Project 1 Connect M Computer Game

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Project Description

This project creates a console-based game of Connect M. The computer uses a minimax algorithm with alpha-beta pruning to make decisions on it's next move against the user. The first to reach M number of tokens in a row wins.

Agent Model & Agent Environment

The agent model used in this project for the computers decision making process is a minimax algorithm with alpha-beta pruning. The agent uses this to simulate potential future moves before deciding on the best one to make based on the scores given for each position. The environment for the agent is a typical grid-based gameboard that is commonly used for a game such as Connect M. The user and computer take turns and the board is updated to show their input for each turn. On each turn the user places an X in the lowest available position for the given column and for the computer it is an O.

Data Structures

There are two main data structures used in this project, vectors and 2D dynamic arrays. Both the weight map and the gameboard make use of a 2D dynamic array for there respective implementations. Vectors in this program are used to temporarily store sequences from rows, columns, or diagonals when checking for consecutive tokens.

Alpha-Beta Pruning

The alpha-beta pruning takes the best maximizer (alpha) and best minimizer (beta) obtained by the minimax algorithm and uses them to test for a better outcome. If the current branch has already reached the best possible outcome, that branch will then be pruned. This then reduces the number of nodes needed to be evaluated, therefore speeding up decision-making.

Heuristic Evaluation Function

The heuristic evaluation function provides a score for each position on the game board based on how favorable of a position it is for the computer. In the case of a win or a loss, the function returns a high score if the computer wins or a low score if the user wins. Otherwise, the weights of each cell that the computer occupies are added together and the same is done for the cells occupied by the user. After that, the user's total weight is subtracted from the computers total weight to decide which board state is more favorable.