Artificial Intelligence (CS 4253/6613)
Project: Game Tree Search (minimax and $\alpha - \beta$)

In this project you will modify the provided Python codebase to implement game tree search procedures. In particular, you will be implementing the minimax and $\alpha - \beta$ algorithms, described in Figures 5.3 and 5.5 respectively in the Russell & Norvig textbook (3rd Edition).

The primary domain of application of game tree search[1] is a discretized and stylized, completely observable two-person soccer game. Consult the Readme file in the enclosed zipped repository for details of the game, including the actions available from any state. The game ends when either player scores a goal and wins or if a particular state, given by the postions of the two players and the ball on the field, is repeated, which corresponds to a draw.

You should play the game interactively to have a better understanding of the soccer domain that should assist you in developing a competitive evaluation function. You should experiment with varying search depth and with simple versus more sophisticated evaluation function to form an understanding of the relative advantages of deeper domain knowledge and the ability to search further ahead in the game.

In your report, you need to explain your rational for constructing your evaluation function.

You should also compare the performance of your system with the provided agent, both going first and second. The lookahead for game-tree search should be limited to 5 moves.

Include an analysis of how alpha-beta helps reduce search over min- imax in a game tree for this particular domain. Also elaborate on your experience on designing a good evaluation function: tradeoffs between deep search and sophisticated evaluation functions.

Your grade break-up for the project is as follows:

Minimax	40%
$\alpha - \beta$	20%
Board Evaluation	20%
Analysis and write-up	20%
Total	100%

[1] A secondary domain of Connect Four is also implemented. It can be useful to use that domain to debug your code, but it is not necessary to use this domain.