# BUILD AN ISOLATION GAME PLAYING AGENT :

## 1 INTRODUCTION

In this project, we develop an AI agent for playing the game of Isolation. Isolation is a two-player game played on a rectangular grid of positions where both players take turns to move their piece and the first player who runs out of available moves loses the game. The positions occupied in previous moves are blocked for all future moves.

The main objectives of this project are:

• Implement Minimax algorithm for searching the game tree.

• Implement Alpha-Beta pruning to improve the efficiency of the minimax game tree search.

• Develop heuristic evaluation functions that perform comparably or better than the provided heuristic evaluation functions.

2 HEURISTIC EVALUATION FUNCTIONS

We propose three different heuristics in addition to the ones provided in the starter package for the project. The heuristic evaluation functions provided to us are described as follows:

• Null Score: This function returns 0 for all game board states which are non-terminal states.

• Open Moves Score: This function returns the number of moves available to player in a given board state as the score for non-terminal states.

• Difference of Open Moves Score (Improved): This function returns the difference in the number of moves available to the player and the opponent player in a given board state as the score for non-terminal states.

The proposed heuristic evaluation functions are described as follows:

• Weighted Open Moves (H1): The idea here is to modify the Open moves score heuristic provided to us by weighting each open move by a weight that depends on the position the move leads to on the game board. The motivation is that positions in the center of the board provide more open moves than those near the edges. The weight for a position is set as the maximum number of moves available from that position on the board

• Difference in Weighted Open Moves (H2): In this heuristic, we calculate the difference in the weighted open moves scores (H1) between the current player and its opponent and use that as the score of the current game state.

• Difference in Open Moves One Ply Ahead (H3): The difference in the number of available moves between the current player and its opponent one ply ahead in the future is used as the score of the current game state. 3 RESULTS The performance of the Isolation playing AI agents is evaluated using a tournament setup which consists of a Random AI agent that moves randomly and a set of AI agents utilizing minimax search (MM) and minimax with alpha-beta pruning (AB) search algorithms with fixed