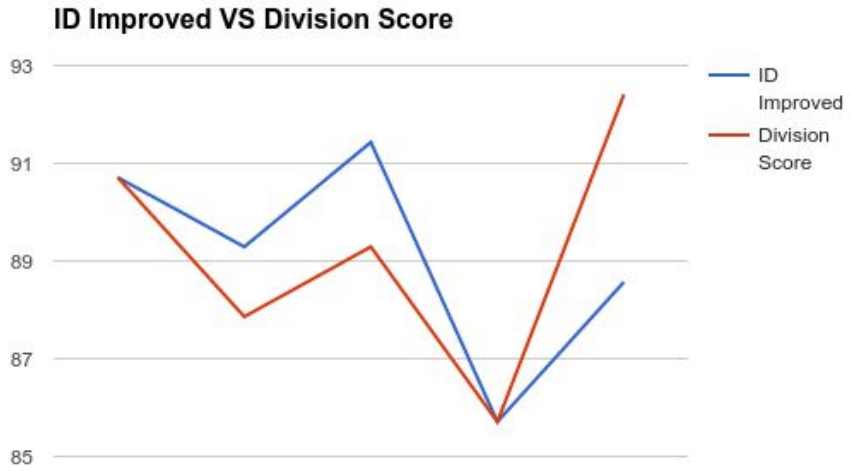
Isolation Game Evaluation Function Analysis

As part of Isolation Game project for Udacity AI Nanodegree. I have developed 3 heuristic functions to determine best moves using by the MInimax algorithm.

For all 3 heuristic functions, they all check to see if the move will result a winning state for the player. If the move will lead to an winning state, positive infinite will be returned, otherwise return negative infinite.

Heuristic function[1]:
Division Score :
The heuristic first check to see if any move will result winning state for either the player or the opponent. If the player win, it will return the score of infinity otherwise negative infinity. The *division score* divide number of player legal move by number of the opponent legal moves. The function use the ratio to determine the best move. The better the ration the more likely the better move.

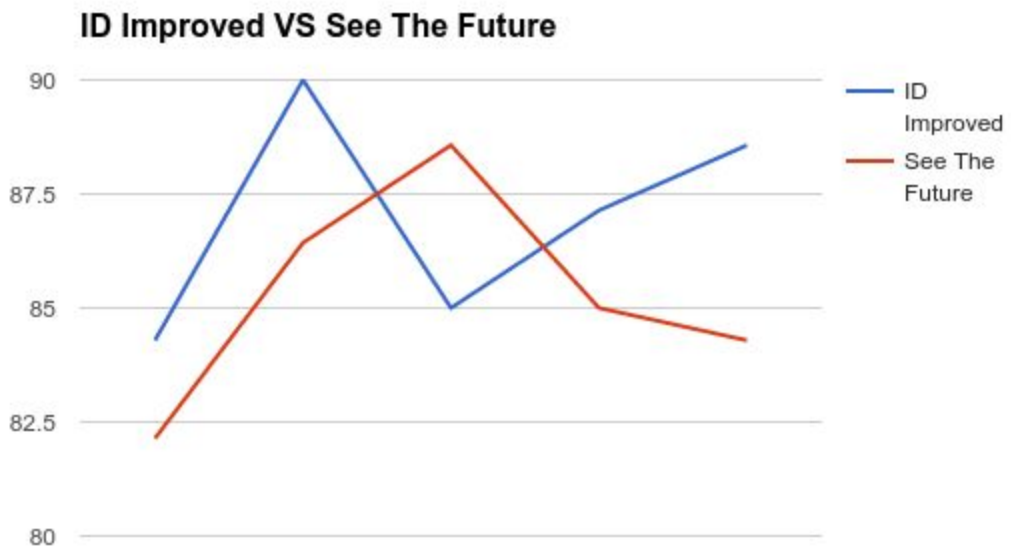
ID Improved	Division Score
90.71	90.71
89.29	87.86
91.43	89.29
85.71	85.71
88.57	92.41
Avg = 89.142	Avg = 89.196



See The Future:

This heuristic focuses on restricting opponent's moves. We add up the total number of moves that an opponent can have and all the immediate future possible moves that can be leaded to by the current possible moves. The higher the possible move count the less likely a move can be a good move. The move that leads to the least opponent move count will be

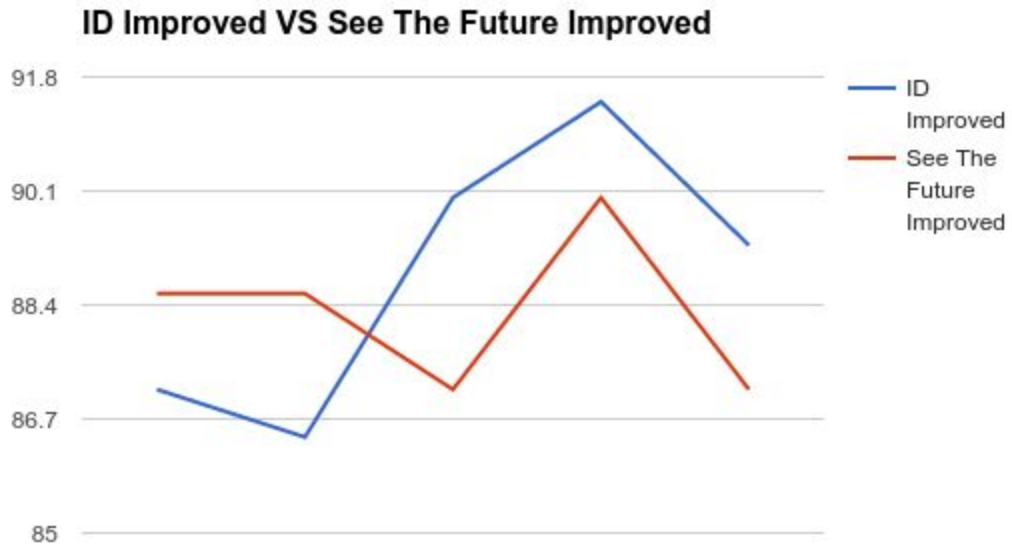
ID Improved	See The Future
84.29	82.14
90.00	86.43
80.005	88.57
87.14	85.00
88.57	84.29
Avg = 87.00	Avg = 85.286



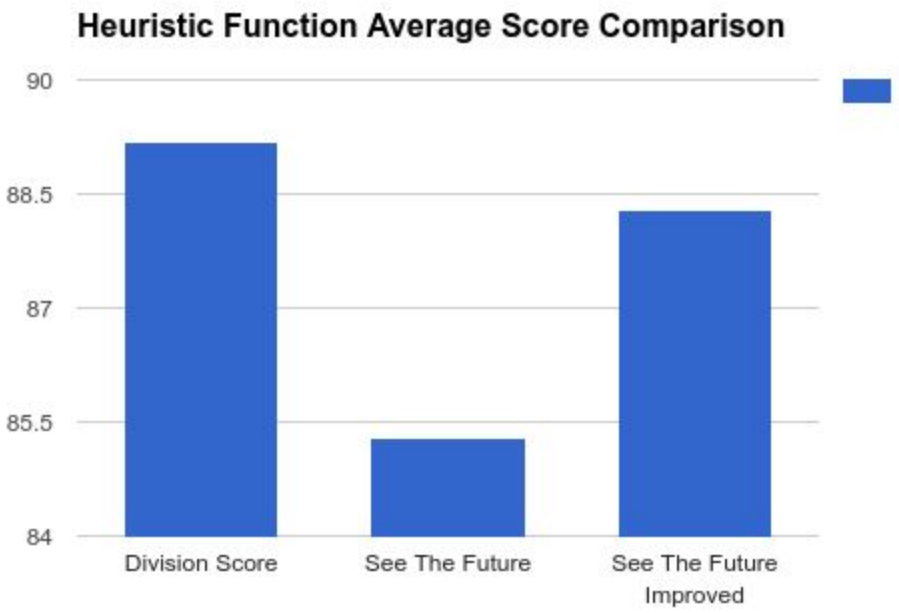
See The Future Improved:

The heuristic function takes the progress of the game and the player opponent move ratio into consideration. If first half of the game, where number of black spaces are bigger than 10. It will add up the total number of moves that an player can have and all the immediate future possible moves that can be leaded to by the current possible moves. I believed the player will be in a better situation if the player start with more options so we add the move counts or the player to the player opponent move ratio. In the later stage of the game, the focus will be on how to greatly restrict opponent's moves so we subtract the move count of the opponent from the player opponent move ratio.

ID Improved	See The Future Improved
87.14	88.57
86.43	88.57
90	87.14
91.43	90
89.29	87.14
Avg = 88.858	Avg = 88.284



Conclusion/Recommendation:



After compare to all three heuristic functions. I recommend using the *Division Score* shall be used as the evaluation function for following reasons.

The *division score* is easy to understand. The division of the number of the player moves and the number of the opponent produce a ratio which represent the advantage and disadvantage moves to the players.

The *division score* is is the simples out of all three heuristic functions. It allows the search to proceed deeper because of it is simple calculation.

The *division score* allows considered move counts for both the player and the opponent. It can make better decision than *the see the future*, which only focus on the restricting the opponent moves.

1. Result shown is the average score of 5 repeated execution.