

# Review of Game Playing Heuristics

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## Introduction

This is a review of all the heuristics developed to play the game of isolation where each player moves like a knight (as in chess). The heuristics being discussed here were compared against other heuristics like Random, that returns a randomly selected utility of all the possible utilities available at that state, open\_move\_score, that outputs a score equal to the number of moves open for your computer player on the board, improved\_score, that outputs a score equal to the difference in the number of moves available to the two players and center\_score, that outputs a score equal to square of the distance from the center of the board to the position of the player.

## Heuristic 1 - Penalized Improved\_score

This heuristic is based on the improved score heuristic where being in the corner is penalized, particularly at end-game. It accepts the current board state and the active player as its parameters and returns a utility value for the current game state from the active player's point of view.

## Heuristic 2 - Penalized Improved\_score Ver. 2.0

This heuristic is also based on the improved score heuristic where the opponent's moves are highlighted, thereby penalizing the active player. It accepts the current board state and the active player as its parameters and returns a utility value for the current game state from the active player's point of view.

## Heuristic 3 - Penalized Center\_score

This heuristic is a variation of the center score heuristic where staying farther away from the center results in a lower utility score. It accepts the current board state and the active player as its parameters and returns a utility value for the current game state from the active player's point of view.

## Results

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Playing Matches									
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Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	8	2	9	1	10	0	8	2
2	MM_Open	7	3	8	2	6	4	4	6
3	MM_Center	8	2	7	3	4	6	9	1
4	MM_Improved	5	5	3	7	5	5	5	5
5	AB_Open	6	4	5	5	7	3	4	6
6	AB_Center	4	6	5	5	4	6	4	6
7	AB_Improved	5	5	7	3	7	3	7	3
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Win Rate:		61.4%		62.9%		61.4%		58.6%	

After coding up the heuristics, they were compared against other heuristics mentioned in the introduction section. AB\_Custom, AB\_Custom\_2 and AB\_Custom\_3 corresponds to Heuristic 1, Heuristic 2 and Heuristic 3 respectively. After running tournament.py, we see that Heuristic 1 outperforms the other heuristics and the pre-defined heuristics very frequently. Heuristic 2 follows Heuristic 1 very closely and gives very similar results. Since both of them are variants of Improved\_Score Heuristic, their results are very similar to the latter. Heuristic 3, however, isn't good enough when compared to the other heuristics and thus it is not recommended.

## Recommendation

The results show that all the three heuristics perform more or less equally. However, Heuristic 1 constantly produces better results. It has a more sophisticated way for calculating the utilities and as the results show, has a higher win rate. I would like to point out that there may be heuristics that would perform better than the ones discussed in this report.