Heuristics Analysis

I chose to implement the following 3 Heuristic functions:

1. Custom Score - Penalization for being in a corner

2. Customer Score 2 - Penalization for being on the edge of the board

3. Customer Score 3 - Run toward the opponent

Results Summary

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        Playing Matches
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Match #   Opponent     AB_Improved    AB_Custom    AB_Custom_2   AB_Custom_3
                       Won | Lost    Won | Lost   Won | Lost    Won | Lost
   1       Random      10  |  0       9  |  1       8  |  2       8  |  2
   2       MM_Open      7  |  3       8  |  2       7  |  3       5  |  5
   3      MM_Center     6  |  4       6  |  4       7  |  3       8  |  2
   4     MM_Improved    7  |  3       7  |  3       6  |  4       6  |  4
   5       AB_Open      5  |  5       5  |  5       3  |  7       3  |  7
   6      AB_Center     6  |  4       5  |  5       7  |  3       3  |  7
   7     AB_Improved    5  |  5       5  |  5       4  |  6       6  |  4
-----------------------------------------------------------------------------
        Win Rate:        65.7%         64.3%         60.0%         55.7%
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Results Analysis

Custom score 1 (corner penalization) was the most effective of the 3 functions, outperforming in almost every game. This makes sense because by deliberately penalizing corner moves, you are inadvertently favoring moves closer to the middle of the board. By nature of the game, this gives you more potential future moves, because you will potentially have moves open to you on

all 4 sides. If you are in a corner, you automatically narrow your potential moves to only two directions. This function also rewards moves which will put the minimizing player in the corner for the same reasons. We want to win, and by putting our opponent in a corner, we are increasing our chances.

Second runner-up was Custom score 2 (edge penalization). I believe this is because corner penalization will already take into account at least some of the edge penalization test cases, and being on the edge, while not ideal, is not always inherently bad, particularly at the beginning of the game when the majority of the middle of the board is still open for moves. By penalizing edges early on in the game, you are forcing your agent to select items only in the center of the board, even if those choices severely limit their future potential moves later in the game and moving toward an edge could potentially free up many different additional possibilities. This function also rewards moves which will put the minimizing player on the edge for the same reasons. We want to win, and by putting our opponent on the edge, we are increasing our chances.

Custom score 3 (run toward opponent) performed the worst of the 3. This is not surprising, since the closer you are to your opponent, the more you are fighting for "good" moves, and the less good moves you are likely to have available to you. There is also increased likelihood of being boxed in with your opponent on a small section of the board, narrowing the possible moves even further, and ending the game early.