Heuristics

Below is a summary of the three heuristics used.

#1

The first heuristic is simply the difference between player 1 and the opponent's number of available moves. This seemed a fitting baseline, and surprisingly, as shown below, performs admirably compared to more complex heuristics.

#2

This custom score uses the centrality of the board as a heuristic. It takes the number of player moves remaining, subtracts the distance from the center of the board for the move, and subtracts the opponent move count. The intuition is that if this is close to the center and the opponent doesn't have many available moves, this is probably a very strong move. In practice, however, it didn't perform very well.

#3

This custom score is similar to the prior one, only we add the centrality of the position to the score instead of subtracting it. The intuition is a bit counter-intuitive, and mostly wanted to try this because subtracting doesn't work as well as expected. This performs the worst of the three, not surprisingly.

Tournament

Interestingly, after spending quite a bit of time on the first two custom heuristics, the simplest one – the difference between player 1 and opponent – ultimately performed the best!

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

 Match #    Opponent    AB_Improved    AB_Custom    AB_Custom_2   AB_Custom_3
                         Won | Lost   Won | Lost   Won | Lost   Won | Lost
    1         Random       9   |   1      9   |   1      6   |   4      6   |   4
    2         MM_Open      5   |   5      7   |   3      8   |   2      7   |   3
    3       MM_Center      6   |   4      9   |   1      7   |   3      6   |   4
    4     MM_Improved      7   |   3      8   |   2      4   |   6      4   |   6
    5         AB_Open      5   |   5      7   |   3      6   |   4      6   |   4
    6       AB_Center      6   |   4      6   |   4      5   |   5      6   |   4
    7     AB_Improved      3   |   7      4   |   6      4   |   6      3   |   7
--------------------------------------------------------------------------------
            Win Rate:      58.6%        71.4%        57.1%        54.3%
```

Chosen Heuristic / Recommendation

The heuristic ultimately chosen for use in submitting the project is the simplest one, for a variety of reasons:

1. It simply performs the best, winning 71.4% of the time
2. It's very simple, so it's both easy to understand
3. It's very, very fast, since it doesn't need to look ahead!