

Proposal Template

Project Title: Tower Trek

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Course: AI

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1. Project Overview

● Project Topic:

Tower Trek is a vertical board-based strategy game where players race to the top of a tower while using special powers to block or sabotage opponents. The game introduces a new form of tactical play with power-ups, traps, and multi-directional movement on a vertical 2D grid.

● Objective:

To develop a strategic AI for Tower Trek using a multi-agent Minimax algorithm with Alpha-Beta Pruning, allowing the AI to make smart decisions involving movement, power usage, and position evaluation.

2. Game Description

● Original Game Background:

Tower Trek is an original game designed for this project. It blends elements of vertical progression (like Snakes and Ladders) with strategic turn-based gameplay.

● Innovations Introduced:

- Power-based turn mechanics (push, teleport, shield, double jump).
- Randomized tiles including traps and boosts.
- Heuristic evaluation for AI moves based on multiple factors.
- Increased complexity with tactical positioning and power usage.
- Multiplayer support (2-4 players) with AI-controlled opponents.

3. AI Approach and Methodology

● AI Techniques to be Used:

- Minimax Algorithm (multi-agent extension)
- Alpha-Beta Pruning
- Optional: Reinforcement Learning (for training AI to use powers efficiently)
- Optional: Monte Carlo Tree Search for move simulation.

● Heuristic Design:

- Distance to top

- Number of boosts and traps in path
- Shield and danger status
- Opponent proximity
- Potential of power usage.
- Complexity Analysis:
 - Time complexity increases with number of players and board size.
 - Power decisions and tile randomness add branching factor.
 - Pruning and heuristics will help reduce computation.

4. Game Rules and Mechanics

- Modified Rules:
 - Players move in any direction (up, down, left, right) within board limits.
 - Each turn, players can move once and use one power.
 - Tiles are randomized with effects (boost/trap).
- Winning Conditions:
 - First player to reach the top row wins.
 - In case of tie, player closest to center wins.
- Turn Sequence:
 - Each player takes one turn per round.
 - Turn consists of movement and optional power usage.

5. Implementation Plan

- Programming Language: Python
- Libraries and Tools:
 - Pygame (for GUI)
 - NumPy (for data handling)
 - Random (tile generation)
 - Optional: TensorFlow or Scikit-learn for RL.
- Milestones and Timeline:
 - Week 1-2: Game design and rule finalization
 - Week 3-4: AI strategy development (Minimax and heuristics)
 - Week 5-6: Coding and testing the game mechanics
 - Week 7: AI integration and testing
 - Week 8: Final testing and report preparation

6. References

- Game AI Pro (Book)
- AI algorithms documentation (GeeksForGeeks, TowardsDataScience)
- Pygame and Python docs