**AI PROJECT PROPOSAL**

**Multiplayer Checkers (3 or 4 Players)**

**SECTION: 6H**

**Members:**

**22K-4320 Marium Arif**

**22K-4159 Rania Ghazanfar**

**22K-4148 Shayan**

**1. Introduction:**

**Game/Puzzle Overview:**

Multiplayer Checkers is an extended version of the classic two-player checkers game, designed for 3 or 4 players. The game is played on a modified checkerboard, where each player controls a set of pieces and aims to eliminate opponents' pieces or strategically position their own to achieve the goal state. The game introduces additional rules, constraints, and dynamics to accommodate the increased number of players, making it more complex and engaging.

**Heuristic Rules and Constraints:**

* Board Configuration: The checkerboard is expanded to accommodate 3 or 4 players. For 3 players, a hexagonal or triangular board may be used, while a standard square board can be partitioned for 4 players.
* Piece Movement: Pieces move diagonally, similar to traditional checkers. Capturing opponent pieces is mandatory when possible.
* Winning Condition: The goal state is achieved when a player either eliminates all opponents' pieces or reaches a predefined scoring threshold.

**Constraints:**

* Players take turns in a fixed order.
* Multiple captures in a single turn are allowed.
* A piece that reaches the farthest row (king row) is crowned a "king" and gains additional movement capabilities.

**Lifelines:**

Players may have a limited number of lifelines (e.g., undoing a move or protecting a piece) to add strategic depth.

**2. Implementation Strategy**

**Algorithms:**

The implementation will leverage advanced AI algorithms to enable intelligent gameplay and decision-making. Two primary algorithms will be explored:

**Monte Carlo Tree Search (MCTS):**

* MCTS will be used to simulate random game states and evaluate the best possible moves based on statistical outcomes.
* This algorithm is particularly effective in games with high branching factors, as it balances exploration and exploitation.

**Minimax with Alpha-Beta Pruning:**

* Minimax will be employed to evaluate game states by minimizing potential losses and maximizing gains.
* Alpha-beta pruning will optimize the search by reducing the number of nodes evaluated, making it computationally efficient.

**3. Deliverables**

**Goal State:**

* The primary goal is to eliminate all opponents' pieces or achieve a predefined scoring threshold.
* Secondary goals may include maximizing the number of kings or controlling key board positions.

**Lifelines:**

* Protect Piece: Save a piece from being captured in the next turn.
* Double Move: Make an additional move in the same turn.

**Game States:**

* Initial State: The board is set up with pieces in their starting positions.
* Intermediate States: Players take turns to move pieces, capture opponents, and crown kings.
* Terminal State: The game ends when a player achieves the goal state or all lifelines are exhausted.