José L. Matus

Heuristics Analysis

Jose L. Matus custom score functions

Heuristic 1: Penalize corners.

This is an extension of the improve score, but penalizing the score when the move is done to a corner. I believe that a move to a corner will trap the player, similar to what happens on the game of chess when a knight moves to a corner. This should at least outperform the improved score function without a considerable added complexity.

Heuristic 2: Penalize board borders and corners.

This an extension of the penalize corners score function, whenever the move is to one of the borders of the board the move is penalize and when the move is to a corner the penalization is greater. This option might produce better results than the penalize corners score. A move to the border of the border is a bad move because it reduces the posible moves and position wise should be penalized.

Heuristic 3: Penalize board borders and corners.

This heuristics computes the move ahead after each one of the legal moves after the current move. This might be a better heuristic because we get information about the subsequent moves that might be available for each player, the score is calculate based on the difference of the forecast moves (second move forecast moves). This is like making a second move and forecasting how the board would be for each player (moves left). The downsize is the loss of computational efficiency because we have to make n + 1 calls to the get_legal_moves function per player.

RESULTS

A couple of tests were ran for the score functions.

```
                    *************************
                         Playing Matches
                    *************************

Match #   Opponent    AB_Improved     corners    CornersBorders     Ahead
                      Won  | Lost   Won  | Lost   Won  | Lost   Won  | Lost
    1       Random     30  |   0    29  |   1    29  |   1    29  |   1
    2       MM_Open    20  |  10    28  |   2    24  |   6    24  |   6
    3      MM_Center   29  |   1    28  |   2    25  |   5    28  |   2
    4     MM_Improved  28  |  10    23  |   7    22  |   8    23  |   7
    5       AB_Open    14  |  16    19  |  11    15  |  15    16  |  14
    6      AB_Center   17  |  13    17  |  13    17  |  13    17  |  13
    7     AB_Improved  14  |  16    13  |  17    15  |  15    15  |  15
--------------------------------------------------------------------------
          Win Rate:      68.6%        74.8%        70.0%        72.4%

There were 9.0 timeouts during the tournament -- make sure your agent handles search timeo
ut correctly, and consider increasing the timeout margin for your agent.
```

```
                    *************************
                         Playing Matches
                    *************************

Match #   Opponent    AB_Improved     corners    CornersBorders     Ahead
                      Won  | Lost   Won  | Lost   Won  | Lost   Won  | Lost
    1       Random     71  |   9    75  |   5    76  |   4    72  |   8
    2       MM_Open    57  |  23    61  |  19    56  |  24    60  |  20
    3      MM_Center   68  |  12    68  |  12    75  |   5    70  |  10
    4     MM_Improved  56  |  24    52  |  28    61  |  19    63  |  17
    5       AB_Open    43  |  37    45  |  35    44  |  36    39  |  41
    6      AB_Center   46  |  34    50  |  30    42  |  38    46  |  34
    7     AB_Improved  36  |  44    40  |  40    35  |  45    39  |  41
--------------------------------------------------------------------------
          Win Rate:      57.3%        59.0%        59.5%        59.5%
```

As displayed above there corners score function seems to be the better one, it outperforms the other functions including the move ahead function (that is some kind of double step). This is consequent with the logic that a move to the corners is a really bad move. From the results it can

be deducted that a move to the borders of the board might not be a bad move in all the scenarios, if it were, that score function should outperform the corners score.

Final Recommendation

The score function that penalizes moves to the corners is the recommended to use.

The score function that penalizes moves to borders and corners is the second option to use instead of the look ahead (two steps look ahead) because it doesn't decrease the computational efficiency.