**Tower Trap – Final AI Project Report**

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 **Course:** AI  
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### **1. Project Summary**

Tower Trap is an original and unconventional 3-player board game implemented in Python using Pygame. The game introduces hidden traps, simple turn-based mechanics, and an intelligent AI agent powered by the Minimax algorithm. The project explores multi-agent interaction, heuristic evaluation, and rule-based decision-making.

### **2. Game Concept**

Each player starts with a single tower on a triangular board of 15 connected cells. On their turn, a player can either move to an adjacent cell or place a trap on any unoccupied cell. Any player who moves onto a trap — including their own — is immediately eliminated. The last surviving player wins.

Key mechanics:

* Unlimited traps allowed per player.
* AI plays as Player 3 (blue), while Players 1 and 2 are human-controlled.
* Traps are not visible to opponents.
* Turns rotate in clockwise order; eliminated players are skipped.

### **3. AI Design**

**Algorithm:** Minimax (depth = 2)  
 **Evaluation Function:**

* +10 per surviving AI tower
* +5 for adjacency to enemy towers (offensive opportunity)
* -3 if the AI tower is surrounded (defensive risk)

**Behavior:**

* AI avoids traps when possible.
* It chooses between movement or trap placement strategically.
* AI accepts death when no safe move is available, ensuring fair rules.

### **4. Implementation Details**

**Language:** Python  
 **Graphics:** Pygame  
 **Core Modules:**

* Game board creation (triangular logic)
* Movement validation
* Trap placement system
* AI decision using Minimax with heuristic
* Turn management and elimination detection

**File:** project.py  
 **Demo Video:** AI-Demo video.mkv

### **5. Testing & Validation**

We tested the system with multiple player configurations:

* Trap placement in random and strategic zones
* AI cornered by traps (suicide behavior verified)
* Turn skipping for eliminated players
* Equal rule enforcement across AI and humans

The AI consistently made logical, survivable choices and used trap placement offensively.

### **6. Final Remarks**

This project demonstrates:

* Multi-agent turn-based design
* Real-time AI decision-making
* Heuristic use in a non-deterministic board setting

Tower Trap is a simple yet strategic game. The AI acts fairly and is competitive under the same rules as human players. It was a valuable learning experience in applying AI to interactive, adversarial gameplay.