USING MINIMAX TO MAXIMIZE TIC TAC TOE

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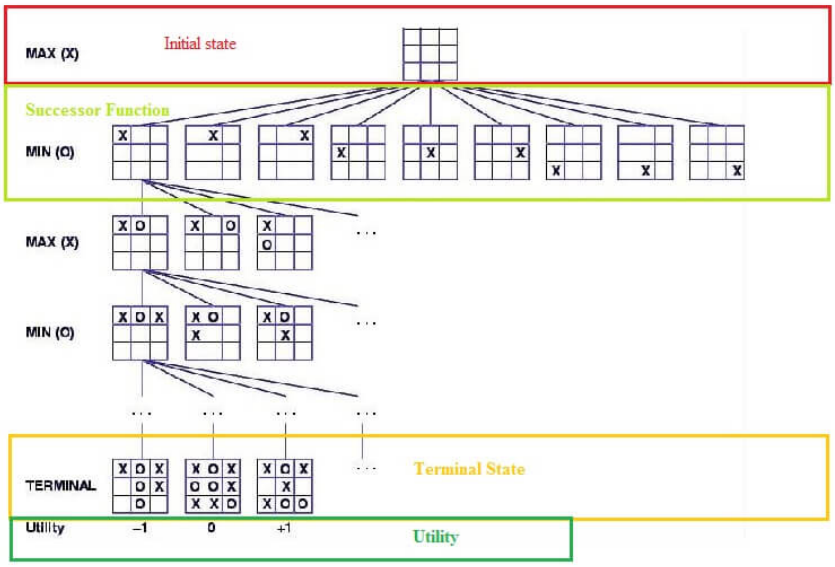
The task at hand is to develop an AI system capable of playing Tic Tac Toe using the minimax algorithm. The primary goal is to create an AI player that possesses the ability to make optimal moves, ensuring a challenging and strategic opponent for human players. By implementing the minimax algorithm, the AI will analyze and evaluate all possible moves, considering both its own potential wins and the opponent's potential moves. This will allow the AI to choose the best possible move, maximizing its chances of victory and providing an engaging and intellectually stimulating experience for anyone who wishes to challenge it.

The chosen method to solve this problem is the minimax algorithm, which is a recursive search algorithm that explores all possible moves and outcomes in a game tree to determine the best move for the AI player. The algorithm evaluates the game state and assigns a score to each possible move, ultimately selecting the move with the highest score. After the game tree has been made, the two players would iterate through each node going from the leaf nodes back to the top. At each layer, alternating players would choose the best value for their objective. As the minimizing player would try and stop the maximizing

player from winning, it would pick the lowest value assigned to the node. While the maximizing player would choose the highest value number, back to the top.



Displays the game tree the AI creates to run through Tic Tac Toe.

For the Tic Tac Toe AI, I decided to represent the game board using a 3x3 grid. The AI player employs the minimax algorithm to search for the best move by simulating all possible moves and outcomes. The AI evaluates the game state and assigns scores based on win/loss/draw conditions.

To evaluate and test the system, various test cases and scenarios can be used. These include playing against the AI multiple times, testing different difficulty levels of the AI player, and analyzing the number of nodes explored by the minimax algorithm. Additionally, conducting multiple playthroughs and tracking win rates and game completion times can provide valuable insights into the system's performance.

	Player 1 (maximizing)	Player 2 (minimizing)	Outcomes – (maximizer)
Game 1	**.5**	**.5**	**Tie**
Game 2	**.5**	**.5**	**Tie**
Game 3	**.5**	**.5**	**Tie**
Game 4	**.5**	**.5**	**Tie**
Game 5	**.5**	**.5**	**Tie**

The effectiveness of the system would depend on the specific implementation and testing conducted. Results can be presented in the form of tables or numerical metrics, such as win rates, draw rates, and average game completion times. Truly showing the effectiveness of the AI. In the data I collected, all games played were ties. This proves that both AI players were both optimal.

Based on the results, if the AI system performs well and demonstrates competitive gameplay, it can be concluded that the chosen methods and implementation choices were successful for the task. Next time, additional features could be added, such as alpha-beta pruning to optimize the minimax search. This would free more memory and increase the speed of the game tree. If more time were available, the AI system could be expanded to support larger board sizes or extended to play other board games. As for ethical implications, in the context of playing Tic Tac Toe, there are no significant ethical concerns.