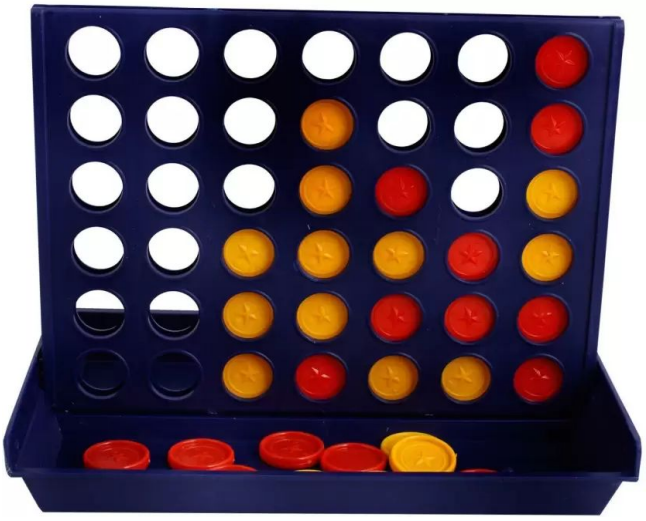
CSE-404: Task-3 (Group: A1+A2)

Two Player Game: 4 in a Row using Alpha-Beta Pruning



Before going into the details of the assignment please look at the rules here: https://www.yucata.de/en/Rules/Four

And definitely play the game here: https://www.mathsisfun.com/games/connect4.html

You have to implement this game using the Alpha-beta pruning algorithm.

Pseudocode for Alpha-Beta Pruning

```
/**
returns the move/action of the agent from current state
*/
function ALPHA-BETA-SEARCH(state, depth)
       v <- MAX-VALUE(state, depth, -Inf, +Inf)
       return the move which results in value v

function MAX-VALUE(state, alpha, beta, depth) returns a utility value
              if state is terminal return Utility(state)
              if depth == 0 return Evaluate(state)
              v = -Inf
              for each possible action a possible from state do
                     v = Max(v, MIN-VALUE(RESULTS(state,a),alpha, beta, depth-1))
                     if v >= beta return v
                     alpha = MAX(alpha, v)
              return v

function MIN-VALUE(state, alpha, beta, depth) returns a utility value
              if state is terminal return Utility(state)
              if depth == 0 return Evaluate(state)
              v = +Inf
              for each possible action a possible from state do
                     v = MIN(v, MAX-VALUE(RESULTS(state,a),alpha, beta, depth-1))
                     if v <= alpha return v
                     beta = MIN(beta, v)
              return v
```

The Task

1. After playing the game online, hope that now you have a better understanding of the game. Implement the **4 in a Row** game using Alpha-beta pruning and all necessary functionalities based on the game rules. Use standard board size. Your implementation should have the following code separations:

Agent	A generic class capable of storing the name and role of a playing agent.
HumanAgent	A class that inherits the Agent. Implementation of the human move method should be coded here.
AlphaBetaAgent	A class that inherits the Agent. Implementation of the AI Agent move method (based on alpha-beta pruning's decision) should be coded here.
Board	A class that stores the state of the board and has necessary utilities.
Game	A generic class that initiates and conducts the game.
FourInRow	A class that inherits the Game class. This has the method play() which conducts the **FourInRow** game.
Driver	This is the driver class that holds the main function and drives the program.

2. **Bonus - 1:** Write an evaluate function for the AI agent that truncates the search before reaching to the final state and returns a utility value from that state. Otherwise your AI agent may take ages to make a move.
3. **Bonus - 2:** Who doesn't want to visualize playing the game? For UI design, you will be rewarded with bonus marks.