Isolation Game Heuristic Analysis

1. Overview

The project aim to implement agent to play game of 'Isolation' using adversarial search. The game is two players deterministic game where in version the player moves restrict to '**L-Shape**'.

The aim of this document is to analyse the chosen heuristics and make recommendation based on there performance in the tournament.

2. Heuristics

The aim of three chosen heuristics is to penalise the moves which maximise opponent moves. More details in the below section.

2.1 custom_score Heuristic

This heuristic penalise the moves which maximise opponent by using below equation to compute the score. The amount penalties increase as the game progress and number of available block decrease.

$$Number\ of\ player\ avaliable\ moves\ -\ weight\ *\ Number\ of\ opponent\ avaliable\ moves$$

Where $Weight\ =\ 1\ -\ \frac{Number\ of\ free\ block}{Total\ number\ of\ blocks}$

2.2 custom_score_2 Heuristic

This heuristic use fix amount of penalties which chosen empirically instead using value which increase overtime, as showing in the below equation.

$$Number\ of\ player\ avaliable\ moves\ -\ \alpha\ *\ Number\ of\ opponent\ avaliable\ moves$$

Where α could be any real values and in my cause used 2.

2.3 custom_score_3 Heuristic

This heuristic apply the penalty by using the ratio between number of available player moves and number of available opponent moves and showing below.

$$\frac{Number\ of\ player\ avaliable\ moves}{Number\ of\ opponent\ avaliable\ moves\ +\epsilon}$$

Where ϵ is small amount added to 'Number of opponent available moves' to avoid dividing by zero.

3. Result and Recommendation

I ran tournament three times where the result is showing below. The result shows the first heuristic is more stable and had more or less the same result.

Where the third shows higher result in the first attempt is far lower then the second. So it seems that the best choices is the first heuristic as it showing more stable results.

	AB Improved	AB Custom	AB Custom 2	AB Custom 3
Random	10/0	10/0	10/0	10/0
MM Open	6/4	8/2	9/1	9/1
MM Center	10/0	10/0	8/2	9/1
MM Improved	9/1	9/1	7/3	7/3
AB Open	4/6	6/4	5/5	6/4
AB Center	7/3	6/4	6/4	8/2
AB Improved	2/8	5/5	4/6	7/3
	68.6%	**77.1%%**	**70.0%%**	**80.0%**

	AB Improved	AB Custom	AB Custom 2	AB Custom 3
Random	10/0	10/0	8/2	10/0
MM Open	7/3	6/4	5/5	8/2
MM Center	7/3	9/1	8/2	10/0
MM Improved	6/4	10/0	8/2	7/3
AB Open	5/5	5/5	7/3	9/1
AB Center	5/5	6/4	6/4	5/5
AB Improved	5/5	5/5	5/5	5/5
	64.3%	**72.9%**	**67.1%**	**67.1%**

	AB Improved	AB Custom	AB Custom 2	AB Custom 3
Random	10/0	10/0	9/1	10/0
MM Open	10/0	9/1	8/2	8/2
MM Center	9/1	9/1	8/2	10/0
MM Improved	9/1	6/4	9/1	7/3
AB Open	6/4	6/4	4/6	9/1
AB Center	5/5	8/2	7/3	5/5
AB Improved	5/5	2/8	6/4	5/5
	77.1%	**71.4%**	**72.9%**	**77.1%**