DEPARTMENT OF
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SEMESTER III
ARTIFICIAL INTELLIGENCE LABORATORY
MINI PROJECT REVIEW

<NIM GAME USING AI>

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PROBLEM STATEMENT

- The Nim Game is a mathematical strategy game involving several piles of stones (or objects).

- Two players take turns removing one or more stones from a single pile on each turn.

- The player who removes the last stone from the board wins the game (Normal Play Rule).

- The goal of the project is to design an AI agent that plays Nim optimally using the Nim-sum (XOR) strategy.

- The system allows modes like Human vs AI, Human vs Human, and AI vs AI, showcasing AI's ability to make perfect strategic moves.

- The project demonstrates how game theory and bitwise operations can be applied in Artificial Intelligence for decision-making.

THEORETICAL BACKGROUND

- It is based on Game Theory, focusing on logical and optimal decision-making.

- The solution uses the Nim-sum (XOR) of all pile sizes to determine winning and losing positions.

- If Nim-sum = 0, the player is in a losing state; otherwise, a winning move exists.

- The AI applies this Nim-sum algorithm to always make the optimal move.

- Nim game is a combinatorial strategy game where players alternately remove objects from piles.

IMPLEMENTATION AND CODE

- Link to code in Git-hub Repository

List	Git-hub Repository Links
Implementation of Code Link	https://github.com/Anbuselvan-dev/AI-FINAL-MINI-PROJECT/commit/7f61419d6ab8d72157f84d704b668d0ca21165ea
Word Document Report Link	https://github.com/Anbuselvan-dev/AI-FINAL-MINI-PROJECT/commit/b9fdc18947387819ef0bce712dedeee5e2525bb8
PPT Link	https://github.com/Anbuselvan-dev/AI-FINAL-MINI-PROJECT/commit/8f32d915def32d72ed87b120a990afaddf852130

OUTPUT

```
Mode (1=H vs AI, 2=H vs H, 3=AI vs AI) [default 1]: 1
Enter piles as space-separated integers (press Enter for default 3 4 5): 3 4 5
Starting piles:
Piles: [0]:3 [1]:4 [2]:5
Piles: [0]:3 [1]:4 [2]:5
Enter 'pile_index remove_count' (e.g. '1 3'): 2 5
Piles: [0]:3 [1]:3 [2]:0
Enter 'pile_index remove_count' (e.g. '1 3'): 1 4
Pile 1 only has 3 stones.
Piles: [0]:3 [1]:3 [2]:0
Enter 'pile_index remove_count' (e.g. '1 3'): 0 3
Game over. Player 1 wins!
PS C:\Users\Lenovo\OneDrive\Desktop\AI MINI PROJECT>
```

RESULTS

- The Nim Game was successfully implemented in Python with modes for Human vs AI, Human vs Human, and AI vs AI.
- The AI uses the Nim-sum (XOR) logic to make perfect, unbeatable moves.
- The game clearly displays pile states, moves, and the winner.
- Future upgrades include adding a GUI, Misère mode, and score tracking for better gameplay experience.
- A web-based version can also be developed for online play.

REFERENCES

- Wikipedia article on **Nim Game** – for understanding the mathematical and game theory principles.

- YouTube video titled **"Nim Game Explained | Game Theory | XOR Trick"** – for visual explanation of optimal strategy.

- GeeksforGeeks article on **Nim Game in Python** – for logic and implementation guidance.

- **ChatGPT (OpenAI)** – used to understand theoretical background, generate the Python code, and refine project documentation.