Manas Jha

RA1911003010643

```
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
# in the previous article ( http://goo.gl/sJgv68 )
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.
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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
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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] = '_'
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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

# This will return the best possible move for the player
def findBestMove(board) :
bestVal = -1000
bestMove = (-1, -1)
# Traverse all cells, evaluate minimax function for
# all empty cells. And return the cell with optimal
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```
# 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

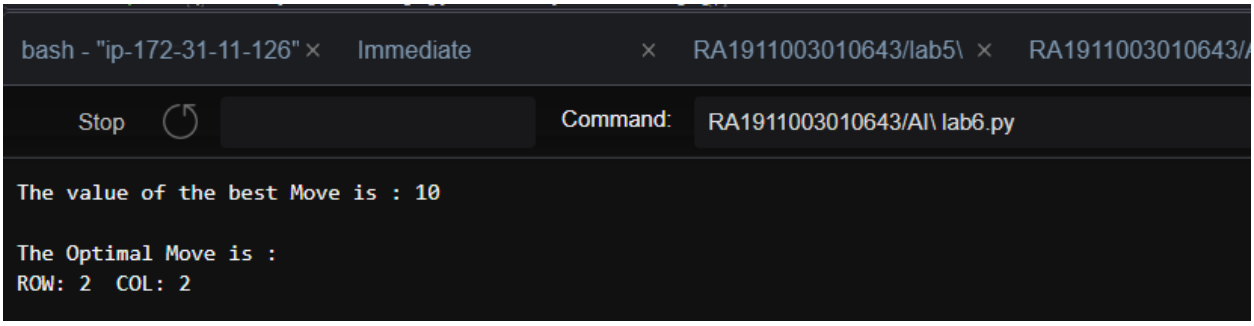
print("The value of the best Move is :", bestVal)
print()
return bestMove

# Driver code
board = [
[ 'x', 'o', 'x' ],
[ 'o', 'o', 'x' ],
[ '_', '_', '_' ]
]
```

```
bestMove = findBestMove(board)

print("The Optimal Move is :")

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



Problem Formulation :

Consider a board having nine element vector where each element will contain '-' for blank, 'x' for indicating the move of player 1 and 0 for player 2's move.

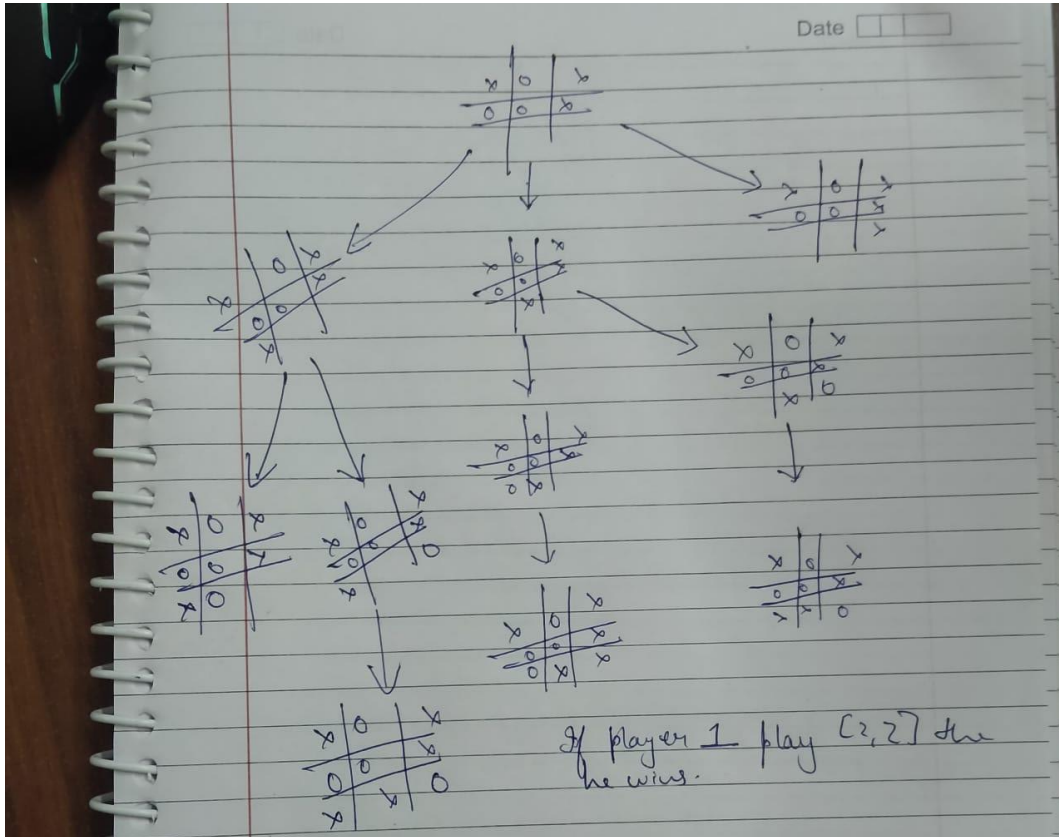
Initial State

x	o	x
o	o	x
-	-	-

Final State

x	o	x
o	o	x
o	x	x

Date



If player 1 play [2,2] then he wins.

Algo:

Make and find best move() function
make best move as null
loop for each move in board
    if current move is better than best move
        best move = current move
return best move

To check if current move is better than the best move using minimax function.

Return value of the move in this function to check best move.