Tic Tac Toe AI Using Minimax Algorithm - Final Report

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# 1. Summary

This project involved creating an AI agent that plays Tic Tac Toe using the Minimax algorithm, guaranteeing optimal decisions. The final implementation allows a user to play against the AI in a Python-based interface.

# 2. Methodology

The Minimax algorithm was implemented recursively. The AI evaluates all possible future game states and chooses the move that maximizes its chance of winning (or forces a draw if it cannot win). Each state is scored as:  
- Win = +1  
- Loss = -1  
- Draw = 0

# 3. Challenges and Solutions

- Handling ties and full-board conditions: Solved by checking available spaces after each move.  
- Performance optimization: Not critical due to the small state space of Tic Tac Toe.  
- Game logic testing: Repeated testing with various move combinations ensured robustness.

# 4. Results

The AI performs as expected:  
- Never loses  
- Forces a draw when it can't win  
- Responds instantly  
  
Sample runs showed that the AI could consistently beat or draw with any user input.

# 5. Future Work

- Add GUI using pygame or tkinter.  
- Extend to 4x4 Tic Tac Toe using alpha-beta pruning.  
- Analyze and compare with reinforcement learning for larger boards.