

# Heuristic Analysis

## I. Evaluation functions Implementation

Here are the three evaluation functions implemented :

### 1. custom\_score:

This function seeks moves with the most options for the player and that chases the opponent moves by differentiating two times the opponent available moves from the player available moves:

```
player_moves = len(game.get_legal_moves(player))
opponent_moves = len(game.get_legal_moves(game.get_opponent(player)))
return float(player_moves-2*opponent_moves)
```

### 2. custom\_score\_2

This function privilege any move when the available moves for the player are greater than the available moves for the opponent.

```
player_moves = len(game.get_legal_moves(player))
opponent_moves = len(game.get_legal_moves(game.get_opponent(player)))
return float(player_moves>opponent_moves)
```

### 3. custom\_score\_3

This function is similar to the first function 'custom\_score' but it is less aggressive being that it only differentiate the opponent available moves from the player available moves.

```
player_moves = len(game.get_legal_moves(player))
opponent_moves = len(game.get_legal_moves(game.get_opponent(player)))
return float(player_moves-opponent_moves)
```

## II. Evaluation functions performance

The result from playing isolation game using each evaluation function are presented bellow:

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	9	1	10	0	10	0	10	0
2	MM_Open	9	1	9	1	10	0	10	0
3	MM_Center	9	1	9	1	10	0	10	0
4	MM_Improved	8	2	6	4	8	2	8	2
5	AB_Open	6	4	5	5	4	6	7	3
6	AB_Center	5	5	6	4	3	7	3	7
7	AB_Improved	5	5	4	6	5	5	4	6
Win Rate:		72.9%		70.0%		71.4%		74.3%	

the win rate is so close between the three evaluation functions (1% to 3% apart from each other) being that all three function uses same comparison criteria which is based on the comparison between the available moves for the player and the available moves for the opponent.

### III. Evaluation functions comparison

Based on the win rate result, I recommend the third function:

- 1) It has the best performance with a win rate of 74.3 %
- 2) It performed very well against the MM opponent (100% win rate) and against AB\_Open
- 3) It is very simple and try to both maximize the player moves and minimize the opponent moves, which help to run the game faster and go in deeper depth so the results would be more accurate.

but it needs some amelioration to handle the case of AB\_Center and AB\_Improved opponents.