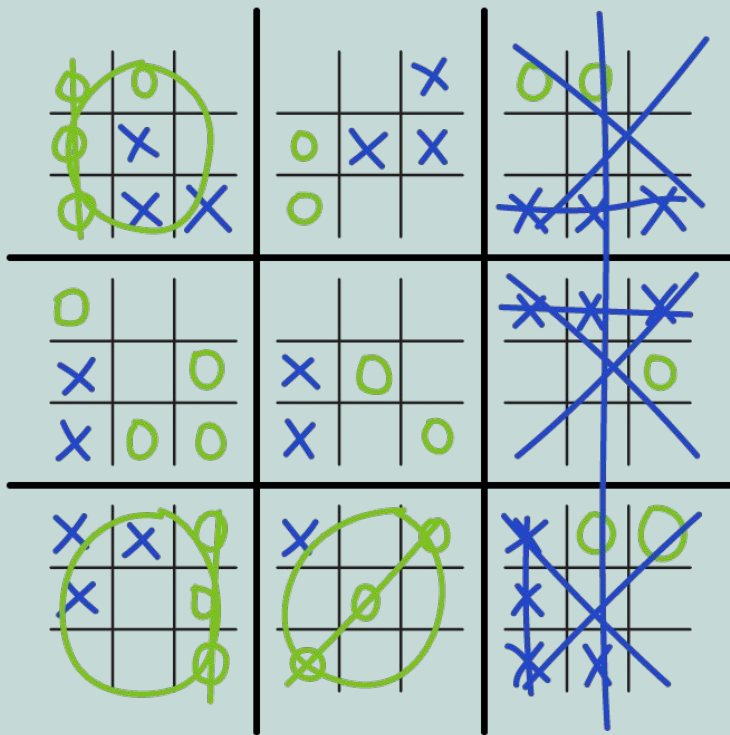




Artificial Intelligence 1st Project Checkpoint

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Ultimate Tic-Tac-Toe



Overview

A variant of the popular Tic-Tac-Toe game consisting of a 3x3 grid of Tic-Tac-Toe boards. Players take turns playing on the smaller boards until one wins in the larger board.

Goal

Implement the game, as well as **computer players** that can play it with varying levels of expertise.



Problem Formulation



State

Since the board is a grid of smaller boards, it can be represented as a multidimensional array.

We opted for a 2D string array with three values: 'X', 'O', or the empty string.

Initial State

The 2D array is filled with empty strings.

Objective Test

Verify if any of the players has won the big board (**win**) or if there are no legal moves remaining (**draw**).

Operators

Preconditions

The rules of Tic-Tac-Toe apply. As such, the players:

- Take turns placing their marks on empty tiles.
- Can only play in the small board dictated by their opponent's last move.
 - Unless it has already been won, in which case the player can choose.

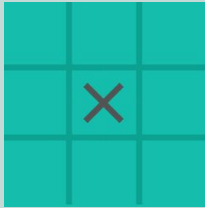
Cost

All moves have the same cost.



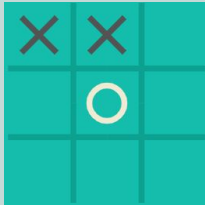
Heuristics

The standard heuristics from Tic-Tac-Toe apply to both the big and small boards.



Middle

Capturing the middle board presents the most victory opportunities.



2 out of 3

Capturing two boards in a winning pattern that is not blocked creates a strong threat.

Blocking

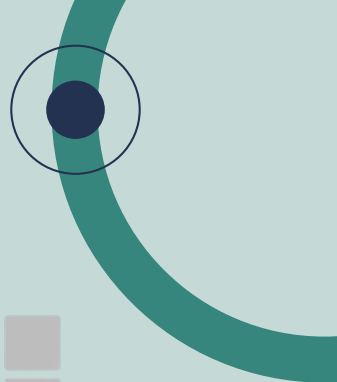
Preventing the opponent from making advantageous moves should be rewarded.



Traps

Forcing the opponent to play in boards where they have a weak presence is crucial.





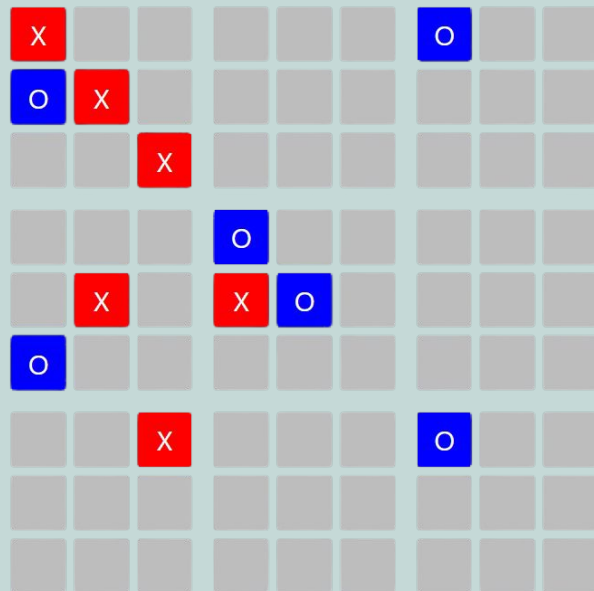
Current Progress

Technologies

- Opted for React with TypeScript.

Game

- Implemented the game state.
 - Used a 2D string array to represent the tiles, as well as a string array for the big board.
 - Implemented valid moves, turns, win conditions, etc.
- Designed the gameplay UI.
 - Designed the big board, small boards, and tiles.
 - Added visual hints to aid the players in understanding the game state.





Bibliography

The following are hyperlinks to the resources we consulted throughout this project:

Technologies

- React
 - [Documentation](#)
 - [Tutorial](#)
 - [Tic-Tac-Toe Tutorial](#)
- TypeScript
 - [Documentation](#)
 - [Documentation for React](#)

Game

- Ultimate Tic-Tac-Toe
 - [Rules](#)
 - [Implementation](#)
 - [Heuristics](#)

Algorithms

- Minimax (w/ Alpha-Beta Pruning)
 - [Video](#)