Report on

AI game using Python (Tic Tac Toe)

Mini Project

TE Electronics & Telecommunication
Semester V

Submitted by

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INTRODUCTION

TIC-TAC-TOE

Tic-tac-toe also known as "Noughts and Crosses", or "Xs and Os" is a paper-and-pencil game for two players, X and O, who take turns marking the spaces in a 3×3 grid. The player who succeeds in placing three of their marks in a horizontal, vertical, or diagonal row is the winner. Because of the simplicity of tic-tac-toe, it is often used as a pedagogical tool for teaching the concepts of good sportsmanship and the branch of artificial intelligence that deals with the searching of game trees.

An early variation of tic-tac-toe was played in the Roman Empire, around the first century BC. The first print reference to "noughts and crosses" appeared in 1858, in an issue of Notes and Queries. In 1952, OXO developed by British computer scientist Alexander S. Douglas for the EDSAC computer at the University of Cambridge, became one of the first known video games. In 1975, tic-tac-toe was also used by MIT students to demonstrate the computational power of Tinkertoy elements.

Permutations and Combinations:-

When considering only the state of the board, and after taking into account board symmetries there are only 138 terminal board positions. A combinatorics study of the game shows that when "X" makes the first move every time, the game is won as follows:

- ➢ 91 distinct positions are won by **(X)**
- ➢ 44 distinct positions are won by **(O)**
- ➢ 3 distinct positions are drawn.

DESCRIPTION

A player can play a perfect game of tic-tac-toe if each time it is their turn to play, they choose the first available move from the following list:

Win: If the player has two in a row, they can place a third to get three in a row.

Block: If the opponent has two in a row, the player must play the third themselves to block the opponent.

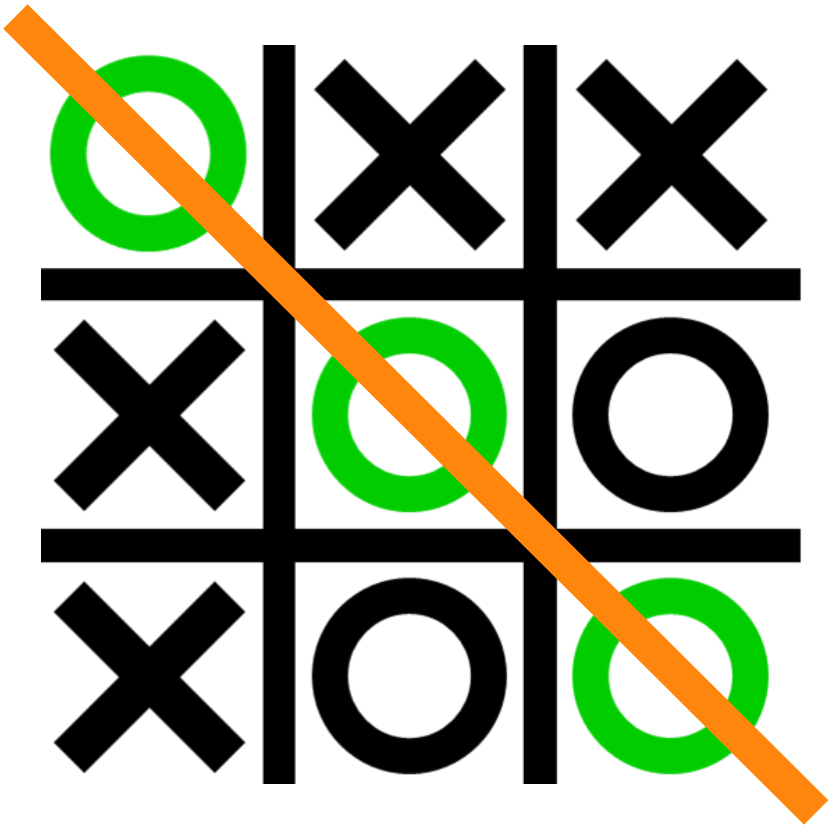
Fork: Create an opportunity where the player has two ways to win.

Center: A player marks the center.

Opposite corner: If the opponent is in the corner, the player plays the opposite corner.

Empty corner: The player plays in a corner square.

Empty side: The player plays in a middle square on any of the 4 sides.



ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is the simulation of human intelligence processes by machines**.** These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction. AI can be categorized as either weak or strong.

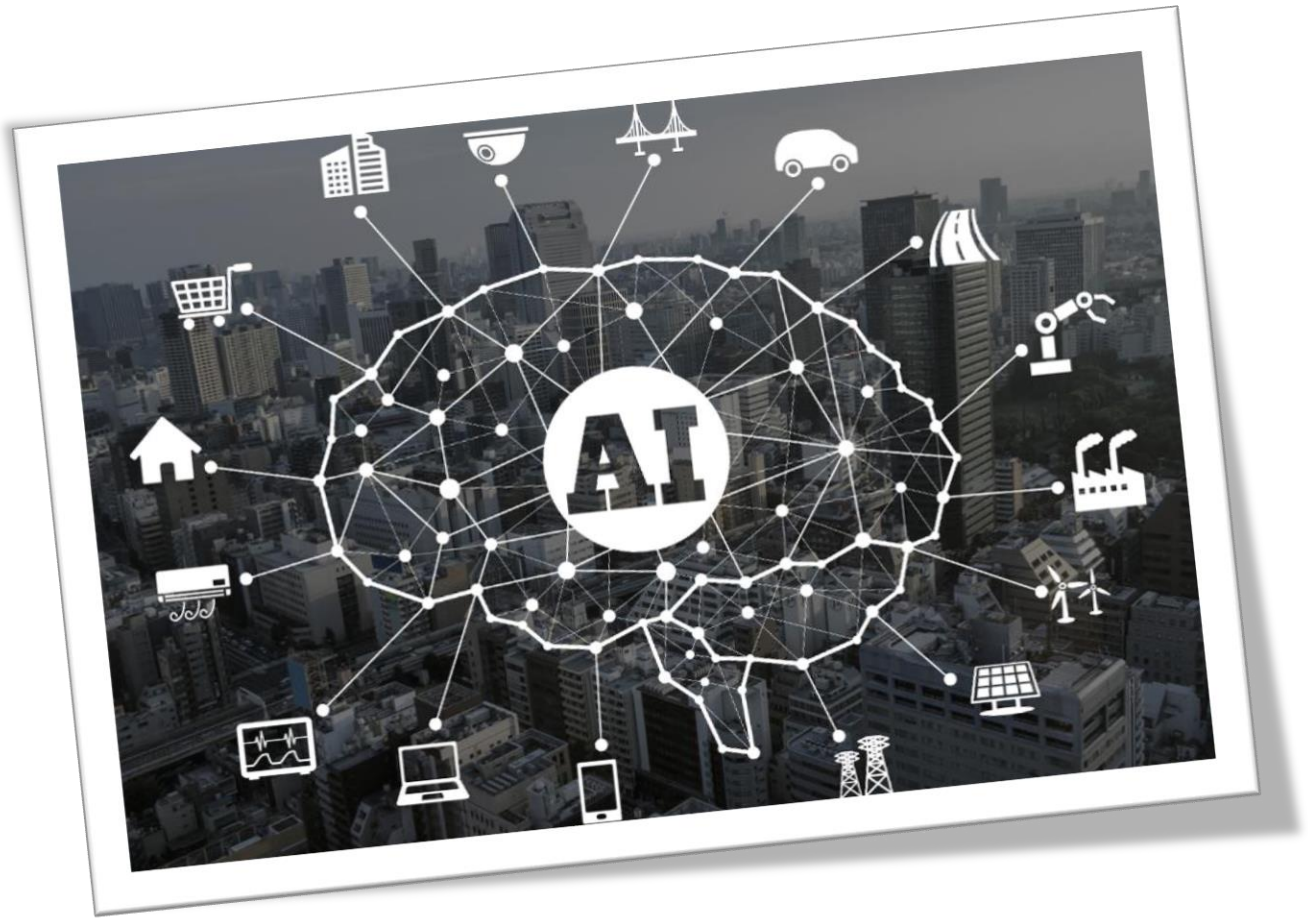
Weak AI, also known as narrow AI, is an AI system that is designed and trained for a particular task. Virtual personal assistants, such as ***Apple's Siri***, are a form of weak AI.

Strong AI, also known as artificial general intelligence, is an AI system with generalized human cognitive abilities. When presented with an unfamiliar task, a strong AI system is able to find a solution without human intervention.

In recent years, the idea of "**hunting**" has been introduced; in this 'hunting' state the AI will look for realistic markers, such as sounds made by the character or footprints they may have left behind.These developments ultimately allow for a more complex form of play. With this feature, the player can actually consider how to approach or avoid an enemy. This is a feature that is particularly prevalent in the stealth genre.

Applications:-

1. **Automation**: Makes a system or process function automatically.For example, **Robotics Process Automation** (RPA) can be programmed to perform high-volume, repeatable tasks that humans normally performed. RPA is different from IT automation in that it can adapt to changing circumstances.
2. **Social Media**: The role of ***artificial intelligence*** becomes even more important when the amount of content increases in the platforms since then, it becomes even more difficult to show users accurate information while fighting spam and improving user experience. In such cases, **AI** can act as a great boon.
3. **Security and Surveillance**:-Technologies like facial recognition and voice recognition are getting better with each passing day. AI is monitoring all the security camera feeds. ***Image processing*** technology utilize the ***data science*** by raising the artificial intelligenc



NEURAL NETWORK

A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. In the most basic sense neural networks refer to systems of neurons, either organic or artificial in nature.

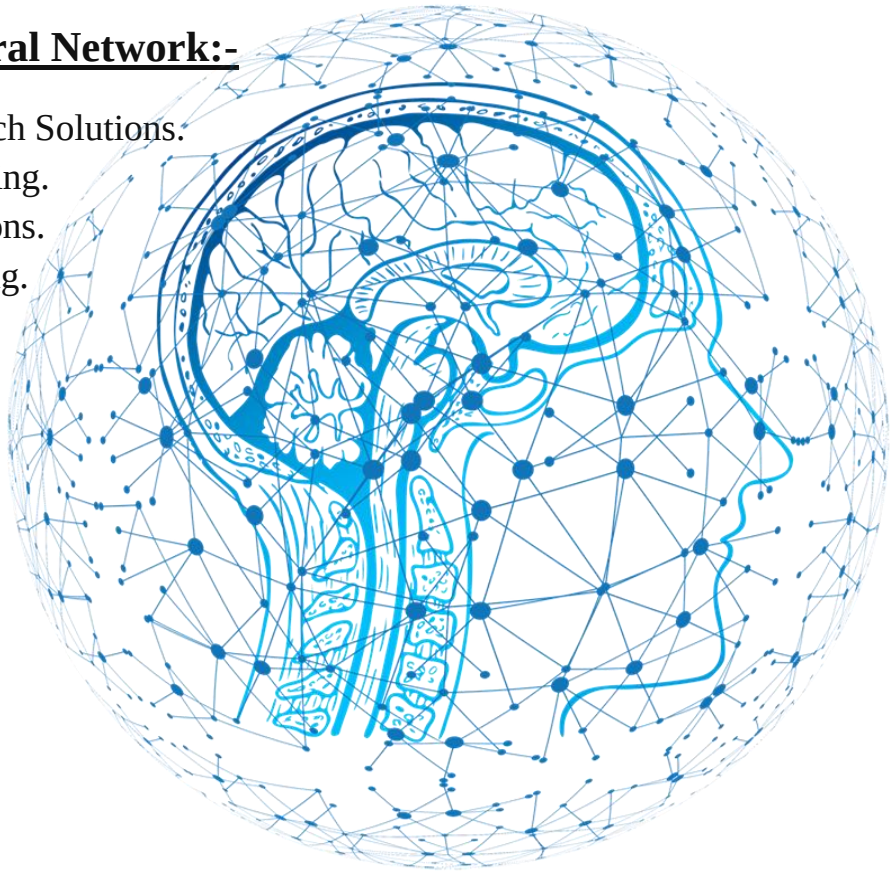
Neural networks can adapt to changing input,so the network generates the best possible result without needing to redesign the output criteria. Hence it can learn from its circumstances and its environment provided to it.

A neural network works similarly to the human brain's neural network. A "neuron" in a neural network is a mathematical function that collects and classifies information according to a specific architecture. The network bears a strong resemblance to statistical methods such as curve fitting and regression analysis.

A neural network contains layers of interconnected nodes. Each node is a perceptron and is similar to a multiple linear regression. The perceptron feeds the signal produced by a multiple linear regression into an activation function that may be nonlinear.

Applications of Neural Network:-

- Marketing Research Solutions.
- Business Forecasting.
- Financial Operations.
- Enterprise Planning.



MINIMAX ALGORITHM

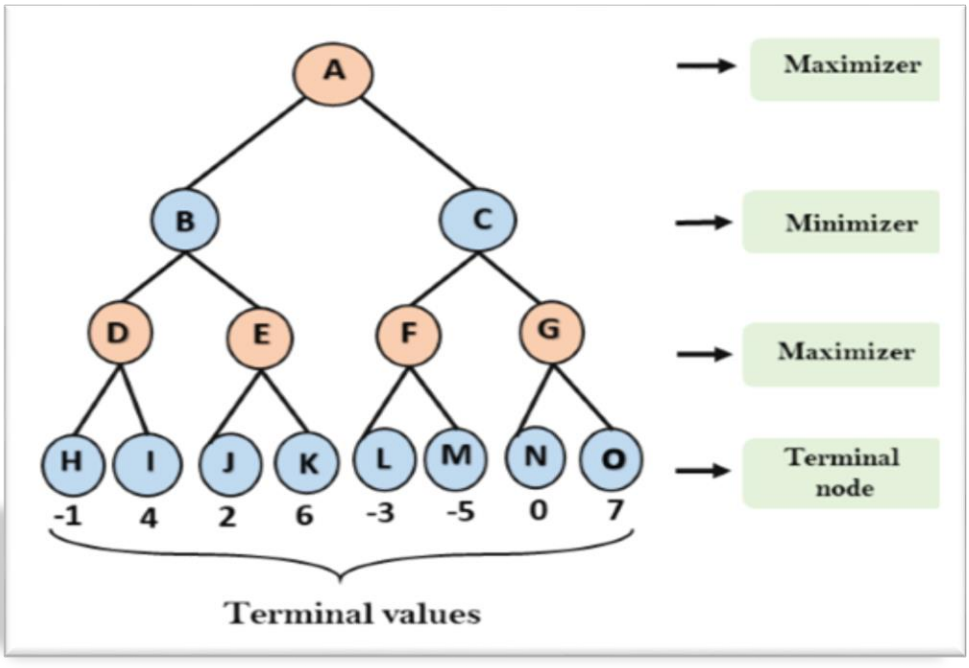
Minimax is a kind of backtracking algorithm that is used in decision making and game theory to find the optimal move for a player, assuming that your opponent also plays optimally. It is widely used in two player turn-based games such as Tic-Tac-Toe, Backgammon, Mancala, Chess, etc.

In Minimax the two players are called maximizer and minimizer. The maximizer tries to get the highest score possible while the minimizer tries to do the opposite and get the lowest score possible.

In a given state if the maximizer has upper hand then, the score of the board will tend to be some positive value. If the minimizer has the upper hand in that board state then it will tend to be some negative value.

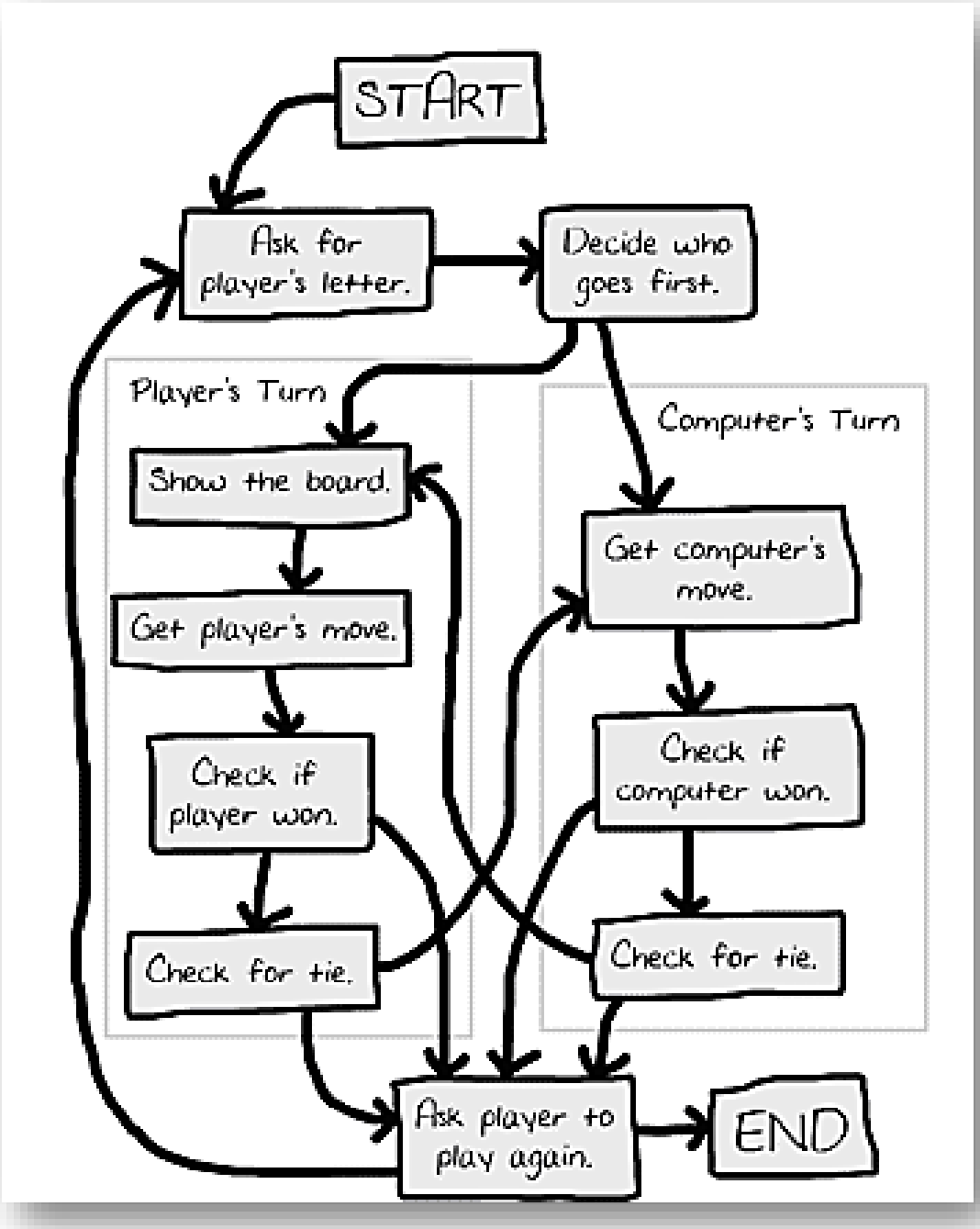
Properties:-

1. **Complete-** Min-Max algorithm is Complete. It will definitely find a solution in the finite search tree.
2. **Optimal-** Min-Max algorithm is optimal if both opponents are playing optimally.
3. **Time complexity-**Time complexity of Min-Max algorithm is **O(b^m)**, where b is branching factor and m is the maximum depth of the tree.
4. **Space Complexity-** Space complexity of Mini-max algorithm is also similar to DFS which is **O(bm)**.

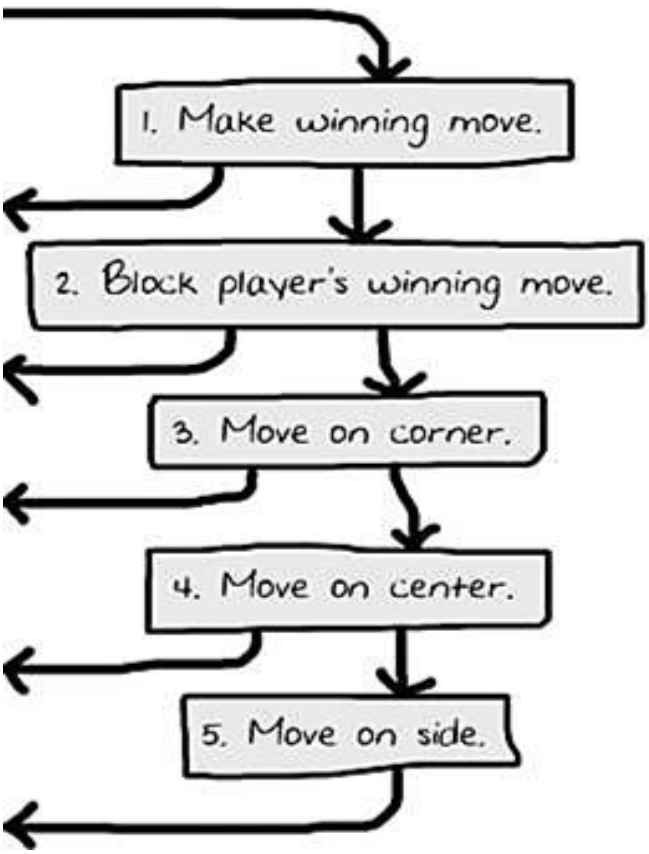


FLOWCHART

WORKING:



LOGIC:

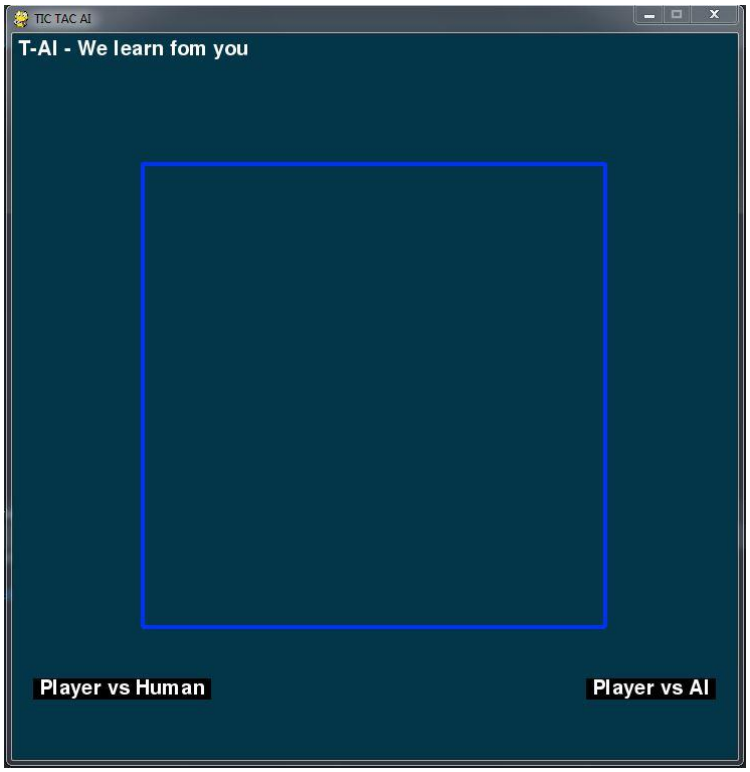


ALGORITHM:

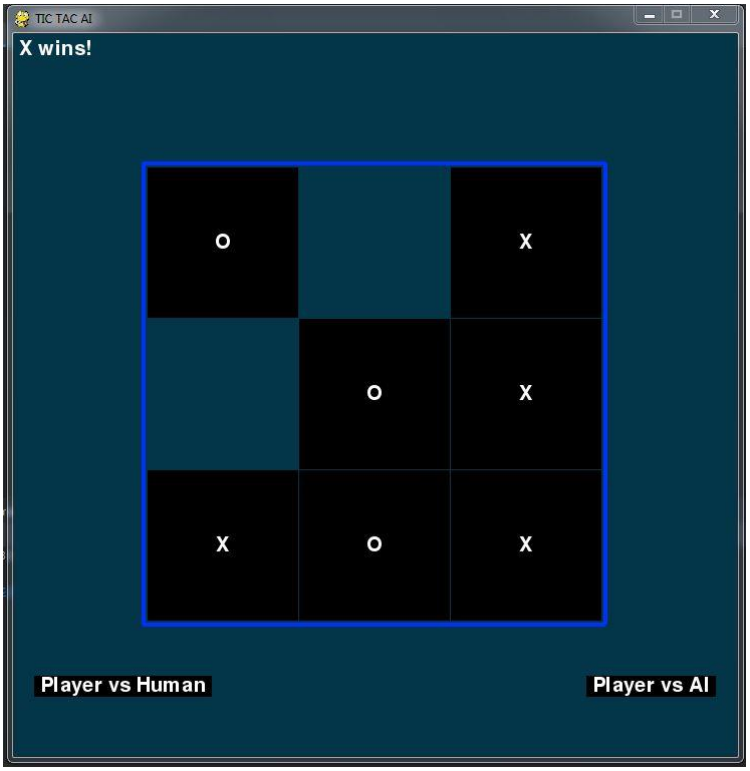
- If someone has a “threat” (i.e. two in a row), take the remaining square. Otherwise,
- If a move “forks” to create two threats at once, play that move. Otherwise,
- Take the center square if it is free. Otherwise,
- If your opponent has played in a corner, take the opposite corner. Otherwise.
- Take an empty corner if it exists. Otherwise,
- Take any empty square.

OUTPUT:

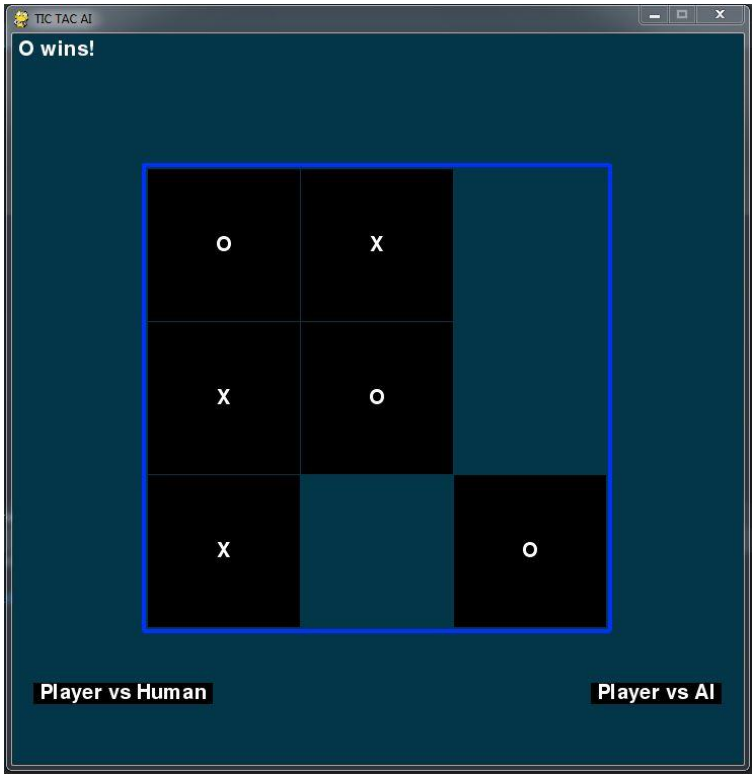
INITIAL SCREEN:



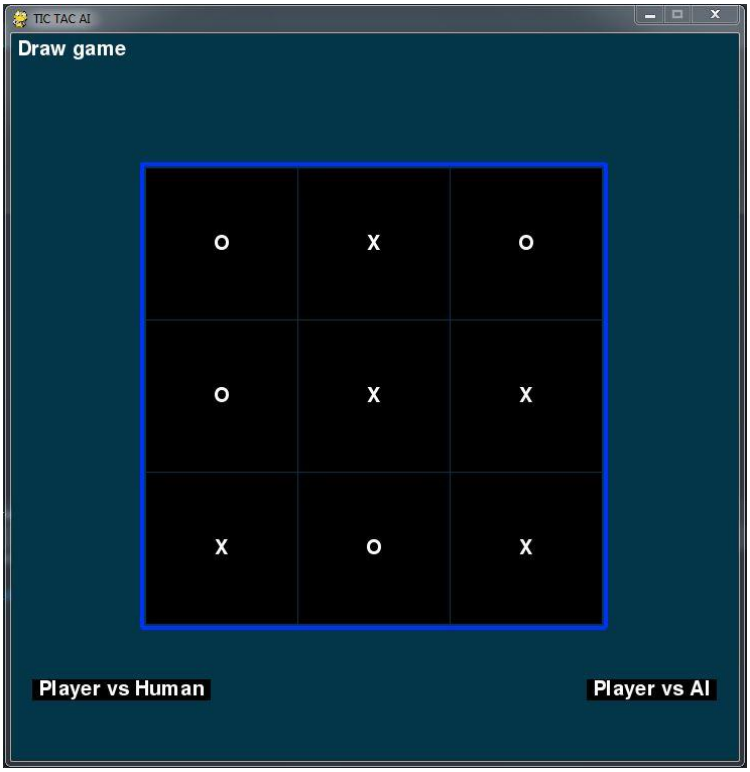
WHEN (X) WINS:



WHEN (O) WINS:



DRAW:



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