Heuristic Analysis

To analyze the evaluation function, I ran multiple tournaments. Following analysis is on the basis of 5 run.

Following are the overall tournament results:

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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        10 |   0        10 |   0        10 |   0
   2       MM_Open       8 |   2        10 |   0        10 |   0         9 |   1
   3      MM_Center      9 |   1         9 |   1         9 |   1        10 |   0
   4     MM_Improved     9 |   1         9 |   1         7 |   3         8 |   2
   5       AB_Open       6 |   4         6 |   4         3 |   7         5 |   5
   6      AB_Center      6 |   4         5 |   5         5 |   5         5 |   5
   7     AB_Improved     4 |   6         6 |   4         4 |   6         6 |   4
-----------------------------------------------------------------------------------
         Win Rate:       74.3%          78.6%          68.6%          75.7%
```

Custom_Score:

As learned in the lesson, this heuristic will allow our computer player to chase after the opponent. This function contently performs well, chasing you opponent is not always a good idea but in this isolation this evaluation function gives an average of **75.5%** success ratio.

	AB_Improved	AB_Custom
Random	10	10
MM_Open	8	10
MM_Center	9	9
MM_Improved	9	9
AB_Open	6	6
AB_Center	6	5
AB_Improved	4	6
	74.3%	78.6%

Custom_Score_2:

It's an Manhattan Distance implementation where we get the distance between the coordinates of computer player and opponent. It provides the minimum cost for moving one space to adjacent space. This function gives an average of **72%**

	AB_Improved	AB_Custom_2
Random	10	10
MM_Open	8	10
MM_Center	9	9
MM_Improved	9	7
AB_Open	6	3
AB_Center	6	5
AB_Improved	4	4
	74.3%	68.6%

Custom_Score_3:

This evaluation function works on the basis of Euclidean distance. Since Euclidean allows us to move any direction and it is shorter than Manhattan distance the performance is better than Manhattan. This function outperforms opponent on **Random** and **Center** cases. The average of this evaluation function is **74%**.

	AB_Improved	AB_Custom_2
Random	10	10
MM_Open	8	9
MM_Center	9	10
MM_Improved	9	8
AB_Open	6	5
AB_Center	6	5
AB_Improved	4	6
	74.3%	75.7%

Conclusion:

I would recommend **Custom_Score** (following the opponent strategy**)** because that gives more chances to win, just like in tic-tac toe if you are not the first once then follow your opponent to stop him from winning.

- Performance data shows that Custom_Score out performs Improved in most of the cases
- Consistency of Custom_Score heuristic is better among all others

- As we are just following our opponent and not doing a lot of computation, this heurist is simple but better.