## **Project Title:** 9x9 Checkers

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## **Course: AI**

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## **1. Project Overview**

**Project Topic:**"9x9 Checkers with AI using Minimax, Alpha-Beta Pruning"

**Objective:**

* Develop a strategic AI capable of playing an enhanced version of Checkers.
* Implement AI techniques that allow for efficient decision-making in a larger state space.
* Optionally support Computer vs. Computer play.

## **2. Game Description**

**Original Game Background:**Traditional Checkers is an 8x8 board game with standard movement and capture rules. Increasing the grid size to 9x9 enhances complexity and strategic depth.

**Innovations Introduced:**

* **Larger board (9x9)** leading to more tactical possibilities.
* **New winning condition**: Capture all opponent’s pieces or block them from moving.
* AI with **Minimax and Alpha-Beta Pruning** to improve efficiency.

## **3. AI Approach and Methodology**

**Techniques Used:**

* Minimax Algorithm (for optimal decision-making).
* Alpha-Beta Pruning (for performance optimization).
* Depth-Limited Minimax (to control computation in large state spaces).

**Heuristic Design:**

* Prioritize moves that lead to captures or block the opponent.
* Assign higher scores to multiple-jump opportunities.
* Positional evaluation.

**Complexity Analysis:**

* The search space is exponentially larger than 8x8 Checkers.
* Alpha-Beta Pruning helps reduce computational overhead.

## **4. Game Rules and Mechanics**

**Modified Rules:**

* The board is **9x9**, not 8x8.
* Standard Checkers movement applies with slight variations for balance.

**Winning Conditions:**

* A player wins when they **capture all opponent pieces** or **block all legal moves**.

**Turn Sequence:**

* Players take turns moving their pieces.
* The AI follows Minimax/Alpha-Beta to make strategic moves.

## **5. Implementation Plan**

**Programming Language:** Python  
**Libraries and Tools:**

* **Pygame** for GUI.

**Milestones:**

* **Week 1-2:** Game board setup & rule implementation.
* **Week 3-4:** Minimax AI logic.
* **Week 5-6:** GUI and AI integration.
* **Week 7:** Optimization and testing.
* **Week 8:** Final testing and report.