Max Hoac
CS 4200.E01

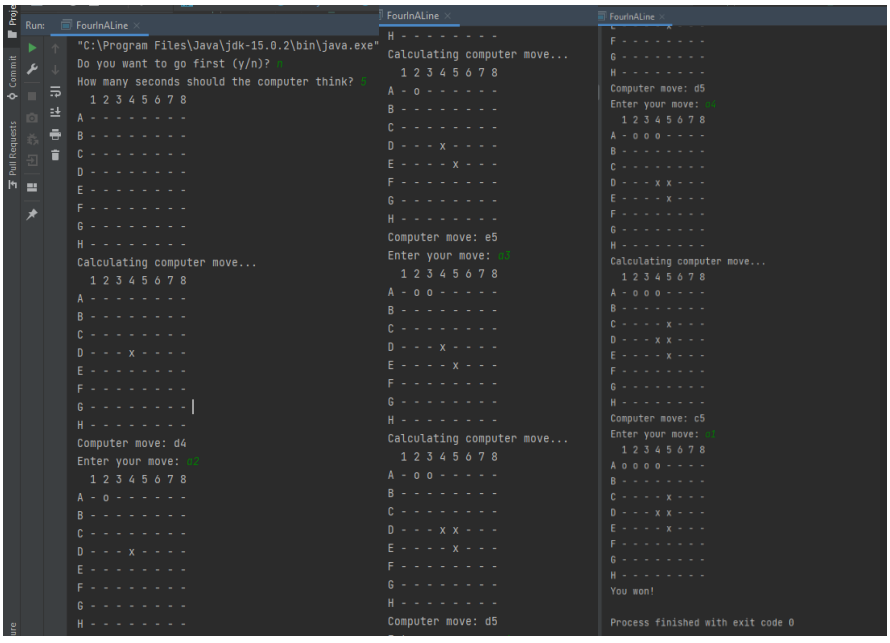
CS 4200 Project 3 Report

Goal: The primary goal of this project is to create a 4-in-a-line game where the user can compete against a computer to achieve a win. The possible ways of winning are to either succeed in getting 4 pieces in a row vertically or horizontally, diagonal wins are not counted. For the computer's decision-making process, it will utilize alpha-beta pruning.

Approach: For my implementation of the evaluation function, if it is first player, or X's turn then the temporary evaluation score will be set to being positive, whereas if it is O's turn the temporary evaluation score will be set to being negative. Otherwise, the temporary score is set to 0. The function will then search through the board and count the number of empty spaces and compare that to the number of X's and O's. If the number of empty spaces is less than the number of both number of taken spaces, the evaluation score will be doubled. In terms of adding the cut-off test, it is added as an additional condition in the alpha-beta pruning algorithm where if the current run time exceeds the maximum runtime or the depth has become 0, the algorithm will return the best evaluated value or best solution available. For the actual alpha-beta pruning implementation, the function will initially fill the board with empty spaces aside from the spaces that are already taken by either an X or an O. Regardless of whose turn it is, the function will calculate the scores of the empty spaces and when it is not the max player's turn the highest score or alpha will be returned. Likewise, when it is the max player's turn, the lowest score or beta will be returned. In terms of how the game is executed, it will initially ask the user if they would like to go first as well as determining the total time, they would like the computer to think about their turn. Upon receiving these two inputs, the game will actually start where the user and the computer will interchange moves until either one wins the game or all the spaces on the board have been filled.

Analysis:

User-win Full Playthrough



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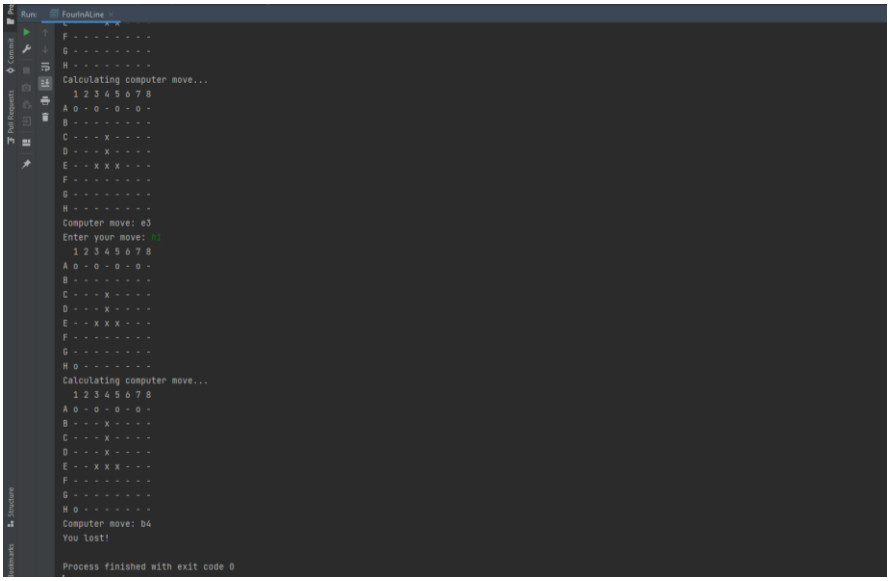
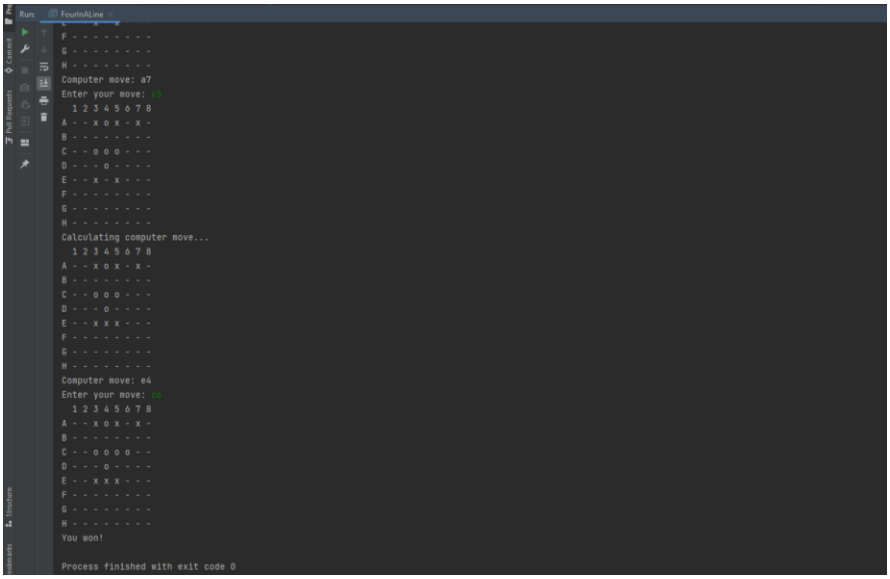
Computer-win Playthrough



User-win, Computer with 1 second to think



Based on several playthroughs, it was fairly easy for the user to win since the computer usually lost a turn in placing one of their pieces apart from their first pieces' placement. Additionally, when adjusting the amount of time allowed for the computer to think, I noticed that when the time allowed is lowered, the computer had the tendency to place their piece relatively close to previous player's move.