Heuristic Analysis
Analysis of Heuristics for Game of Isolation

Game Description
The Game of Isolation for which we are designing heuristics is a unique variation on the standard isolation. Here each player moves like a knight in Chess.

Motivation behind Design
The approach in heuristic design was to simulate human behaviours (albeit simplified) to win the game.

Comparison of Heuristic
The Heuristics developed were compared against another heuristic of measurement called as **"AB_Improved"** which evaluates the board as ***score = player_moves – opponent_moves***

Heuristic 1 – Degree of Freedom
In the First Heuristic, we measure the degree of freedom of a player, i.e. The number of legal moves the player has. The Goal of the heuristic is to maximize the degree of freedom for the player and minimize the degree of freedom for the opponent.

$$score \propto \frac{freedom(player)}{freedom(opponent)}$$

Heuristic 2 – Look for Overlap
In the second heuristic, we adopted a more aggressive approach towards isolation. The idea is built on top of Degree of Freedom talked in Heuristic 1.
The Idea is to find the intersection or overlap between the moves that both players can make. If the player has move degree of freedom return a positive score else return a negative score.
If the intersection is not present we score the board according to Heuristic 1.
We want the agent to pick more aggressive moves so we add a weight of 10 in the score if an intersection is present.

Heuristic 3 – Trivial Lookup
In the Third heuristic, we realized that ideally we want to make a few predefined opening moves.

Play aggressively in the middle and then let the opponent commit mistakes towards the end.

Translating that into a scoring mechanism –

1- For First Three moves – Play closer to the centre.
2- For all the moves between 3 – 10 – Play according to heuristic 2 (aggressive).
3- For the rest of the moves > 10, Play according to heuristic 1 (maximize your moves and minimize the opponent moves).

Comparison of Heuristics with AB_Improved

	AB_Improved	One - Degree of Freedom	Two - Look for Overlap	Three - Trivial Look Up
Result	60%	**68.60%**	54.30%	65.70%

The comparison points to Heuristic 1 or Heuristic 3 are our best heuristics.

Results and Preferred Heuristic

I would like to recommend **the heuristic number 3 – Trivial Look Up**

1- It resembles how a human would strategize his play the problem
    a. Starts with predefined moves.
    b. Attack while you can during the middle part of the game
    c. Towards the end when the legal moves are less – It ensures the agent Takes positions where it can have maximum freedom.
2- It combines the best elements of the other 2 heuristics
3- Speed of the heuristic is faster because of initial look up we have introduced
4- It is more logical implementation – Combines aspects of memory (Look up), attack and defence.
5- Performance against the AB_Improved heuristic is much better than the rest.