

I have explored 3 heuristics.

- 1) **custom_score_30()**: The first heuristic is simply returning the number of legal moves that our agent has *minus* the number of moves the opponent has. This value is +ve if our agent has more moves than opponent, -ve if less, and 0 if same. This is an amateurish heuristic which relies on an assumption that the more moves our agent has, the better. This heuristic is ignorant of the board positions or good moves. This can give you surprising good results at times, but is not reliable.
- 2) **custom_score_20()**: In this heuristic, I am playing with the euclidean distance of the agent and the opponent from the center. The nearer any participant is to the center, the better. Because it has more directions to move to compared to edges. The score in this case is the distance of agent *minus* the distance of opponent (from the center). On paper this seems to have an advantage over the previous heuristic (more closer to the game's rules), but the information is not enough to judge which board is better. The tournament simulations in fact did not grade this heuristic any better than the 1st one.
- 3) **custom_score()**: In this approach which is my proposed approach:
 - Divide the isolation grid into 3 layers: Outer layer, Middle layer, and Inner region.
 - Get the legal moves of agent (current) player
 - Calculate a 'score' by giving more weightage to the moves in Inner region, less weightage to the moves in Middle layer, and least weightage to the moves in Outer layer. The rationale being that moves near to the center are more valuable since it results in more available options (as discussed in lecture). This gives a heuristic positional intuition about the current board.
 - Similarly calculate a similar 'score' for the opponent.
 - The resultant score that is returned is (a) + (b) where:
 - a = (difference in 'score' of agent and opponent)
 - b = (difference in number of moves between agent and opponent)
 - (a) is +ve if agent has higher score, -ve otherwise, which makes sense.
 - The rationale to add (b) is to add one more differentiator which can take care if the 'score' difference (i.e. (a)) tends to 0. Also from other heuristics, I have observed that this plays well, since more moves means more options available (obviously)

Here are 3 runs of the tournament, with custom_score() getting best accuracy.

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

Win Rate:		58.6%		72.9%		47.1%		62.9%	

Playing Matches

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3	MM_Center	6	4	10	0	6	4	7	3
4	MM_Improved	6	4	8	2	7	3	6	4
5	AB_Open	3	7	5	5	4	6	7	3
6	AB_Center	6	4	6	4	6	4	6	4
7	AB_Improved	6	4	4	6	5	5	5	5
Win Rate:		55.7%		71.4%		58.6%		64.3%	

Playing Matches

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4	MM_Improved	8	2	6	4	5	5	6	4
5	AB_Open	6	4	6	4	5	5	8	2
6	AB_Center	6	4	5	5	5	5	6	4
7	AB_Improved	7	3	4	6	5	5	3	7
Win Rate:		67.1%		64.3%		55.7%		62.9%	