player
- Q19** What does the existential quantifier ( $\exists$ ) in predicate calculus indicate?  
(A) All elements satisfy the predicate  
(B) No elements satisfy the predicate  
(C) At least one element satisfies the predicate  
(D) Exactly one element satisfies the predicate
- Q20** Which of the following best defines 'first-order logic'?  
(A) A system of logic that allows quantifiers over individuals and predicates  
(B) A logic system that only permits first-order predicates  
(C) A logic where each sentence is evaluated in isolation  
(D) A form of logic where quantification is only over individuals, not predicates or functions
- Q21** Which of the following is true about modal logic?  
(A) It is less expressive than propositional logic



- (B) It deals with the concepts of necessity and possibility
- (C) It does not allow for truth-functional operators
- (D) It is mainly used for numerical calculations

**Q22** Which of the following statements is true for the logical OR ( $\vee$ ) operation in truth tables?

- (A) True  $\vee$  True = False
- (B) False  $\vee$  True = False
- (C) True  $\vee$  False = True
- (D) False  $\vee$  False = True

**Q23** In adversarial search, the "horizon effect" refers to:

- (A) The limit of a player's ability to predict future moves
- (B) The point where two players agree to a draw
- (C) The maximum depth of the search tree
- (D) A situation where long-term strategy is prioritized over immediate gains

**Q24** In the Minimax algorithm, "pruning" is used to:

- (A) Increase the branching factor
- (B) Reduce the search space and improve efficiency
- (C) Guarantee a win for the first player
- (D) Simplify the game rules



## Answer Key

Q1 (C)

Q2 (B)

Q3 (D)

Q4 (B)

Q5 (B)

Q6 (B)

Q7 (C)

Q8 (C)

Q9 (C)

Q10 (B)

Q11 (A)

Q12 (D)

Q13 (C)

Q14 (A)

Q15 (B)

Q16 (B)

Q17 (C)

Q18 (A)

Q19 (C)

Q20 (D)

Q21 (B)

Q22 (C)

Q23 (A)

Q24 (B)



# Hints & Solutions

## Q1 Text Solution:

Adversarial search is typically used in scenarios like chess or Go, where players compete against each other.

## Q2 Text Solution:

Chess is deterministic because all information is available and there is no element of chance.

## Q3 Text Solution:

Minimax aims to minimize the maximum possible loss while maximizing the minimum gain.

## Q4 Text Solution:

Propositional logic, with its structure and semantics, is often used in AI for constructing rational agents.

## Q5 Text Solution:

The " $\wedge$ " symbol is used to denote logical AND.

## Q6 Text Solution:

Predicate calculus extends propositional calculus by handling predicates and quantifiers.

## Q7 Text Solution:

First-order logic allows quantifiers like  $\forall$  (for all) and  $\exists$  (there exists) to be applied to variables.

## Q8 Text Solution:

Modal logic introduces modal operators to express modalities like possibility ( $\diamond$ ) and necessity ( $\Box$ ).

## Q9 Text Solution:

$P \rightarrow Q$  (P implies Q) is only false when P is true and Q is false.

For more questions, you may want to create them progressively, focusing on each topic separately, or consult resources dedicated to AI, logic, and algorithm design

## Q10 Text Solution:

Heuristic evaluation functions provide an estimate of the strategic value of a game position.

## Q11 Text Solution:

Alpha-beta pruning reduces the number of nodes evaluated in the game tree, optimizing the minimax algorithm.

## Q12 Text Solution:

Circular reasoning is a logical fallacy, not a valid rule of inference.

## Q13 Text Solution:

The universal quantifier ( $\forall$ ) is used to express that a predicate holds for all elements of a domain.

## Q14 Text Solution:

First-order logic includes quantification over individuals and the use of predicates and functions, but not quantification over predicates or functions.

## Q15 Text Solution:

The necessity operator ( $\Box$ ) in modal logic indicates that a proposition is necessarily true.

## Q16 Text Solution:



By De Morgan's laws,  $\text{NOT } (P \text{ AND } Q)$  is equivalent to  $\text{NOT } P \text{ OR NOT } Q$ .

**Q17 Text Solution:**

In a zero-sum game, one player's gain is exactly balanced by the losses of the other players.

**Q18 Text Solution:**

Terminal states are the end states of the game, where the outcome is determined.

**Q19 Text Solution:**

The existential quantifier ( $\exists$ ) indicates that there is at least one element in the domain for which the predicate is true.

**Q20 Text Solution:**

First-order logic extends propositional logic by including quantification over individuals (but not over predicates or functions) and the use of predicates.

**Q21 Text Solution:**

Modal logic extends the capabilities of classical logic by introducing modalities such as necessity and possibility.

**Q22 Text Solution:**

In a logical OR operation, the result is true if at least one of the operands is true.

**Q23 Text Solution:**

The horizon effect is a limitation in adversarial search algorithms where the ability to foresee future moves is constrained by the search depth.

**Q24 Text Solution:**

Pruning, especially alpha-beta pruning, is used in the Minimax algorithm to eliminate branches that need not be explored, thus improving the algorithm's efficiency.



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