

Isolation AI Agent Heuristic Analysis

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The custom evaluation functions were defined as follows:

- AB Custom 1: Divide the number of moves the player has left by the number of empty spaces left on the board. This gives a percentage.
- AB Custom 2: Use the formula from AB Custom 1 to get a percentage for both players then subtract the opponents percentage from the main players.
- AB Custom 3: Subtract the number of moves left for the opponent from the number of moves left for the main player then divide this number by the number of empty spaces left.

After running the `tournament.py` script 5 times the results were varied. If we go by the winning percentage then the AB Improved doesn't come out on top in any of the 5 tests. The third test ended in a draw between the AB Improved, AB Custom 1, and AB Custom 2 heuristics. In the first two test cases AB Custom 2 was triumphant whereas in the last two test cases AB Custom 3 was triumphant so the choice seems to be between these two.

	AB Improved	AB Custom 1	AB Custom 2	AB Custom 3
Total Wins	213	212	221	217
Highest Win Percentage	64.3%	65.7%	67.1%	68.6%
Lowest Win Percentage	54.3%	52.9%	57.1%	55.7%
Wins Against Random Agents	39	38	41	42
Wins Against MM Agents	96	99	103	101
Wins Against AB Agents	78	75	77	74

I would recommend that we use the AB Custom 2 heuristic based on the following factors:

- It achieved the highest total win count of 221.
- It achieved the second highest win percentage of 67.1% which was slightly less than AB Custom 3's 68.6%. It also has the highest minimum win percentage of all the heuristics.
- It achieved the highest number of wins against the MM agents and the second highest number of wins against the AB agents. It is only beaten in terms of wins against the AB agents by 1 point which isn't a big difference because it didn't lose to it's closest competitor AB Custom 3 but rather AB Improved which doesn't have anything else going for it. It was also beaten by one point against random agents but this is also not an issue because random agents can vary the results significantly between tests.

It is for these reasons that I believe AB Custom 2 is the optimal choice however these results might have differed if I had ran more tests. AB Custom 3 would have also been a good option due to its highest win percentage and second highest minimum win percentage in all 5 tests. AB Improved was also impressive as it achieved the highest win count in the 3 rounds of every test that were against AB agents which are better than the MM agents or the random agent.

AB Custom 1 performed worse than all the others in terms of total win count and percentages.

Opponent	AB Improved		AB Custom 1		AB Custom 2		AB Custom 3	
	Won	Lost	Won	Lost	Won	Lost	Won	Lost
Random	9	1	7	3	8	2	8	2
MM Open	5	5	6	4	7	3	7	3
MM Center	9	1	8	2	8	2	8	2
MM Improved	5	5	6	4	5	5	5	5
AB Open	6	4	5	5	5	5	5	5
AB Center	5	5	5	5	7	3	5	5
AB Improved	4	6	5	5	6	4	3	7
Win Rate:	61.4%		60.0%		65.7%		58.6%	

Opponent	AB Improved		AB Custom 1		AB Custom 2		AB Custom 3	
	Won	Lost	Won	Lost	Won	Lost	Won	Lost
Random	8	2	5	5	10	0	9	1
MM Open	5	5	6	4	8	2	7	3
MM Center	8	2	6	4	6	4	5	5
MM Improved	6	4	5	5	6	4	6	4
AB Open	6	4	5	5	6	4	4	6
AB Center	6	4	5	5	6	4	4	6
AB Improved	6	4	5	5	5	5	4	6
Win Rate:	64.3%		52.9%		67.1%		55.7%	

Opponent	AB Improved		AB Custom 1		AB Custom 2		AB Custom 3	
	Won	Lost	Won	Lost	Won	Lost	Won	Lost
Random	9	1	7	3	9	1	8	2
MM Open	7	3	8	2	7	3	6	4
MM Center	7	3	7	3	8	2	7	3
MM Improved	6	4	7	3	6	4	7	3
AB Open	4	6	6	4	7	3	5	5
AB Center	8	2	6	4	5	5	4	6
AB Improved	4	6	4	6	3	7	7	3
Win Rate:	64.3%		64.3%		64.3%		62.9%	

Opponent	AB Improved		AB Custom 1		AB Custom 2		AB Custom 3	
	Won	Lost	Won	Lost	Won	Lost	Won	Lost
Random	5	5	9	1	7	3	8	2
MM Open	7	3	4	6	6	4	6	4
MM Center	5	5	8	2	7	3	6	4
MM Improved	7	3	6	4	7	3	9	1
AB Open	6	4	5	5	4	6	7	3
AB Center	4	6	5	5	6	4	5	5
AB Improved	4	6	5	5	6	4	4	6
Win Rate:	54.3%		60.0%		61.4%		64.3%	

Opponent	AB Improved		AB Custom 1		AB Custom 2		AB Custom 3	
	Won	Lost	Won	Lost	Won	Lost	Won	Lost
Random	8	2	10	0	7	3	9	1
MM Open	5	5	7	3	6	4	8	2
MM Center	9	1	8	2	8	2	7	3
MM Improved	5	5	7	3	8	2	7	3
AB Open	4	6	4	6	3	7	4	6
AB Center	6	4	6	4	4	6	6	4
AB Improved	5	5	4	6	4	6	7	3
Win Rate:	60.0%		65.7%		57.1%		68.6%	