# Lab 8 Task - Minimax Algorithm

Subject: Artificial Intelligence

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## 🡪 Task 1: Minimax Algorithm (Explanation)

The Minimax Algorithm is one of the most important concepts in Artificial Intelligence, mainly used in decision-making and game theory. It helps the computer make the best possible move assuming that the opponent also plays optimally. The algorithm works on the idea of minimizing the possible loss while maximizing the potential gain.

## 🡪 How It Works:

1. The algorithm uses a tree structure to represent all possible moves.  
2. Each node in the tree represents a game state, and the leaf nodes contain the final scores or outcomes.  
3. The algorithm moves recursively through the tree — one player tries to maximize the score (maximizing), while the other tries to minimize it (Minimizer).  
4. When the target depth is reached, the algorithm returns the value of that state.  
5. While moving back up the tree, the maximizing player picks the highest value, and the minimizing player picks the lowest value.  
6. This continues until the root node is reached, giving the optimal value or best possible decision.

## 🡪 Key Components:

- Maximizing Player: Tries to get the highest possible value.  
- Minimizing Player: Tries to reduce the opponent’s advantage by choosing the lowest possible value.  
- Depth: Represents how many levels deep the algorithm explores in the decision tree.  
- Scores: The final results or payoffs of different possible game outcomes.

## 🡪 Example Use Case:

A common example of the Minimax Algoithm is in games like Tic-Tac-Toe, Chess, or Checkers. For instance, in Tic-Tac-Toe, the algorithm looks ahead at all possible future moves to determine the best move that guarantes at least a draw or a win for the player using the algorithm .

🡪 Advantages :

- Ensures optimal decisions if both players play perfectly.  
- Can handle complex muti-level decision-making scenarios.  
- Forms the basis for many advanced AI algorithms like Alpha-Beta Pruning.

## 🡪 Conclusion:

In summary, the Minimax Algorithm is a core concept in Artificial Intelligence that allows systems to make logical and strategic decisions. It simulates human-like thinking by considering both its own moves and those of the opponent, leading to more intelligent and optimal gameplay.