**National University of Computer and Emerging Sciences, Karachi**  
 **FAST School of Computing, Spring 2025**

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**Project Report: AI-Based Board Game - Territory Conquest**

**Group Members:**

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**1. Project Title**

AI-Based Board Game: Territory Conquest

**2. Introduction**

This project aims to develop an AI-driven board game based on territory conquest, where two players compete to acquire more tiles and accumulate points. The game features an aesthetically appealing display with dynamic animations and engaging gameplay mechanics.

**3. Objectives**

* Develop a strategic board game that challenges players to expand their territory.
* Implement AI-based decision-making for different difficulty levels.
* Introduce multiple game modes, including AI vs. AI and AI vs. Human.
* Enhance gameplay experience with dynamic power-ups and speed variations.
* Ensure an engaging and visually appealing UI/UX for an immersive experience.

**4. Features**

* **Game Modes:**
  + AI vs. AI: Two AI models competing against each other.
  + AI vs. Human: Player competes against an AI-controlled opponent.
  + Potential additional modes to be introduced in future updates.
* **Power-ups:**
  + Freeze: Temporarily restricts opponent movement.
  + Bonus Points: Adds extra points to a player's score.
  + Power-ups appear dynamically based on game difficulty and timing.
* **Difficulty Variations:**
  + Normal Mode: Standard AI behavior.
  + Hard Mode: AI makes more optimized moves and reacts faster.
  + Speed variation: The difficulty will determine how fast the game progresses.
* **Visual & Aesthetic Appeal:**
  + Smooth animations and visually appealing board design.
  + Interactive UI with real-time updates and game progress indicators.

**5. Technical Stack**

* **Programming Language:** Python
* **Frameworks:** Pygame (for game rendering)

**6. Implementation Using Pygame**

Pygame is a Python library used for developing 2D games and multimedia applications. It provides modules for handling graphics, animations, sounds, user input, and event-driven programming. We will use Pygame to implement the **Territory Conquest** game with the following approach:

* **Game Board and Rendering:**
  + The board will be a grid-based system where players compete for territory.
  + Pygame’s Surface and Rect modules will be used to render and update board tiles dynamically.
  + Animations will be implemented using Clock and update() methods.
* **Player & AI Mechanics:**
  + User input (keyboard/mouse) will be handled via pygame.event.get().
  + AI will use decision-making algorithms like **Minimax** or **Reinforcement Learning** to make strategic moves.
  + Difficulty levels will be adjusted by modifying AI response time and decision efficiency.
  + The AI will utilize the **Minimax algorithm with Alpha-Beta Pruning** to evaluate optimal moves.
* **Game Modes & Logic:**
  + AI vs. AI mode will have two AI models competing based on predefined strategies.
  + AI vs. Human mode will allow a player to interact with the game while the AI responds dynamically.
* **Power-Ups & Effects:**
  + Special power-ups like Freeze and Bonus Points will be randomly placed using **Pygame’s random module** and triggered upon interaction.
  + Timed events will be managed using pygame.time.set\_timer() to introduce dynamic gameplay elements.
* **User Interface & Experience:**
  + The UI will include animations for transitions, score updates, and player actions.
  + Pygame’s **Font module** will be used to display scores and game messages.
* **Testing & Optimization:**
  + Debugging tools will be used to resolve gameplay bugs.
  + Performance optimization will be done using Clock.tick() to ensure smooth frame rates.

**7. Expected Outcomes**

* A fully functional AI-driven board game with strategic depth.
* Enhanced gameplay experience with power-ups and difficulty variations.
* An engaging and visually appealing interface for players.
* AI opponents with adaptive decision-making strategies.