

Heuristic Analysis

Summary

Three heuristic scores are evaluated.

1. Custom Score 1 is improved score that equal to the difference in the number of moves available to the two players, but opponent moves are weighted. The weight is twice ([code](#)).
2. Custom Score 2 is ratio of the number of moves available to the two players. The score is zero when own player is lose, and +infinity when own player is win ([code](#)).
3. Custom Score 3 is rate of the number of places that can be moved. The score is zero when own player is lose, and one when own player is win ([code](#)).

Results

Results of win rate are below.

	Improved Score	Custom Score 1	Custom Score 2	Custom Score 3
Win Rate	68.6%	61.4%	77.1%	78.6%

Custom Score 3 is outperform to compare with Improved Score.

The best heuristic score

The custom score 3 that is ratio of places that can be moved is the best. There are three reasons.

- It is considering how good it is for the opponent. It is the same as improved score.
- The score indirectly represents win probability on the current board state.
- In particular, It is outperform for random and minimax opponents scores.

Appendix

Full tournament results are below.

***** Playing Matches *****									
Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	9	1	9	1	10	0	10	0
2	MM_Open	6	4	5	5	10	0	9	1
3	MM_Center	7	3	10	0	8	2	8	2
4	MM_Improved	7	3	6	4	10	0	7	3
5	AB_Open	7	3	4	6	6	4	9	1
6	AB_Center	7	3	5	5	5	5	6	4
7	AB_Improved	5	5	4	6	5	5	6	4

Win Rate:		68.6%		61.4%		77.1%		78.6%	

In particular, Custom Score 3 defeats random and minimax opponents.