# Multiple-Choice Questions

1. What is the primary goal of the Minimax algorithm in adversarial search?

A) To maximize the utility for one player while minimizing the utility for the other.

B) To eliminate all opponent's pieces from the game board.

C) To reduce the search space and improve execution speed.

D) To predict the next move of the opponent with absolute certainty.

\*\*Answer: A) To maximize the utility for one player while minimizing the utility for the other.\*\*

2. In the context of artificial intelligence, what does the heuristic function \( h(n) \) represent in informed search strategies?

A) The exact cost to reach the goal state from node \( n \).

B) The estimated cost of the cheapest path from node \( n \) to a goal node.

C) The total number of nodes expanded during the search.

D) The maximum depth of the search space.

\*\*Answer: B) The estimated cost of the cheapest path from node \( n \) to a goal node.\*\*

3. Which of the following is NOT a feature of the A\* search algorithm?

A) Combining heuristic and actual costs to determine the path.

B) Guaranteeing the shortest path in every scenario.

C) Utilizing both forward cost and backward cost in its evaluation.

D) Keeping all nodes in memory to ensure optimality.

\*\*Answer: B) Guaranteeing the shortest path in every scenario.\*\*

# True/False Questions

4. True or False: Alpha-beta pruning can potentially examine fewer nodes than the Minimax algorithm without affecting the final result.

\*\*Answer: True.\*\*

\*\*Explanation: Alpha-beta pruning is designed to eliminate branches that cannot possibly affect the final decision, thus reducing the number of nodes evaluated compared to Minimax.\*\*

5. True or False: The Greedy Best-First Search algorithm is optimal and always finds the shortest path to the goal.

\*\*Answer: False.\*\*

\*\*Explanation: While Greedy Best-First Search is efficient in reaching a solution, it does not guarantee that the path found is the shortest possible, as it can be misled by its heuristic.\*\*

6. True or False: The A\* search algorithm is complete and optimal as long as the heuristic function is admissible.

\*\*Answer: True.\*\*

\*\*Explanation: The A\* search algorithm is both complete and optimal under the condition that the heuristic function used does not overestimate the cost to reach the nearest goal state (admissibility).\*\*

7. True or False: In adversarial search, the utility function only evaluates the terminal states of the game.

\*\*Answer: True.\*\*

\*\*Explanation: In adversarial games like chess or checkers, the utility function is typically applied at terminal states to determine the outcome of the game (win, loss, draw).\*\*

8. True or False: Genetic Algorithms utilize mutation and crossover operations to evolve solutions from one generation to the next.

\*\*Answer: True.\*\*

\*\*Explanation: Genetic Algorithms mimic natural evolutionary processes, using crossover to combine parent solutions and mutation to introduce variations, thereby generating new candidate solutions.\*\*

# Short Answer Questions

9. Describe the principle of how Alpha-beta pruning optimizes the search process in adversarial games.

\*\*Answer: Alpha-beta pruning reduces the number of nodes evaluated in the game tree by eliminating branches that cannot influence the final decision. It uses two parameters, alpha and beta, to keep track of the minimum score that the maximizing player is assured of and the maximum score that the minimizing player is assured against, respectively. If it is determined that a move cannot improve the outcome compared to previously examined moves, further exploration of that move's consequences is stopped early.\*\*

10. Explain how a heuristic function affects the performance of the Best-First Search algorithm.

\*\*Answer: The heuristic function in Best-First Search algorithms helps prioritize nodes for expansion based on their estimated cost from the node to the goal. This heuristic guides the search towards the goal more directly than uninformed search strategies. The effectiveness and efficiency of the search are highly dependent on the accuracy of this heuristic function; a better heuristic leads to faster and more efficient goal-reaching.\*\*