1. Implement Tic –Tac –Toe Game.

Code:

```
board={1:' ',2:' ',3:' ',
      4:' ',5:' ',6:' ',
      7:' ',8:' ',9:' '
}

print("Sonal , 1BM22CS286")

def printBoard(board):
   print(board[1]+'|'+board[2]+'|'+board[3])
   print('-+-+-')
   print(board[4] + '|' + board[5] + '|' + board[6])
   print('-+-+-')
   print(board[7] + '|' + board[8] + '|' + board[9])
   print('\n')

def spaceFree(pos):
   if(board[pos]==' '):
      return True
   else:
      return False

def checkWin():
   if(board[1]==board[2] and board[1]==board[3] and board[1]!=' '):
      return True
   elif(board[4]==board[5] and board[4]==board[6] and board[4]!=' '):
      return True
   elif(board[7]==board[8] and board[7]==board[9] and board[7]!=' '):
      return True
   elif (board[1] == board[5] and board[1] == board[9] and board[1] != ' '):
      return True
   elif (board[3] == board[5] and board[3] == board[7] and board[3] != ' '):
      return True
   elif (board[1] == board[4] and board[1] == board[7] and board[1] != ' '):
      return True
   elif (board[2] == board[5] and board[2] == board[8] and board[2] != ' '):
      return True
   elif (board[3] == board[6] and board[3] == board[9] and board[3] != ' '):
      return True
   else:
      return False
```

```
def checkMoveForWin(move):
  if (board[1]==board[2] and board[1]==board[3] and board[1] ==move):
     return True
  elif (board[4]==board[5] and board[4]==board[6] and board[4] ==move):
     return True
  elif (board[7]==board[8] and board[7]==board[9] and board[7] ==move):
     return True
  elif (board[1]==board[5] and board[1]==board[9] and board[1] ==move):
     return True
  elif (board[3]==board[5] and board[3]==board[7] and board[3] ==move):
     return True
  elif (board[1]==board[4] and board[1]==board[7] and board[1] ==move):
     return True
  elif (board[2]==board[5] and board[2]==board[8] and board[2] ==move):
     return True
  elif (board[3]==board[6] and board[3]==board[9] and board[3] ==move):
     return True
  else:
     return False

def checkDraw():
  for key in board.keys():
     if (board[key]==' '):
        return False
  return True


def insertLetter(letter, position):
  if (spaceFree(position)):
     board[position] = letter
     printBoard(board)

     if (checkDraw()):
        print('Draw!')
     elif (checkWin()):
        if (letter == 'X'):
           print('Bot wins!')
        else:
           print('You win!')
     return

  else:
     print('Position taken, please pick a different position.')
     position = int(input('Enter new position: '))
     insertLetter(letter, position)
```

```
    return

player = 'O'
bot ='X'

def playerMove():
  position=int(input('Enter position for O:'))
  insertLetter(player, position)
  return

def compMove():
  bestScore=-1000
  bestMove=0
  for key in board.keys():
    if (board[key]==' '):
      board[key]=bot
      score = minimax(board, False)
      board[key] = ' '
      if (score > bestScore):
        bestScore = score
        bestMove = key

  insertLetter(bot, bestMove)
  return


def minimax(board, isMaximizing):
  if (checkMoveForWin(bot)):
    return 1
  elif (checkMoveForWin(player)):
    return -1
  elif (checkDraw()):
    return 0

  if isMaximizing:
    bestScore = -1000

    for key in board.keys():
      if board[key] == ' ':
        board[key] = bot
        score = minimax(board, False)
        board[key] = ' '
        if (score > bestScore):
          bestScore = score
    return bestScore
```

```
  else:
    bestScore = 1000

    for key in board.keys():
      if board[key] == ' ':
        board[key] = player
        score = minimax(board, True)
        board[key] = ' '
        if (score < bestScore):
          bestScore = score
    return bestScore

while not checkWin():
  playerMove()
  compMove()
```

Output :

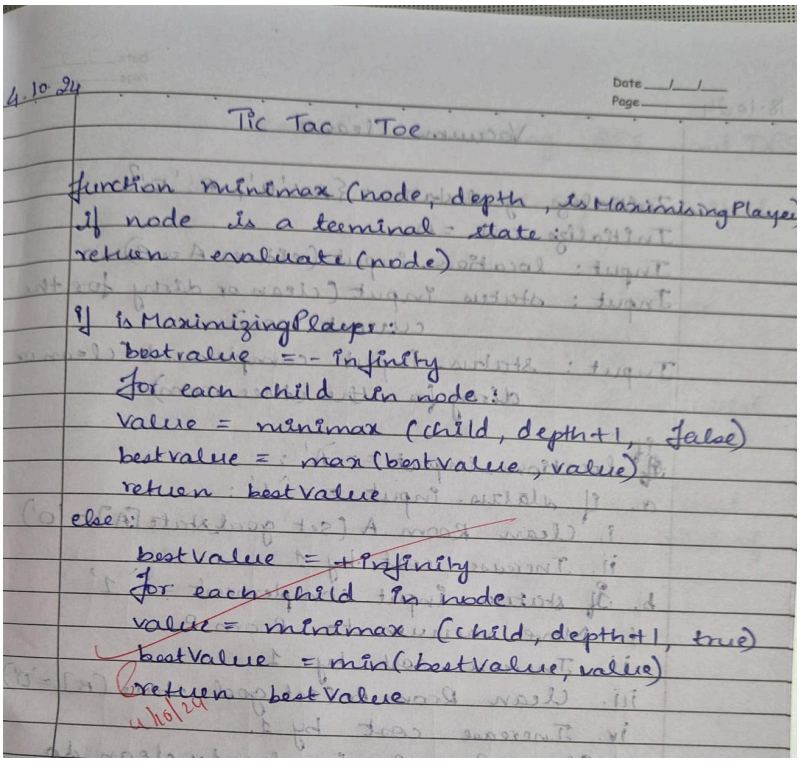
```
Sonal , 1BM22CS286
Enter position for O:1
O| |
-+-+-
 | |
-+-+-
 | |


O| |
-+-+-
 |X|
-+-+-
 | |
```

```
Enter position for O:9
O|X|O
-+-+-
O|X|X
-+-+-
X|O|O


Draw!
```

Observation book screenshots:



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Tic Tac Toe

```
function minimax(node, depth, isMaximizingPlayer)
if node is a terminal state:
return evaluate(node)
if isMaximizingPlayer:
    bestvalue = -Infinity
    for each child in node:
    value = minimax(child, depth+1, false)
    bestvalue = max(bestvalue, value)
    return bestValue
else:
    bestValue = +Infinity
    for each child in node:
    value = minimax(child, depth+1, true)
    bestValue = min(bestValue, value)
    return bestValue
```

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