# Assignment 3:
Game Tree Search

Due Sunday, 21 May, 11:30pm

Loopless Slant game[1] is a two-player zero-sum game played on a $m \times m$ grid, where m is even and some intersections contain circles with numbers ranging from 1 to 3.

Each player has its own diagonal line: the right diagonal line '/ ' belongs to Player 1, and the left diagonal line ' \' belongs to Player 2.

When a player's turn comes, she must place her diagonal line into a single empty cell on the board once. This completes the player's move. When the move ends; if the number of diagonal lines that intersect at a circle is equal to n (where n is the number on that circle) and no player received a point from that circle before, she gets n points. For every n points she gets, her opponent receives -n points. Note that in this case, a player can get points from a circle at most once, but she can get points from multiple circles with one move.

The game ends when all cells are filled. The player with more points wins the game.
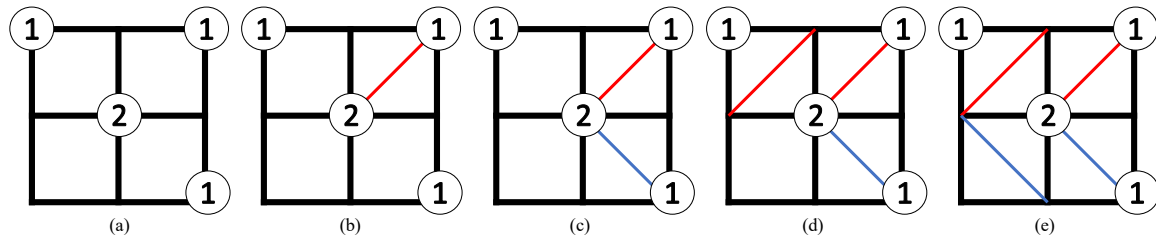
In the Figure above:

(a) shows the initial board.

(b) shows the first move of Player 1, where she places her diagonal to the upper right corner. After this move, Player 1 gains 1 point and Player 2 loses 1 point.

(c) shows the first move of Player 2, where she places her diagonal to the lower right corner. After this move, Player 1 loses 3 points and Player 2 gains 3 points.

(d) shows the second move of Player 1. In this move, none of the players gain or lose points. Note that there can be a circle that does not yield any points.

(e) shows the second move of Player 2. After this move, the game ends with Player 1 having -2 points and Player 2 having 2 points in total. Thus, Player 2 wins the game.

Note that, this execution might not contain the optimal moves for each player. It is only included here to show the rules of the game.

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[1]The rules of this game are different from the Slant puzzle in Assignment 2. Please read this document accordingly.

The assignment consists of two parts:

1. Model this game as a game tree search problem (i.e., define the players, the states, the initial state, terminal states, the state transition function, the payoff function).

2. (provided that part 1 is completed) Implement the game in PYTHON using alpha-beta pruning.

Submit   the following three files at SUCourse+:

- a pdf file (at most 2 pages) containing a description of your model,

- a zip file containing your PYTHON code, and

- a text file containing the traces of two different runs of the program, with you playing against the computer.

Demos   You are expected to make a demo of your implementation so that we can grade part 2 of the assignment. The demos are planned for the week following the deadline and will be scheduled later on.