Heuristic analysis

I implemented 3 custom scores as a part of the game playing agent

1. Custom_score - make your player play aggressively against the opponent right from the get go. Award the human player for a positive result and award the computer player for a negative result.

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

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

    #return float(len(game.get_legal_moves(player)))
    own_moves = len(game.get_legal_moves(player))
    #print(len(own_moves))
    opponent_moves = len(game.get_legal_moves(game.get_opponent(player)))
    #print(len(opponent_moves))
    return float(own_moves - (2*opponent_moves))
```

2. Customer_Score2 - While playing with an opponent with pen and paper, i found a pattern where if either the opponent or the human player corners themselves into the corner location of the board, then the chances of losing are more. Reward the players for not making bad moves.

```
bad_moves = [(0,0),(0,7),(7,0),(7,7)]
    player1_score = 0
    player2_score = 0
    game_location_1 = game.get_player_location(player)
    if(game_location_1 in bad_moves):
        player1_score = player1_score-1
    game_location_2 = game.get_player_location(game.get_opponent(player))
    if(game_location_2 in bad_moves):
        player2_score = player2_score-1

    return float(player1_score - player2_score)
```

3. Customer_Score3 - play more aggressively if the number of blank spaces are above 35 and less aggressively towards the end of the game as the blank spaces are lesser

```
blank_spaces = game.get_blank_spaces()
    #return float(len(game.get_legal_moves(player)))
    own_moves = len(game.get_legal_moves(player))
    #print(len(own_moves))
    opponent_moves = len(game.get_legal_moves(game.get_opponent(player)))
    if len(blank_spaces) >= 35:
        return float(own_moves - 3*opponent_moves)
    else:
        return float(3*own_moves - opponent_moves)
```

Here are the best of 3 games using these heuristics.

Round 1

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

 Match #    Opponent    AB_Improved    AB_Custom    AB_Custom_2  AB_Custom_3
                         Won | Lost    Won | Lost    Won | Lost    Won | Lost
    1        Random       7  |   3      7  |   3      7  |   3      8  |   2
    2        MM_Open      4  |   6      7  |   3      6  |   4      7  |   3
    3       MM_Center     5  |   5      5  |   5      8  |   2      7  |   3
    4     MM_Improved     7  |   3      8  |   2      5  |   5      5  |   5
    5        AB_Open      4  |   6      3  |   7      4  |   6      3  |   7
    6       AB_Center     4  |   6      4  |   6      4  |   6      5  |   5
    7     AB_Improved     3  |   7      6  |   4      7  |   3      5  |   5
----------------------------------------------------------------------------
          Win Rate:      48.6%        57.1%        58.6%        57.1%
```

Round 2

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

 Match #    Opponent    AB_Improved    AB_Custom    AB_Custom_2  AB_Custom_3
                         Won | Lost    Won | Lost    Won | Lost    Won | Lost
    1        Random       7  |   3      8  |   2      8  |   2      8  |   2
    2        MM_Open      7  |   3      5  |   5      5  |   5      5  |   5
    3       MM_Center     3  |   7      9  |   1      7  |   3      7  |   3
    4     MM_Improved     8  |   2      6  |   4      6  |   4      6  |   4
    5        AB_Open      6  |   4      5  |   5      5  |   5      8  |   2
    6       AB_Center     6  |   4      6  |   4      5  |   5      2  |   8
    7     AB_Improved     4  |   6      5  |   5      6  |   4      4  |   6
----------------------------------------------------------------------------
          Win Rate:      58.6%        62.9%        60.0%        57.1%
(aind) Raghus-MacBook-Pro:AIND-Isolation raghuramakrishnan$
```

Round 3

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

 Match #    Opponent    AB_Improved   AB_Custom   AB_Custom_2  AB_Custom_3
                         Won | Lost   Won | Lost   Won | Lost   Won | Lost
    1       Random        7  |   3     8  |   2     9  |   1     6  |   4
    2       MM_Open       5  |   5     9  |   1     7  |   3     8  |   2
    3      MM_Center      4  |   6     7  |   3     2  |   8     4  |   6
    4     MM_Improved     4  |   6     8  |   2     7  |   3     8  |   2
    5       AB_Open       6  |   4     4  |   6     2  |   8     5  |   5
    6      AB_Center      5  |   5     4  |   6     7  |   3     4  |   6
    7     AB_Improved     6  |   4     5  |   5     6  |   4     5  |   5
--------------------------------------------------------------------------
          Win Rate:      52.9%        64.3%        57.1%        57.1%
```

Conclusion: Based the 3 games shown below Custom_Score has consistently beaten AB_Improved and has a overall a higher winning % than the other custom_scores and AB_improved. Moreover, it enables the human player to play aggressively trying to chase the opponent. Custom_score being quiet straightforward it would probably be more efficient with larger depths and will not degrade performance.