

# Snakes and Ladders with Prediction Challenge

## Submitted By:

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## 1. Project Overview

### Project Topic:

This project aims to create a modified version of the traditional Snakes and Ladders game, introducing strategic elements like prediction-based moves and resource management. Players predict dice outcomes to gain advantages, such as skipping turns or earning token points to neutralize snakes.

### Objective:

The main goal is to enhance the strategic depth of Snakes and Ladders by integrating prediction mechanics and token-based resource management, making the game more engaging and less reliant on luck alone.

## 2. Game Description

### Original Game Background:

Snakes and Ladders is a simple board game where players move based on dice rolls, climbing ladders to advance and sliding down snakes to move back. The first player to reach the last square wins.

### Innovations Introduced:

- **Prediction Challenge:** Players predict the dice outcome before rolling. Correct predictions offer strategic choices.
- **Token System:** Players earn tokens for correct predictions, which can be used to neutralize snakes based on their size.

- **Opponent Interaction:** Opponents predicting correctly can skip a player's turn or force them to move backward.
- **Enhanced Strategy:** These changes add a layer of decision-making, reducing reliance on luck.

### 3. AI Approach and Methodology

#### AI Techniques to be Used:

- **Minimax Algorithm:** Adapted for multiplayer scenarios to optimize move predictions.
- **Alpha-Beta Pruning:** To improve efficiency in decision-making for AI opponents.
- **Reinforcement Learning (Optional):** For AI to learn optimal prediction strategies based on past games.

#### Heuristic Design:

- **Prediction Accuracy:** Heuristics will evaluate the likelihood of each player's prediction being correct.
- **Token Management:** Heuristics for when to spend tokens to neutralize snakes.

#### Complexity Analysis:

- **Time Complexity:** Minimax with Alpha-Beta Pruning reduces complexity in multi-player settings.
- **Challenges:** Integrating prediction and resource management into AI decisions.

### 4. Game Rules and Mechanics

#### Modified Rules:

##### 1. Prediction Mechanic:

- Before each turn, players predict the dice outcome.
- Correct opponent predictions allow them to skip a turn or earn tokens.
- Multiple correct predictions: One skips the turn, another moves the player backward by the dice roll.

## **2. Token Usage:**

- Tokens can neutralize snakes based on their size.
- Larger snakes require more tokens.

## **3. Current Player Advantage:**

- Correct prediction allows either a bonus roll or additional tokens.

## **Winning Conditions:**

- First to reach the last square wins, with prediction and token usage influencing the path.

## **Turn Sequence:**

1. Prediction phase for all players.
2. Dice roll and movement based on predictions.
3. Token spending option if a snake is encountered.

## **5. Implementation Plan**

**Programming Language:** Python

### **Libraries and Tools:**

- Pygame or Tkinter: For GUI.
- NumPy: For data handling.

### **Milestones and Timeline:**

- **Week 1-2:** Game design and rule finalization.
- **Week 3-4:** AI strategy (Minimax and heuristics).
- **Week 5-6:** Coding and testing mechanics.
- **Week 7:** AI integration and testing.
- **Week 8:** Final testing and report preparation.

## 6. References

- Online resources and research papers on game AI.
- Documentation for Pygame and AI algorithms.