**Proposal: Warping Ludo with 5 Players**

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**1. Project Overview**

**Project Topic:**

Warping Ludo with 5 Players: A modified version of Ludo where special warp zones on the board allow pieces to teleport to different locations. Additionally, the game is expanded to support five players instead of the usual four. The AI will play against human opponents in this unpredictable version of Ludo.

**Objective:**

The goal of this project is to develop an AI agent that can play Warping Ludo effectively, making strategic decisions based on warp zones and multiple opponents. The AI will be designed using decision trees and probabilistic modeling to navigate an ever-changing board.

**2. Game Description**

**Original Game Background:**

Ludo is a classic board game where players race to move all four of their pieces from their starting base to the finishing area by rolling a die. Players can capture opponents' pieces, sending them back to their starting position. The first player to get all their pieces to the finish wins.

**Innovations Introduced:**

1. Warp Zones: Certain tiles act as teleporters, instantly moving pieces to different parts of the board.
2. Changing Warp Locations: The warp zones shift every few turns, forcing players to continuously adapt their strategies.
3. Five Players Instead of Four: The board layout is modified to accommodate a fifth player, increasing competition and requiring new strategic considerations.

**Impact on Gameplay:**

* Players must consider not just movement but also the changing warp locations to maximize their advantage.
* The AI must predict optimal moves while accounting for warp zones and increased player interactions.
* A five-player format makes the game more dynamic and less predictable than standard Ludo.

**3. AI Approach and Methodology**

**AI Techniques to be Used:**

* Decision Trees: The AI will evaluate possible moves based on current warp zones and piece positions.
* Probabilistic Modeling: The AI will consider the likelihood of reaching a warp zone and its impact on future turns.
* Game State Evaluation: AI will assess board states to determine optimal strategies for piece movement, capturing, and utilizing warp zones.

**Heuristic Design:**

* Piece Safety: AI will prioritize keeping pieces in safe zones while avoiding risky positions.
* Warp Advantage: AI will strategically use warp zones to advance its pieces faster than opponents.
* Capture Probability: The AI will calculate when it's advantageous to capture an opponent's piece vs. progressing toward the finish.

**Complexity Analysis:**

* The standard Ludo state space grows exponentially with five players.
* Changing warp zones add another layer of complexity, requiring the AI to frequently recalculate move values.
* A mix of rule-based decision-making and Monte Carlo simulations will be used to balance efficiency and strategy.

**4. Game Rules and Mechanics**

**Modified Rules:**

1. The game is played by five players instead of four.
2. Warp Zones are placed on the board and change location every three turns.
3. A player landing on a warp zone teleports to a linked location.
4. Standard Ludo rules still apply for movement, capturing, and winning.

**Winning Conditions:**

* The first player to move all four of their pieces to the finish wins.

**Turn Sequence:**

1. A player rolls the die and moves a piece.
2. If the piece lands on a warp zone, it teleports.
3. After every three turns, warp zones change positions.
4. The next player takes their turn.
5. Repeat until a winner is determined.

**5. Implementation Plan**

**Programming Language:**

* **Python**

**Libraries and Tools:**

* Pygame (for graphical interface)
* NumPy (for handling board transformations)
* AI Libraries: Custom implementation of decision trees and Monte Carlo methods

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| **Week** | **Task** |
| **1-2** | Design game board and finalize rules |
| **3-4** | Implement game logic and warp zone mechanics |
| **5-6** | Develop and test AI decision-making |
| **7** | Integrate AI with the game and run test cases |
| **8** | Final testing and project report |