LOVELY PROFESSIONAL UNIVERSITY

ARTIFICIAL INTELIGENCE REPORT ON

TIC-TAC-TOE GAME

SUMBITTED TO: **MOIN HASSAN(25676)**

SUMBITTED BY:

SNEHA SINGH   (11808742)

ARINDAM NANDI   (11808640)

PRATEEK KUMAR(11808661)

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ABSTRACT

This project is on tic tac toe game using python in AI. Tic-Tac-Toe is one of the paper-and-pencil games. This game requires two players in 3x3 grid with Player 1 acts as "O" and Player 2 acts as "X", or vice vers. The objective of this game is to take place of three connecting grids in a horizontal, vertical, or diagonal way. This research findings explains about the common AI algorithm for Tic-Tac-Toe game, including the strategy in order to beat human player.

INTRODUCTION

Tic-Tac-Toe is one of the paper-and-pencil games. This game requires two players in 3x3 grid with Player 1 acts as "O" and Player 2 acts as "X", or vice versa . The objective of this game is to take place of three connecting grids in a horizontal, vertical, or diagonal way.
This was the first video game of Tic-Tac-Toe and it has AI inside, therefore human could play against the computer opponent.
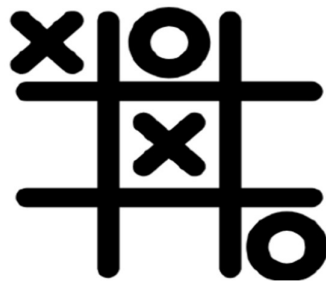
Fig : tic tac toe sample image

LITERATURE REVIEW

HOW TO PLAY?

RULES FOR TIC-TAC-TOE

1. The game is played on a grid that's 3 squares by 3 squares.

2. You are **X**, your friend (or the computer in this case) is **O**. Players take turns putting their marks in empty squares.

3. The first player to get 3 of her marks in a row (up, down, across, or diagonally) is the winner.

4. When all 9 squares are full, the game is over. If no player has 3 marks in a row, the game ends in a tie.

Game Strategy :

Tic-Tac-Toe game has many strategies that can be used. The main point of the strategy is the players have to block the opponent fork, either horizontally, vertically, or diagonally, while the players have to find their own fork to win.

 In combinatorial study, suppose "X" moves first, then the game is won as follows

- 91 distinct positions are won by X.
- 44 distinct position are won by 0.
- 3 distinct positions are drawn.

PROPOSED METHODOLOGY

ALGORITHM DETAILS:

Two type of algorithms are used in tic tac toe game and the algorithms are

* Minimax Algorithm

* Alpha Beta Pruning

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.
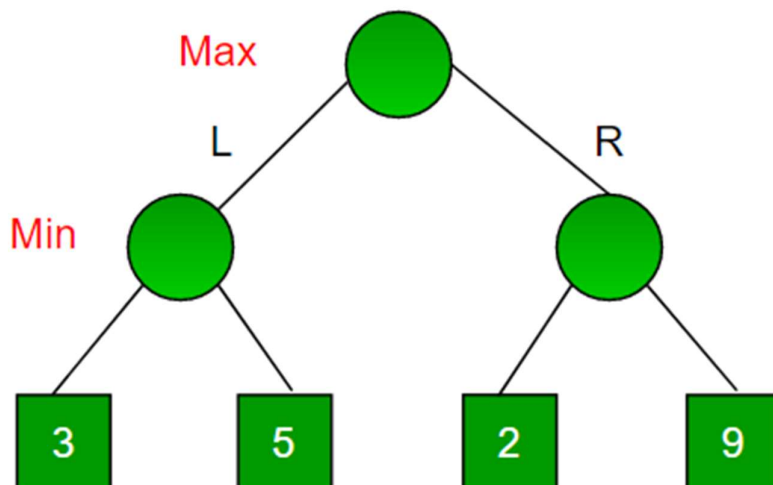
Minimax Algorithm used in Tic Tac Toe:

To check whether or not the current move is better than the best move we take the help of **minimax()** function which will consider all the possible ways the game can go and returns

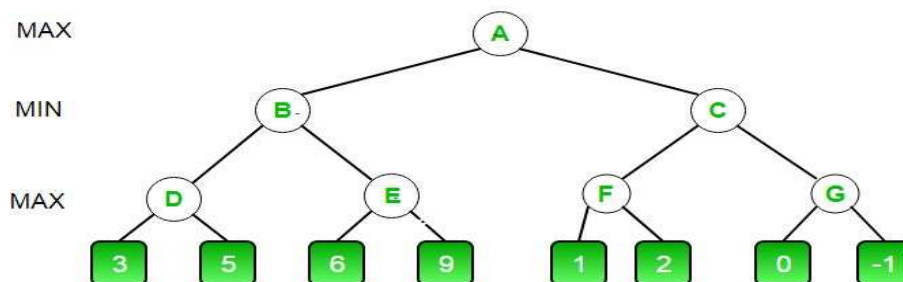the best value for that move, assuming the opponent also plays optimally.
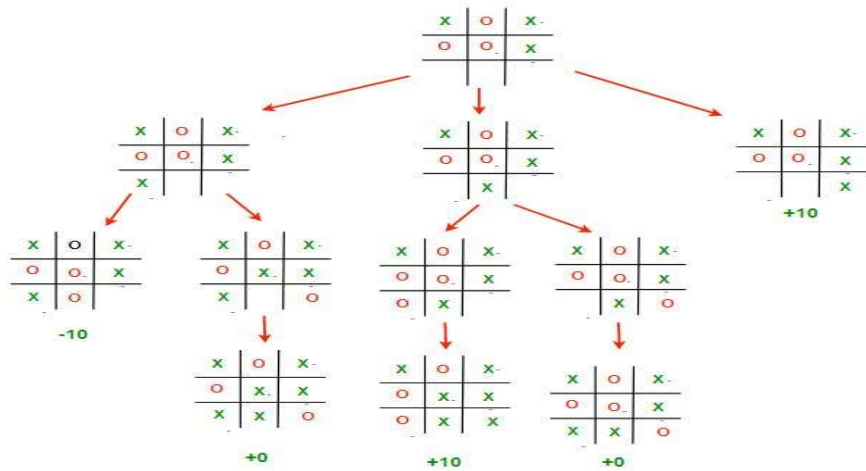
This image depicts all the possible paths that the game can take from the root board state. It is often called the **Game Tree**.

The 3 possible scenarios in the above example are :

- **Left Move** : If X plays [2,0]. Then O will play [2,1] and win the game. The value of this move is -10
- **Middle Move** : If X plays [2,1]. Then O will play [2,2] which draws the game. The value of this move is 0
- **Right Move** : If X plays [2,2]. Then he will win the game. The value of this move is +10;

ALPHA BETA PRUNING

Alpha-Beta pruning is not actually a new algorithm, rather an optimization technique for minimax algorithm. It reduces the computation time by a huge factor. This allows us to search much faster and even go into deeper levels in the game tree. It cuts off branches in the game tree which need not be searched because there already exists a better move available. It is called Alpha-Beta pruning because it passes 2 extra parameters in the minimax function, namely alpha and beta.

RESULT

```
1        2        3

4        5        6

7        8        9
                        USER (X)
enter position : 5
.        .        .

.        X        .

.        .        .
                        COMPUTER (O)
 0 10
.        .        O

.        X        .

.        .        .
                        USER (X)
enter position : 9
.        .        O

.        X        .

.        .        X
                        COMPUTER (O)
 0 10
O        .        O
```

```
.        .        X
                        COMPUTER (O)

 0 10
O        .        O

.        X        .

.        .        X
                        USER (X)
enter position : 2
O        X        O

.        X        .

.        .        X
                        COMPUTER (O)
 0 10
O        X        O

.        X        .

.        O        X
                        USER (X)
enter position : 7
O        X        O

.        X        .
```

```
                                USER (X)
enter position : 7
O         X         O

.         X         .

X         O         X

                                COMPUTER (O)

 0 10
O         X         O

.         X         O

X         O         X

                                USER (X)
enter position : 4
O         X         O

X         X         O

X         O         X

                                MATCH DRAW
```

In [ ]:

CONCLUSION

The Tic Tac Toe game is most familiar among all the age groups. Intelligence can be a property of any purpose-driven decision maker. This basic idea has been suggested many times. An algorithm of playing Tic Tac Toe has been presented and tested that works in efficient way.In this minimax algorithm is used to make the game more efficient.

REFERENCES

- **Wikipedia**
- **Geeks for geek**
- **Slide share**