

AI Lab 10

Section A

Connect Four Game Overview:

Connect Four is a two-player connection game in which the players first choose a color and then take turns dropping one of their colored discs from the top into a vertically suspended grid. The pieces fall straight down, occupying the lowest available space within the column. The object of the game is to connect four of one's own discs of the same color vertically, horizontally, or diagonally before the opponent.

Problem Statement:

You have to implementing an AI player for the Connect Four game. The AI should use the minimax algorithm with alpha-beta pruning to make intelligent decisions. Additionally, you need to consider challenges related to dynamic board sizes, allowing for flexibility in the size of the Connect Four grid.

Implementation Steps:

1. Game Representation:

- Define a data structure to represent the Connect Four game board. Consider using a 2D array to represent the grid.

2. Player Moves:

- Implement functions for player moves, such as dropping a disc into a specific column. Ensure that the functions validate whether a move is valid.

3. Game State Evaluation:

- Develop a heuristic function that evaluates the desirability of a game state. The function should assign scores to different states, with higher scores indicating more favorable positions.

4. Minimax Algorithm:

- Implement the minimax algorithm to traverse the game tree and determine the best move for the AI player. Use

recursion to explore possible moves and apply the heuristic function to evaluate each game state.

5. Alpha-Beta Pruning:

- Enhance the minimax algorithm with alpha-beta pruning to improve its efficiency. Implement alpha-beta pruning to eliminate unnecessary branches in the game tree.

6. Dynamic Board Sizes:

- Allow for dynamic board sizes by parameterizing the dimensions of the Connect Four grid. This allows players to choose different sizes for the game.

7. User Interface (Optional):

- Develop a simple user interface to facilitate human-computer interaction. This can be a console-based interface where players input moves or a graphical interface for a more engaging experience.

8. Testing and Optimization:

- Test the AI player with various board sizes and scenarios. Optimize the algorithm's performance by tweaking parameters and ensuring it makes intelligent decisions in a reasonable amount of time.