

# Isolation Game Heuristic Analysis

## Heuristics

In this report I present three heuristics that I came up with along with my analysis of them backed up by data of actual game play. During initial few runs of tournament.py I noticed that “Open Moves” and “Center” heuristics performed well against different sets of opponents so I decided to try out a heuristic that combined them both. After a few trial and error here’s the three heuristics I finalized.

1. Custom Score:  $\text{own\_moves} - \text{opp\_moves} * 2 - \text{center\_score} * \text{center\_score}$
2. Custom Score 2:  $\text{own\_moves} - \text{opp\_moves} + \text{center\_score}$
3. Custom Score 3:  $\text{own\_moves} - \text{opp\_moves} - \text{center\_score}$

I initially started out with “ $\text{own\_moves} - \text{opp\_moves} * 2$ ” i.e., to give more weight to the open moves for the opponent. However, it fared badly against Center Score heuristics so had to drop that one.

I ran the tournament six times to reduce the factors such as CPU availability. The data from six runs is provided in the Appendix-A.

As the game data shows, the custom-score heuristic, being the best of both the worlds, performs better than both open move and center score heuristics. I conjecture, as I can’t back it up, it performs better than center-score is because it gives more weight to the center-score and more weight to open moves available to the opponent.

## Recommendation

I recommend “Custom Score” i.e., () as the evaluation function for the following three reasons.

1. It is stable. Meaning that it’s able to consistently perform better than rest of the heuristics. While AB\_Custom\_3 did perform better on couple of occasions, it isn’t reliable as the results varied wildly (ranging from 78% to 57%).
2. It’s success rate across all the other heuristics is consistently more than 50%.
3. It out performed AB\_Improved on four occasions, matched it once and was below par just once.

## Appendix A

Match #	Opponent	AB_Improved	AB_Custom	AB_Custom_2	AB_Custom_3
		Won   Lost	Won   Lost	Won   Lost	Won   Lost
1	Random	8   2	10   0	10   0	8   2
2	MM_Open	7   3	8   2	7   3	8   2
3	MM_Center	8   2	9   1	9   1	9   1
4	MM_Improved	8   2	9   1	7   3	7   3
5	AB_Open	6   4	6   4	4   6	5   5
6	AB_Center	7   3	6   4	4   6	3   7
7	AB_Improved	5   5	5   5	4   6	4   6
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	Win Rate:	70.0%	75.7%	64.3%	62.9%

Match #	Opponent	AB_Improved	AB_Custom	AB_Custom_2	AB_Custom_3
		Won   Lost	Won   Lost	Won   Lost	Won   Lost
1	Random	8   2	10   0	9   1	9   1
2	MM_Open	9   1	8   2	8   2	5   5
3	MM_Center	7   3	9   1	10   0	9   1
4	MM_Improved	9   1	8   2	7   3	6   4
5	AB_Open	6   4	4   6	4   6	3   7
6	AB_Center	4   6	4   6	5   5	5   5
7	AB_Improved	6   4	6   4	2   8	3   7
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	Win Rate:	70.0%	70.0%	64.3%	57.1%

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	8   2	9   1	6   4	9   1
3	MM_Center	10   0	9   1	8   2	8   2
4	MM_Improved	8   2	7   3	7   3	8   2
5	AB_Open	5   5	3   7	5   5	5   5
6	AB_Center	4   6	5   5	5   5	3   7
7	AB_Improved	4   6	6   4	3   7	4   6
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	Win Rate:	70.0%	68.6%	60.0%	64.3%

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	9   1
2	MM_Open	8   2	9   1	6   4	8   2
3	MM_Center	10   0	8   2	9   1	9   1
4	MM_Improved	8   2	10   0	8   2	7   3
5	AB_Open	5   5	5   5	6   4	6   4
6	AB_Center	4   6	7   3	4   6	5   5
7	AB_Improved	5   5	5   5	3   7	5   5
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	Win Rate:	71.4%	77.1%	65.7%	70.0%

Match #	Opponent	AB_Improved	AB_Custom	AB_Custom_2	AB_Custom_3
		Won   Lost	Won   Lost	Won   Lost	Won   Lost
1	Random	9   1	10   0	10   0	10   0
2	MM_Open	7   3	8   2	6   4	9   1
3	MM_Center	8   2	9   1	9   1	10   0
4	MM_Improved	9   1	8   2	9   1	9   1
5	AB_Open	5   5	5   5	4   6	6   4
6	AB_Center	5   5	5   5	5   5	7   3
7	AB_Improved	6   4	6   4	5   5	4   6
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	Win Rate:	70.0%	72.9%	68.6%	78.6%