Spike: 04
Title: Graphs, Search & Rules

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Goals / deliverables:

1. Tic-tac-toe code modified to represent the game state as a graph.
2. An AI that randomly searches the graph
3. An AI that improves the efficiency of a basic random search
4. An AI that improves the effectiveness of a basic random search

Technologies, Tools, and Resources used:

- Python 3.11
- Visual Studio Code
- AI strategy planning

Tasks undertaken:

- Designed the software architecture on paper
- Created board representation and render function
- Implemented the game loop (input, update, render)
- Developed random_ai() for random move selection
- Developed minimax_ai() for optimal play
- Created a function to simulate AI vs AI battles
- Documented the software design
- Created and tested all features in Python

What we found out:

Screenshot 1: Game Startup & State Generation

```
sk\ 2\ -\ Graph,\ Search\ \&\ Rules
marcogiacoppo@Marcos-MacBook-Pro Assignment 2 Task 2 - Graph, Search & Rul
es % python3 main.py
5478 game states generated.

      |   |
   -----------
      |   |
   -----------
      |   |

The current player is: X
Player 1 (X) - Enter your move (1-9):
```

This demonstrates the successful use of graph-based state generation via adjacency list.

Screenshot 2: Mid-Game Interaction

```
The current player is: X
Player 1 (X) - Enter your move (1-9): 5

     |   |
  -----------
     | X |
  -----------
     |   |

The current player is: O
AI (O) chooses position 1

   O |   |
  -----------
     | X |
  -----------
     |   |

The current player is: X
Player 1 (X) - Enter your move (1-9): 2

   O | X |
  -----------
     | X |
  -----------
     |   |

The current player is: O
AI (O) chooses position 8

   O | X |
  -----------
     | X |
  -----------
     | O |

The current player is: X
Player 1 (X) - Enter your move (1-9):
```

Highlights turn-based logic and AI decision-making using Minimax to choose the best spot.

Open issues/risks [Optional – **remove** heading/section if not used!]**:**

- Minimax may be slow on larger boards
- No input validation for non-integer human input