EXPERIMENT NO: 6 A N V SREEVISHNU
DATE: 12/03/2021 RA1811003010333

IMPLEMENTATION OF MINMAX ALGORITHM

Aim: To implement Min Max Algorithm in AI using Python.

Procedure/Algorithm:

- First, Create a tic tac te table of our choice.
- Check the empty spaces left and feed in data of O's move.
- A series of possibilities should be shown of the remaining game.
- The path with the most success rate is chosen.
- The output is therefore shown as to the move of the X that should be done at the point in the game.

Code:

```
player, opponent = 'x', 'o'

# This function returns true if there are moves

# remaining on the board. It returns false if

# there are no moves left to play.

def isMovesLeft(board) :
```

```
    for i in range(3) :

        for j in range(3) :

            if (board[i][j] == '_') :

                return True

    return False



# This is the evaluation function as discussed

def evaluate(b) :



    # Checking for Rows for X or O victory.

    for row in range(3) :

        if (b[row][0] == b[row][1] and b[row][1] == b[row][2]) :

            if (b[row][0] == player) :
```

```
            return 10

        elif (b[row][0] == opponent) :

            return -10



# Checking for Columns for X or O victory.

for col in range(3) :



    if (b[0][col] == b[1][col] and b[1][col] == b[2][col]) :



        if (b[0][col] == player) :

            return 10

        elif (b[0][col] == opponent) :

            return -10
```

```
# Checking for Diagonals for X or O victory.

if (b[0][0] == b[1][1] and b[1][1] == b[2][2]) :


    if (b[0][0] == player) :

        return 10

    elif (b[0][0] == opponent) :

        return -10


if (b[0][2] == b[1][1] and b[1][1] == b[2][0]) :


    if (b[0][2] == player) :

        return 10
```

```
        elif (b[0][2] == opponent) :
            return -10

    # Else if none of them have won then return 0
    return 0

# This is the minimax function. It considers all
# the possible ways the game can go and returns
# the value of the board
def minimax(board, depth, isMax) :
    score = evaluate(board)

    # If Maximizer has won the game return his/her
```

```
# evaluated score

if (score == 10) :

    return score



# If Minimizer has won the game return his/her

# evaluated score

if (score == -10) :

    return score



# If there are no more moves and no winner then

# it is a tie

if (isMovesLeft(board) == False) :

    return 0
```

```
# If this maximizer's move
if (isMax) :
    best = -1000

    # Traverse all cells
    for i in range(3) :
        for j in range(3) :

            # Check if cell is empty
            if (board[i][j]=='_') :

                # Make the move
```

```
            board[i][j] = player

            # Call minimax recursively and choose
            # the maximum value
            best = max( best, minimax(board,
                                      depth + 1,
                                      not isMax) )

            # Undo the move
            board[i][j] = '_'
    return best

# If this minimizer's move
```

```
else :
    best = 1000

    # Traverse all cells
    for i in range(3) :
        for j in range(3) :

            # Check if cell is empty
            if (board[i][j] == '_') :

                # Make the move
                board[i][j] = opponent
```

```
            # Call minimax recursively and choose

            # the minimum value

            best = min(best, minimax(board, depth + 1, not isMax))



            # Undo the move

            board[i][j] = '_'

        return best




def findBestMove(board) :

    bestVal = -1000

    bestMove = (-1, -1)
```

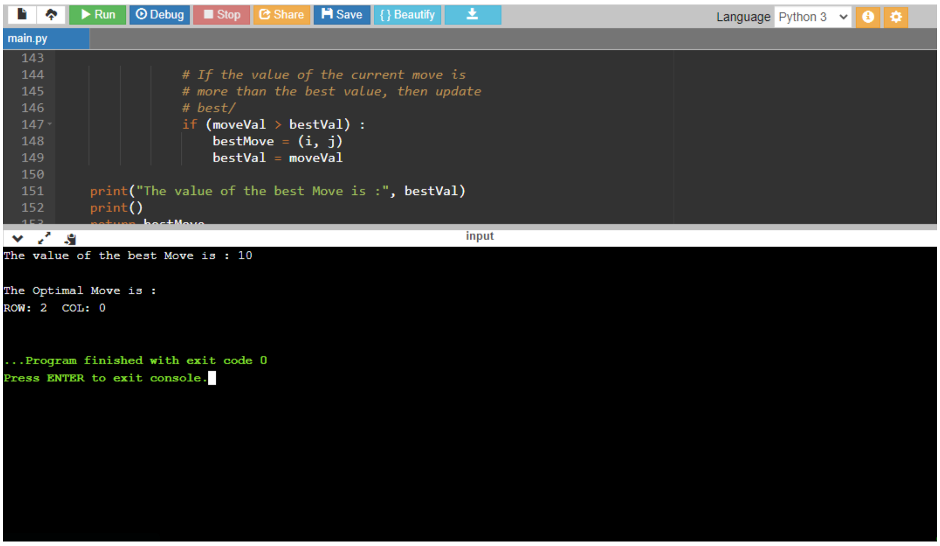
```
# Traverse all cells, evaluate minimax function for
# all empty cells. And return the cell with optimal
# value.
for i in range(3) :
    for j in range(3) :

        # Check if cell is empty
        if (board[i][j] == '_') :

            # Make the move
            board[i][j] = player

            # compute evaluation function for this
```

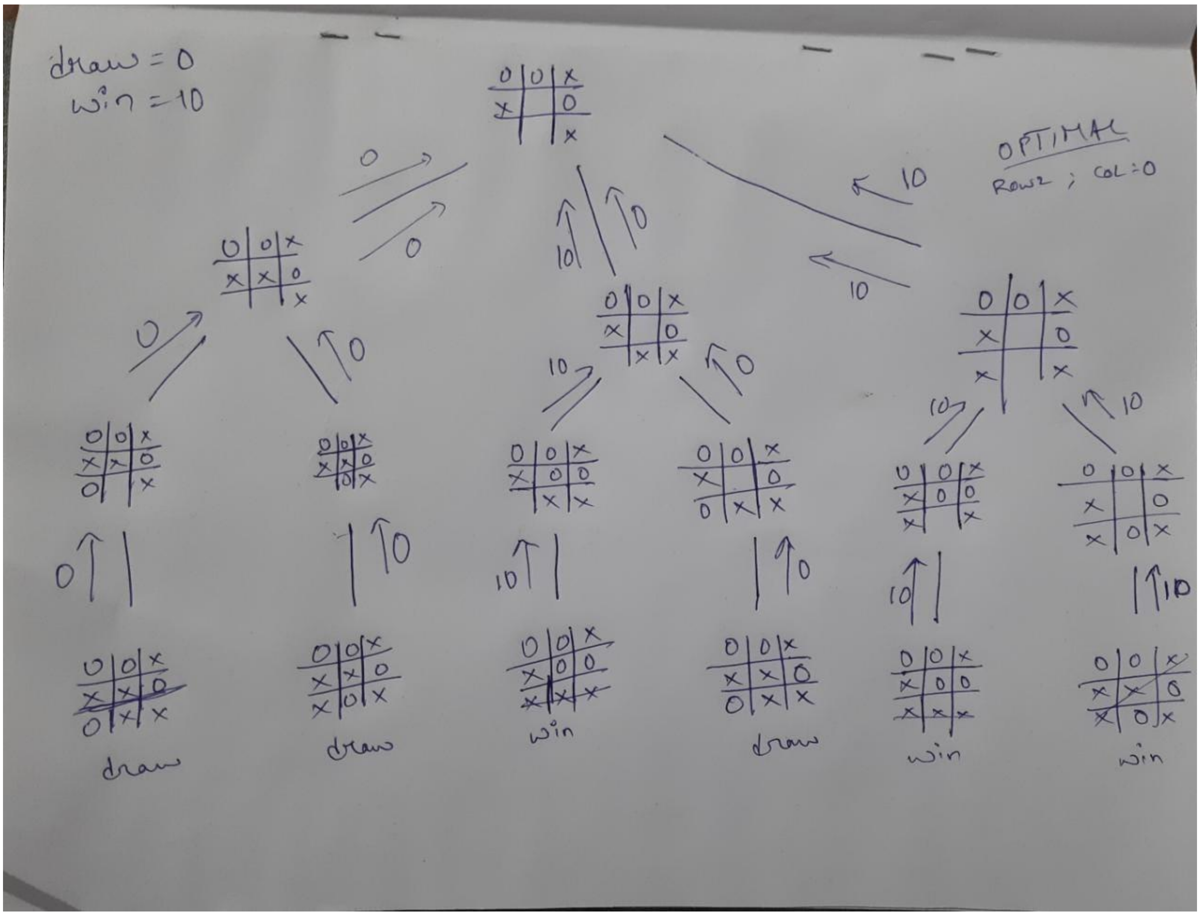
```
# move.

moveVal = minimax(board, 0, False)



# Undo the move

board[i][j] = '_'



# If the value of the current move is

# more than the best value, then update

# best/

if (moveVal > bestVal) :

    bestMove = (i, j)

    bestVal = moveVal
```

```
    print("The value of the best Move is :", bestVal)

    print()

    return bestMove

# Driver code

board = [

    [ 'o', 'o', 'x' ],

    [ 'x', '_', 'o' ],

    [ '_', '_', 'x' ]

]



bestMove = findBestMove(board)



print("The Optimal Move is :")
```

print("ROW:", bestMove[0], " COL:", bestMove[1])

Output:





Result: Thus,the implementation of Min Max algorithm in AI using Python has been successfully done.