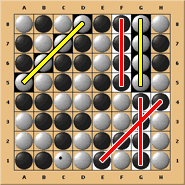
CS480/580 Introduction to Artificial Intelligence

## Assignment 4

Total Points: 100

Due date: 11/17/2020

1. The Freedom game



“Freedom is a two-player abstract strategy board game invented by Veljko Cirovic and Nebojsa Sankovic in 2010. It is played with black and white stones on a square board. The game is related to Go-Moku and Slimetrail. It can be played with a Go set or with pen and paper.

Rules:

Board: Freedom is played on a 10×10 square board. Beginners can try the game on a 8×8 board. Other board sizes may be also used.

Objective: The objective of Freedom is to have more "live" stones at the end of the game, than your opponent. A stone is considered to be "live" if it is a part of some horizontal, vertical or diagonal row of **exactly** 4 stones of the same color.

Play: A game begins with an empty board. Each player has an allocated color: White and Black. White plays first, putting one white stone anywhere on the board. After this move players take turns placing their stones on empty cells adjacent to the last opponent's stone. If all cells adjacent to the last opponent's stone are occupied then the player gets the right ("freedom") to place his stone on any empty cell of the board. The game ends when the board is filled with stones. The last player has the right to pass on his last turn (and leave the last cell empty) if placing his stone reduces his score.”

https://boardgamegeek.com/boardgame/100480/freedom

Your task is to write an AI program to play Freedom with a human player. Your tasks include

1. Implement a Freedom playing interface that one can play the game.
2. Design an evaluation function for the intermediate states.
3. Implement your program using the minimax algorithm and enhance your program using alpha-beta pruning algorithm.

What to Hand in

1. Demonstrate your program to the instructor.
2. Well-documented program.
3. Design of your program, including the evaluation function.
4. Analysis of your results with respective to the evaluation functions you used.

To easily debug, you may want to start to implement your game on a 6x6 board (or even smaller board) then extend it to an 8x8 game. Please send your program and analysis report via blackboard before the assignment due date.

Extra credit (20 pts)

Innovative evaluation function design.