Heuristics Analysis

custom_score

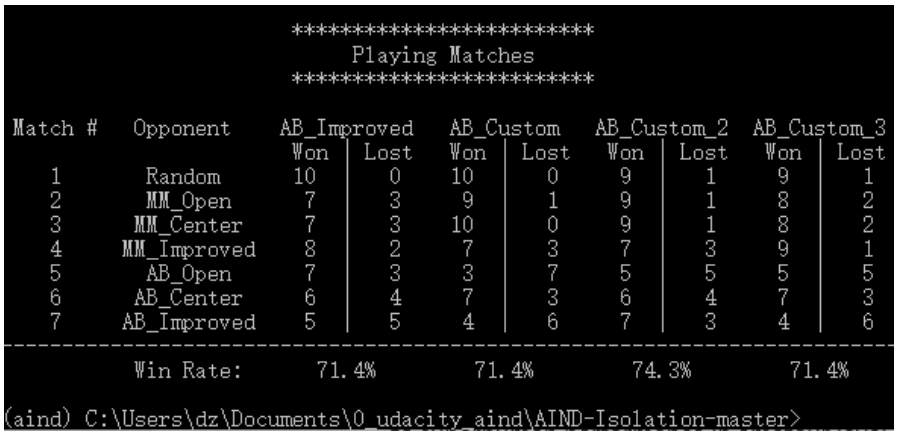
This heuristic calculates the percentage of *legal_moves of the player / legal_moves of both the player and opponent*.

custom_score_2

This is based on *improved_score*, returns *(legal_moves of the player – 2* legal_moves of opponent)*.

custom_score_3

This function returns *(legal moves of the player – legal_moves of opponent) * (legal_moves of both sides / blank spaces)*.



```
                    ***************************
                        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     9  |  1     8  |  2
   3      MM_Center     7  |  3     10  |  0     9  |  1     8  |  2
   4     MM_Improved    8  |  2      7  |  3     7  |  3     9  |  1
   5       AB_Open      7  |  3      3  |  7     5  |  5     5  |  5
   6      AB_Center     6  |  4      7  |  3     6  |  4     7  |  3
   7     AB_Improved    5  |  5      4  |  6     7  |  3     4  |  6
--------------------------------------------------------------------
          Win Rate:      71.4%        71.4%        74.3%        71.4%

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```

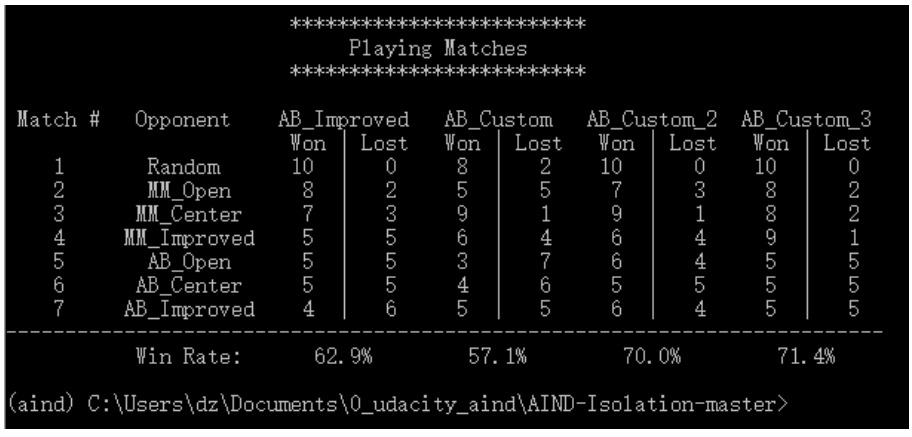

```
                    ***************************
                        Playing Matches
                    ***************************

Match #   Opponent    AB_Improved   AB_Custom   AB_Custom_2  AB_Custom_3
                      Won | Lost   Won | Lost   Won | Lost   Won | Lost
   1       Random      10  |  0      8  |  2     10  |  0     10  |  0
   2       MM_Open      8  |  2      5  |  5      7  |  3      8  |  2
   3      MM_Center     7  |  3      9  |  1      9  |  1      8  |  2
   4     MM_Improved    5  |  5      6  |  4      6  |  4      9  |  1
   5       AB_Open      5  |  5      3  |  7      6  |  4      5  |  5
   6      AB_Center     5  |  5      4  |  6      5  |  5      5  |  5
   7     AB_Improved    4  |  6      5  |  5      6  |  4      5  |  5
--------------------------------------------------------------------
          Win Rate:      62.9%        57.1%        70.0%        71.4%

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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      10  |  0     10  |  0     10  |  0     10  |  0
   2       MM_Open      9  |  1      8  |  2      6  |  4      8  |  2
   3      MM_Center     9  |  1      8  |  2      8  |  2      9  |  1
   4     MM_Improved   10  |  0      6  |  4      7  |  3      8  |  2
   5       AB_Open      4  |  6      4  |  6      6  |  4      7  |  3
   6      AB_Center     4  |  6      4  |  6      7  |  3      5  |  5
   7     AB_Improved    5  |  5      4  |  6      3  |  7      5  |  5
--------------------------------------------------------------------------
          Win Rate:      72.9%        62.9%        67.1%        74.3%

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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      10  |  0      9  |  1      9  |  1     10  |  0
   2       MM_Open      7  |  3      6  |  4      6  |  4     10  |  0
   3      MM_Center     9  |  1     10  |  0      8  |  2     10  |  0
   4     MM_Improved    5  |  5      8  |  2      7  |  3      8  |  2
   5       AB_Open      5  |  5      5  |  5      6  |  4      4  |  6
   6      AB_Center     5  |  5      4  |  6      7  |  3      5  |  5
   7     AB_Improved    6  |  4      4  |  6      3  |  7      4  |  6
--------------------------------------------------------------------------
          Win Rate:      67.1%        65.7%        65.7%        72.9%

(aind) C:\Users\dz\Documents\0_udacity_aind\AIND-Isolation-master>
```

Due to the huge time cost of testing, I could only run 4 times of the tournament. Apparently, AB_Custom_3 had the highest Win Rate on average and quite stable – above 70% in all tests. But it failed to outperform AB_Improved and MM_Improved in some tests.

In fact, no heuristic function is ideal, but I would choose AB_Custom_3, if I had to, because:

- The best average winning rate, and stable winning rate
- It is relatively a bit complicated in calculation, while the extra complexity causes little increase in time.
- Even though it failed to beat ID_Improved in some tests, it is still better than the other 2 heuristic functions.