

# Heuristic Analysis

## Comparison of heuristics

### Heuristics

The heuristic experiments started with variations of AB\_Improved and worked their way to some experiments based on my intuition. The five heuristics that I tested are listed below:

- 1) Heuristic 1: Minimizing opponents moves

$$\text{len}(\text{my\_available\_moves}) - X * \text{len}(\text{opponents\_available\_moves})$$

- 2) Heuristic 2: Maximizing available moves

$$X * \text{len}(\text{my\_available\_moves}) - \text{len}(\text{opponents\_available\_moves})$$

- 3) Heuristic 3: Start the game focusing on the center, then choose AB\_Improved

*If move.count < X*  
*Distance from center*  
*Else*  
*AB\_Improved*

- 4) Heuristic 4: Ratio of available moves to opponents moves

$$\text{len}(\text{my\_available\_moves}) / \text{len}(\text{opponents\_available\_moves})$$

- 5) Heuristic 5: Ratio of opponents moves to available moves

$$- \text{len}(\text{opponents\_available\_moves}) / \text{len}(\text{my\_available\_moves})$$

## Preliminary Results

Match #	Opponent	AB_Improved		<b>Heuristic 4</b>		<b>Heuristic 3</b>		<b>Heuristic 1</b>	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	AB_Improved	51	49	46	54	41	59	47	53
Win Rate:		51.0%		46.0%		41.0%		47.0%	

Match #	Opponent	AB_Improved		<b>Heuristic 5</b>		<b>Heuristic 2</b>		<b>Heuristic 1</b>	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	AB_Improved	54	46	52	48	55	45	54	46
Win Rate:		54.0%		52.0%		55.0%		54.0%	

I increased the number of matches played to 50 to create less variability in the results. I first focused the tournament on AB\_Improved to come up with the top 3 heuristics. For X in the heuristic, I varied the number of subsequent tests and picked the best results.

The top 3 heuristics were Heuristic 1, Heuristic 2, and Heuristic 5. I ran a series of tests to get the final result with the top 3 heuristics.

## Final Results

Match #	Opponent	AB_Improved		<b>Heuristic 1</b>		<b>Heuristic 2</b>		<b>Heuristic 5</b>	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	91	9	99	1	92	8	92	8
2	MM_Open	66	34	80	20	76	24	74	26
3	MM_Center	81	19	89	11	90	10	86	14
4	MM_Improved	74	26	73	27	80	20	72	28
5	AB_Open	53	47	52	48	48	52	60	40
6	AB_Center	60	40	59	41	55	45	57	43
7	AB_Improved	53	47	48	52	50	50	50	50
Win Rate:		68.3%		71.4%		70.1%		70.1%	

The final results were close but Heuristic 1 with X = 1.5 was the winner.