**Assignment No: 5**

**Problem Statement:**

Implement the Minimax Algorithm for game playing.

**Theory:**

The Minimax Algorithm is a recursive approach utilized for decision-making in turn-based, two-player games such as tic-tac-toe, chess, or checkers. The primary objective of this algorithm is to maximize the score for one player while minimizing it for the opponent, assuming both players play optimally.

* Minimax Decision: The player aims to maximize their minimum guaranteed score.
* Game Tree: A structured representation of possible moves where each node signifies a game state, and edges illustrate actions that lead to subsequent states.

**Methodology:**

1. Game Representation:
   * Model the game state as a tree encompassing all possible moves.
   * Each node corresponds to the current configuration of the game, while each edge represents a potential move.
2. Minimax Function:
   * Recursively assess the game tree. At every step:
     + Maximizing Player: Selects the move that yields the highest score.
     + Minimizing Player: Chooses the move that results in the lowest score.
3. Game Evaluation:
   * Assign scores to terminal states (e.g., win, draw, or loss).
   * The algorithm examines all possible game outcomes to identify the best move.
4. Alpha-Beta Pruning (Optional):
   * Eliminate branches of the game tree that do not influence the final decision, thereby reducing the number of nodes that need evaluation.
5. Applications:
   * Tic-Tac-Toe: The algorithm guarantees that the game will either end in a win or a draw for the maximizing player.
   * Chess or Checkers: While Minimax can be applied, more advanced algorithms are typically used in practice due to the increased complexity of these games.

**Conclusion:**

We successfully implemented the Minimax algorithm for game playing, enabling the computer to make optimal decisions by evaluating all possible moves.

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