

# Heuristic Analysis of Isolation Game

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I implemented 3 different heuristics in order to evaluate the performance of each of them. My goal is to find the better heuristic than AB\_Improved. Here are my heuristic functions description.

## Explanation of Heuristics

**Heuristic 1 :**  $\text{own\_moves} - 2 * \text{opp\_moves}$

With this heuristic, the more available moves, which the player can move, subtract weighted the opponent player's moves, the higher win rate. In this function, `own_moves` is moves which the player can move and `opp_moves` is moves which the opponent player can move. And, `opp_moves` multiply 2 because of weight. I expected that it will be better evaluation if there is proper weight.

**Heuristic 2 :** `own_moves`

With this heuristic, the more available moves which the player has, the higher win rate. In this function, `own_moves` is moves which the player can move. But, this heuristic can't check the opponent player's moves. It means that the opponent's moves can be more than the player's move. That's why it has the lowest win rate.

**Heuristic 3 :**  $(\text{own\_moves} - \text{opp\_moves}) + (\text{opp\_distance\_to\_center} - \text{own\_distance\_to\_center})$

With this heuristic, the more available moves, which the player can move, subtract the opponent player's moves and closer to center, the higher win rate. '`own_moves`' and '`opp_moves`' are same as Heuristic 1. In this function, `own_distance_to_center` is  $(h - y)^2 + (w - x)^2$ , which means the distance between center and the player's location. '`h`' is game board's height / 2, '`w`' is game board's width / 2, '`y`' is y-coordinate of the player location, and '`x`' is x-coordinate of the player location. '`opp_distance_to_center`' is  $(h - y1)^2 + (w - x1)^2$ , which means the distance between center and the opponent player's location. If the player is closer to center than the opponent player, the player has more available moves than the opponent.

## The Result

I implemented 3 heuristics and here is the result.

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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	27	3	29	1	27	3	30	0
2	MM_Open	25	5	26	4	21	9	24	6
3	MM_Center	25	5	23	7	28	2	28	2
4	MM_Improved	18	12	20	10	18	12	23	7
5	AB_Open	15	15	15	15	15	15	16	14
6	AB_Center	16	14	16	14	16	14	17	13
7	AB_Improved	16	14	16	14	14	16	16	14
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Win Rate:		67.6%		69.0%		66.2%		73.3%	

Third heuristic is the highest among other heuristics. I guessed that the first heuristic, which is more available moves compared to the opponent player, has the highest win rate. But the third heuristic which is more available moves compared to the opponent player and closer to center has the highest win rate. Above the screen shot, AB\_Custom\_3 has 73.3% win rate and AB\_Custom has 69.0% win rate. Therefore, the closer center and the more available moves compared to the opponent player, the higher win rate.

And, I expected the moves which the player can move has lower win rate than the moves which is weighted. It is correct in that AB\_Custom's win rate, 69.0% is higher than AB\_Custom\_2's win rate, 66.2%.

Also, all results are more than 60%. AB\_Custom and AB\_Custom\_3 have higher win rate than AB\_Improved's win rate. Therefore, this result is quite good and I achieved the goal which is to find the better heuristic than AB\_Improved.