Project Title: HYST - Heist Your Stolen Treasure
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Course: AI
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1. Project Overview

Project Topic:

HYST is a competitive multiplayer digital board game where players take on the role of thieves hired to rob a museum. However, only one thief will walk away with the reward. The objective is to steal the diamond from the museum's center and escape through the entrance from which the player originally entered. The museum is a randomly generated maze filled with traps, surveillance systems, and armed guards. Players roll dice to sneak around the maze and can use action cards to either hinder opponents or pass obstacles. AI integration will enhance dynamic trap placements, player behavior predictions, and game balancing.

Objective:

The project aims to develop an AI-driven strategic experience by utilizing reinforcement learning techniques to dynamically adjust difficulty, predict player moves, and control NPC security systems within the game. The AI will also be responsible for maze generation and adapting in-game challenges to players' actions.

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2. Game Description

Original Game Background:

HYST is an original game concept combining elements of strategy, turn-based movement, and competitive sabotage. Players navigate a randomly generated museum while avoiding traps, triggering obstacles, and outmaneuvering opponents to steal the diamond and escape.

Innovations Introduced:

- **Procedural Museum Generation:** Each game features a unique randomized maze with multiple pathways, requiring strategic movement planning.

- **AI-Controlled Surveillance:** AI dynamically adjusts the difficulty of security measures based on player actions.
- **Adaptive AI Guards:** AI-driven NPCs can act as guards, reacting to player movements and creating dynamic challenges.
- **Reinforcement Learning for AI Balancing:** AI adapts its strategy over multiple sessions to make the game fair yet challenging.

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3. AI Approach and Methodology

AI Techniques to be Used:

- **Minimax Algorithm:** Used for AI-driven NPC security guards, calculating optimal moves.
- **Reinforcement Learning:** AI learns from past player strategies and adapts difficulty accordingly.
- **Procedural Maze Generation Algorithm:** Ensures unique layouts each round for replayability.
- **Pathfinding Algorithms (A* or Dijkstra's Algorithm):** AI security guards and NPCs navigate effectively.

Heuristic Design:

- AI will evaluate board states by prioritizing pathways to the diamond, tracking opponent movements, and setting up strategic obstacles to challenge players.
- Dynamic difficulty adjustment based on player success/failure rate.

Complexity Analysis:

- The use of procedural generation and reinforcement learning will require computational resources for real-time decision-making.
- Balancing AI difficulty will be a key challenge, requiring iterative testing.

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4. Game Rules and Mechanics

Modified Rules:

- Players roll dice to move in a turn-based system.
- If a player is caught by the guard, they must return to their starting point.
- The diamond can be stolen from other players if they are within range.

- Players can use a limited number of steps to perform actions such as use a flashbang or go camouflage.

Winning Conditions:

- The first player to successfully steal the diamond and exit through their original entrance wins.

Turn Sequence:

1. Roll dice to move.
2. Move and use steps strategically.
3. AI determines security responses (guard movement).
4. Continue turns until a player successfully escapes with the diamond.

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5. Implementation Plan

Programming Language: Python

Milestones and Timeline:

- **Week 1:** Define core mechanics and game structure.
- **Week 2:** Implement AI-driven maze generation and pathfinding.
- **Week 3:** Develop AI strategies..
- **Week 4:** Integrate AI with game mechanics and playtesting.
- **Week 5:** Final testing, optimization, and documentation.