AI Player Implementation and Heuristic Description

The AI Player is designed as a class with multiple methods to facilitate strategic gameplay in a Connect Four scenario. Utilising the alpha-beta pruning algorithm, the player aims to optimise its decision-making process, enhancing its chances of success by efficiently exploring and evaluating potential moves.

1. Implementation of Alpha-Beta Pruning

The alpha_beta_pruning technique effectively explores and assesses possible actions by employing the alpha-beta pruning algorithm. It makes decisions based on knowledge about players, board condition, and current depth.

2. Acquire Alpha-Beta Action

The alpha-beta pruning algorithm is called with a specified depth, alpha, and beta values using the get_alpha_beta_move method. It gives back the suggested column's index for the following move, displaying the strategic judgement of the AI.

3. Expectimax Implementation

An alternate method of making decisions is the {expectimax} method, which uses the expectimax algorithm. This method provides a novel gameplay strategy by taking into account the opponent's probability plays.

4. Get Expectimax Move

The expectimax algorithm is called via the get_expectimax_move method, which offers a suggested move based on the probabilistic assessment of possible outcomes. By using this technique, the AI can adjust to competing against an unknown player.

5.Evaluation and Scoring

 The eval method calculates a score for a given window of the game board, considering various patterns. The evaluation_function method uses these scores to assess the overall utility of the current board state for the AI player.

6. Heuristic Description:

The heuristic approach used by our AI entails assessing the board according to various criteria, including centre column control, winning sequence preparation, piece alignment, and blocking the opponent's winning moves. The AI makes decisions based on these factors in order to maximise the chances of success.For moving pieces, it employs expectimax algorithms and alpha beta pruning.

Performance with Different Time Constraints: -

Limited Time: Focuses on immediate advantages.
Moderate Time: Considers future scenarios.
Extended Time: Thoroughly analyses options, balancing thinking and acting.

Performance Analysis with Self-Play:

When playing self-play situations, the player who goes first frequently gets a small edge that affects how the game turns out. Experiments

show that the first player usually wins more games, highlighting the significance of early, calculated actions.

Taking the initiative increases the chances of success by giving you a tactical advantage.

This AI implementation shows how to play Connect Four in a flexible and strategic way, displaying its adaptability to various algorithms, time limits, and self-play scenarios.