Eduardo Alejandro Avilés Jiménez

Heuristics analysis

As part of the implementation of the game agent, we tested it with three different heuristics to determine which one of them has a better performance. According to the final results, the best Heuristic is the first custom score in which the score has been improved using the probability for a knight in chess to move from one place to another, assuming that the knight is in a good position being able to choose from all 8 possible moves.

Custom score

Assuming the knight is at an ideal position it will have 8 possible moves:
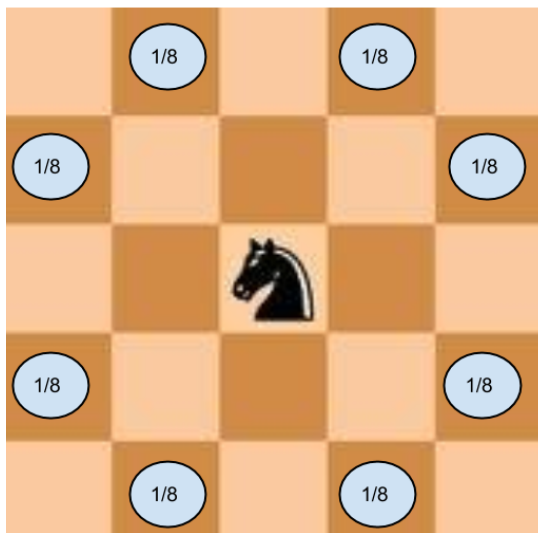
So I'm multiplying by ⅛ the possibility for the player to move to an specific place

```
player1_moves = len(game.get_legal_moves(player))/8
player2_moves = len(game.get_legal_moves(game.get_opponent(player)))/8
return float(player1_moves - player2_moves)
```

Custom score 2

With this heuristic, I calculate the percentage between the total moves related to each player and get the difference between both percentages.

```
player1_moves = float(player1_moves / total)
player2_moves = float(player2_moves / total)
return float(player1_moves - player2_moves)
```

Custom score 3

With custom score 3 heuristic, first I calculate the distance from the center for each player using the euclidean distance between two coordinates. Then I divide the amount of legal moves by the distance of the player from the center, to return the difference between the data of the two players

```
if game.is_loser(player):
    return float("-inf")

if game.is_winner(player):
    return float("inf")

w, h = game.width / 2., game.height / 2.
y, x = game.get_player_location(player)
d1 =  float((h - y) ** 2 + (w - x) ** 2)

y2, x2 = game.get_player_location(game.get_opponent(player))
d2 = float((h - y2) ** 2 + (w - x2) ** 2)

player1_moves = len(game.get_legal_moves(player)) / d1
player2_moves = len(game.get_legal_moves(game.get_opponent(player))) / d2

return float(player1_moves - player2_moves)
```

The result for the three heuristics are giving below:

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

Match #   Opponent    AB_Improved    AB_Custom    AB_Custom_2   AB_Custom_3
                      Won | Lost    Won | Lost    Won | Lost    Won | Lost
   1       Random     10  |  0      10  |  0       9  |  1        9  |  1
   2       MM_Open     7  |  3       9  |  1       6  |  4        9  |  1
   3       MM_Center   9  |  1      10  |  0      10  |  0        9  |  1
   4       MM_Improved 8  |  2      10  |  0       6  |  4        5  |  5
   5       AB_Open     3  |  7       5  |  5       3  |  7        6  |  4
   6       AB_Center   6  |  4       7  |  3       5  |  5        6  |  4
   7       AB_Improved 4  |  6       6  |  4       4  |  6        4  |  6
----------------------------------------------------------------------------
         Win Rate:      67.1%        81.4%         61.4%         68.6%
```