

# Heuristic Analysis:

The following three heuristics were used and tested:

**Heuristic 1 (AB\_Custom):** It returns the difference in the number of available moves between the current player and its opponents one ply ahead and is used as the score of the current game state.

```
for move in p_moves:
    own_score += len(game.forecast_move(move).get_legal_moves())
for move in opp_moves:
    opp_score += len(game.forecast_move(move).get_legal_moves())
return float(own_score - opp_score + len(p_moves) - len(opp_moves))
```

where,

*p\_moves* – Player moves  
*opp\_moves* – Opponent's moves

**Heuristic 2 (AB\_Custom\_2):** Here we use an empirical factor to reduce opponent moves. This is similar to IM improved but more aggressive in the sense that it weights the opponent legal moves in a ratio to player's legal moves before taking the difference.

```
return float(len(p_moves) - len(2*opp_moves))
p_moves – Player moves
opp_moves – Opponent's moves
```

**Heuristic 3 (AB\_Custom\_3):** If player has more options to move than his/her opponent that player has more probability of winning. Here we calculate the ratio of player to opponent moves.

```
return float((len(p_moves) / len(opp_moves)))
p_moves – Player moves
opp_moves – Opponent's moves
```

## Results:

***** Playing Matches *****									
Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	10	0	8	2	9	1	6	4
2	MM_Open	5	5	7	3	4	6	5	5
3	MM_Center	9	1	9	1	5	5	5	5
4	MM_Improved	6	4	5	5	4	6	3	7
5	AB_Open	4	6	4	6	5	5	5	5
6	AB_Center	7	3	6	4	5	5	5	5
7	AB_Improved	5	5	3	7	1	9	4	6
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Win Rate:		65.7%		60.0%		47.1%		47.1%	

Based on the results, it is recommended to use Heuristic 1 (AB\_Custom) and can be justified as follows:

1. It is based on the number of moves looking ahead 1 ply in future.
2. The running time complexity is comparable to improved heuristic and should not directly effect the maximum depth searched.
3. As noted from the tournament results, Heuristic 1 perform better than heuristic 2 and 3.
4. Isolation game where L shaped moves are allowed, it is difficult to predict game state by just counting immediately available moves. One ply lookahead strategy can provide more accurate evaluation function.