Evaluation Function Performance for Isolation Game

Three independent and different evaluation functions were created to come up with the best heuristic and evaluate the performance of the isolation game that can give the best result against the computer player.

These three evalution functions were defined in AB_Custom, AB_Custom_2 and AB_Custom_3 functions.

AB_Custom had a heuristic, which is similar to AB_Improved except it is aggressive in attacking the computer player and determines the best node to visit to win the game. The function was defined as my_moves – (2 * opp_moves).

AB_Custom_2 takes the difference between the two players form the center of the board to evaluate positional advantage. Best case is when you are at the center of the board and your opponent is in one corner of the board. This gives our player more room to move.

AB_Custom_3 keeps your computer player close to you. The closer you are to the computer player, the better heuristic you have as you can be aggressive and trap the opponent to one side of the board.

The summary of the results for all the three-evaluation function is shown in the table below.

```
This script evaluates the performance of the custom_score evaluation
function against a baseline agent using alpha-beta search and iterative
deepening (ID) called `AB_Improved`. The three `AB_Custom` agents use
ID and alpha-beta search with the custom_score functions defined in
game_agent.py.

                        **************************
                             Playing Matches
                        **************************

 Match #    Opponent    AB_Improved   AB_Custom   AB_Custom_2  AB_Custom_3
                         Won | Lost   Won | Lost   Won | Lost   Won | Lost
    1        Random      18  |   2    19  |   1    17  |   3    19  |   1
    2        MM_Open     17  |   3    15  |   5    15  |   5    17  |   3
    3       MM_Center    19  |   1    16  |   4    16  |   4    18  |   2
    4     MM_Improved    14  |   6    14  |   6    15  |   5    12  |   8
    5        AB_Open     12  |   8     9  |  11    11  |   9    11  |   9
    6       AB_Center    12  |   8    11  |   9    10  |  10    13  |   7
    7     AB_Improved     8  |  12     7  |  13     6  |  14     8  |  12
--------------------------------------------------------------------------
           Win Rate:      71.4%        65.0%        64.3%        70.0%
```

As you can see from the above table, the best evaluation function from the three defined is AB_Custom_3. The test was run for 20 games and it was repeated twice.

Each time, AB_Custom_3 evaluation function performed better than the other two. One time it performed better than AB_Improved as well; however, in the second try it was slightly below in performance. This heuristic performs best because of following reasons:

1) It is aggressive in attacking the opponent and limiting its moves
2) If the opponent is trapped to one side of the board then this heuristic forces towards trapping the opponent
3) It keeps you closer to your opponent to end the game faster.