Game Playing Agent Heuristic Analysis

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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    38 |  2       37 |  3      36 |  4       39 |  1
   2       MM_Open   30 | 10       29 | 11      25 | 15       32 |  8
   3       MM_Center 32 |  8       34 |  6      35 |  5       35 |  5
   4      MM_Improved 26 | 14      33 |  7      31 |  9       27 | 13
   5       AB_Open   21 | 19       19 | 21      22 | 18       18 | 22
   6       AB_Center 26 | 14       24 | 16      22 | 18       24 | 16
   7      AB_Improved 21 | 19      23 | 17      20 | 20       16 | 24
--------------------------------------------------------------------------
         Win Rate:     69.3%        71.1%        68.2%         68.2%
```

Note: 20 matches are played against each opponent

custom_score

$$\#my\_moves - \#opp\_moves - distance\_from\_center$$

This evaluation function is around the assumptions that
1. good moves should provide more moves than opponents'.
2. it's better to stick around the center of the board if possible as a knight has more moves compared to the edge of the board. The distance function used is Manhattan distance.

custom_score_2

$$\#my\_moves - \#opp\_moves - distance\_from\_opponent$$

This evaluation function is around the assumptions that
1. good moves should provide more moves than opponents'.
2. it's better to stay close to the opponent as much as possible as it has higher chance of blocking opponent's moves compared to staying away from the opponent. The distance function used is Manhattan distance.

custom_score_3

$$-distance\_from\_center$$

This evaluation function is around the assumption that
1. it's better to stick around the center of the board if possible as a knight has more moves compared to the edge of the board. The distance function used is Manhattan distance.

Conclusion
Based on the evaluation results, the baseline, *improved_score #my_moves - #opp_moves,* evaluation is a decent evaluation function giving 69.3% win rate. *custom_score_3* uses a single strategy giving 68.2% win rate which is almost as good as the baseline. *custom_score* then combines both strategies together giving even better win rate of 71.1%. *custom_score_2* on the other hand combines the baseline strategy with a different strategy trying to stay close to the opponent but it incurs the performance slightly giving the worst win rate of 68.2%. Therefore, considering all agents with different evaluation functions, *custom_score* is preferred amongst other evaluation functions.

Furthermore, it can be clearly seen that baseline and all student agents perform better than agents with Minimax. More specifically, agent *AB_Improved* performs better than agent *MM_Improved.* This shows that AlphaBeta is better than Minimax. This is because AlphaBeta allows for pruning which ignores search space not contributing to victory. This means agents with AlphaBeta can search more on paths that might lead to victory.

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