

Heuristic 1

```
if game.is_loser(player):  
    return float("-inf")  
  
if game.is_winner(player):  
    return float("inf")  
  
return len(game.get_legal_moves(player))/len(game.get_blank_spaces())
```

This metric attempted to estimate getting stuck and cut-off via partitioning. I attempted to do this by assuming that when a partition is successfully made then the ratio of legal moves to available spaces will be lower. I also then realized however that since players can move just like a horse can move in chess that partitioning might not be as detrimental as say if the movement pattern was more like that of a queen.

Heuristic 2

```
if game.is_loser(player):  
    return float("-inf")  
  
if game.is_winner(player):  
    return float("inf")  
meLoc = game.get_player_location(game.active_player)  
oppLoc = game.get_player_location(game.get_opponent(game.active_player))  
usDist = abs(meLoc[0] - oppLoc[0]) + abs(meLoc[1] - oppLoc[1])  
  
return len(game.get_legal_moves(player))/len(game.get_blank_spaces()) + usDist
```

This metric attempts to estimate our player's access to the open blank spaces while also preferring moves that put more distance between our player and the opponent. This is a tactic that seemed to work well for me when I played against friends and tried to express that in this heuristic. Overall I think this heuristic performed most consistently compared to the two other heuristics whose performance varied much more greatly.

Heuristic 3

```
if game.is_loser(player):
    return float("-inf")

if game.is_winner(player):
    return float("inf")

totalMoves = 1 + len(game.get_blank_spaces())
oppMoves = len(game.get_legal_moves(game.get_opponent(player)))

meLoc = game.get_player_location(game.active_player)
oppLoc = game.get_player_location(game.get_opponent(game.active_player))
usDist = abs(meLoc[0] - oppLoc[0]) + abs(meLoc[1] - oppLoc[1])

return -(oppMoves/totalMoves) + usDist
```

This metric attempts to score our player's success relative to our opponent's demise; instead of taking the difference we are taking the negative of the ratio of opponent moves to blank spaces. From playing against friends I noticed that due to the horse movement the available moves at any point is less and more quickly lessened it seemed compared to when playing with queen movement. I thought then that perhaps choosing to limit the opponent's limited movement would have a greater effect than trying to increase my limited movement as well.

Below are three tournament runs:

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	7	3	5	5	5	5	6	4
2	MM_Open	0	10	0	10	0	10	0	10
3	MM_Center	0	10	4	6	4	6	2	8
4	MM_Improved	1	9	1	9	2	8	0	10
5	AB_Open	5	5	6	4	3	7	6	4
6	AB_Center	9	1	6	4	6	4	8	2
7	AB_Improved	7	3	4	6	5	5	2	8
Win Rate:		41.4%		37.1%		35.7%		34.3%	

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	6	4	3	7	8	2	8	2
2	MM_Open	3	7	0	10	1	9	2	8
3	MM_Center	7	3	2	8	3	7	3	7
4	MM_Improved	1	9	2	8	2	8	2	8
5	AB_Open	7	3	5	5	4	6	2	8
6	AB_Center	6	4	4	6	3	7	8	2
7	AB_Improved	4	6	6	4	4	6	3	7
Win Rate:		48.6%		31.4%		35.7%		40.0%	

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	7	3	3	7	8	2	7	3
2	MM_Open	1	9	1	9	3	7	0	10
3	MM_Center	4	6	1	9	4	6	5	5
4	MM_Improved	1	9	0	10	2	8	1	9
5	AB_Open	6	4	7	3	4	6	6	4
6	AB_Center	6	4	4	6	6	4	7	3
7	AB_Improved	10	0	7	3	6	4	6	4
Win Rate:		50.0%		32.9%		47.1%		45.7%	

Results Analysis

Heuristic 1 performed best initially however that performance was not repeated and in fact H1 proceeded to perform the worst in subsequent tournaments. I would suspect that my estimation of partitioning alone is not enough to provide guidance to victory.

Heuristic 2 performed consistently and at one point performed the strongest. This heuristic took into account not only the partitioning or “how much access” our player had to squares on the board but also the distance of our player to our opponent. I imagine that this allows our agent to place our player in positions of access while also avoiding the opponent to some extent.

Heuristic 3 performed as erratically as H1 but slightly better. This heuristic is similar to H2 in that it wants to put distance between our player and the opponent while it is almost opposite to H1. H3 focuses on minimizing the opponent’s access to the board instead of maximizing our player’s access to the board.

Recommendation

Based on the tournament results I recommend using heuristic 2 (H2). Although this heuristic did not break a 50% success rate its performance was consistent. To me this indicates that this heuristic will serve our player better in the long run.

