TIC TAC TOE ASSIGNMENT

BASSAM AHMED
2022001

Assignment Requirements:

1. Abstraction ✓
2. Decomposition ✓
3. Pseudocode ✓
4. Python code

Abstraction

Abstraction essentially refers to the process of simplification of a task or a problem such that all low-level, unnecessary and irrelevant details are hidden behind a layer of abstraction, ie. they are "abstracted" away. In other words, we do not worry about the meticulous implementation details, we only worry about how to effectively utilize the products of those details.

Therefore, the process of abstraction involves the following:

1. Hiding the irrelevant details
2. Generalising the common essence

Abstraction of Tic Tac Toe

Game Setup

1. Prompt user for name of two players
2. Assign the x and O symbols to the two players
3. Inform the players of player 1 + their symbol and player 2 + their symbol

4. Prompt player 1 for location on game-board to place their symbol
5. Keep re-asking as long as entered location is either invalid or already occupied
6. If game has been won, end game and reset board
7. If game has not been won, go to line 8

8. Prompt player 2 for location on game-board to place their symbol
9. Keep re-asking as long as entered location is either invalid or already occupied
10. If game has been won, end game and reset board
11. If game has not been won, go to line 4

DECOMPOSITION

Decomposition refers to the process of breaking down a particular task (in our case, the task is executing a PvP tic tac toe game) into sub-tasks, which are then broken down further into processes, which are broken down into activities.

This process of simplification continues until the tasks can no longer be simplified while keeping the high-level implementation in mind

Decomposition of Tic Tac Toe (Using a tree diagram)

PSEUDOCODE

```
DECLARE gameOver : BOOLEAN
DECLARE turn : INTEGER
gameOver ← FALSE
turn ← 1
DECLARE gameBoard : ARRAY [1:3, 1:3] OF CHAR
DECLARE victor : STRING
```

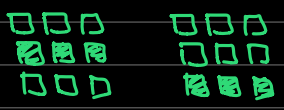
```
OUTPUT "Enter name for Player 1"
INPUT player1
OUTPUT player1, "'s symbol is X"

OUTPUT "Enter name for Player 2"
INPUT player2
OUTPUT player2, "'s symbol is O"

REPEAT
  IF turn MOD 2 <> 0
    THEN
      currentPlayer ← player1
      playerSymbol ← 'X'
    ELSE
      currentPlayer ← player2
      playerSymbol ← 'O'
  ENDIF
  // Player executes his turn
  REPEAT
    OUTPUT currentPlayer, " enter your row number"
    INPUT y
    OUTPUT currentPlayer, " enter your column number"
    INPUT x
  UNTIL (gameBoard[y, x] <> 'X' OR gameBoard[y, x] <> 'O')
    AND ((x >= 1 AND x <= 3) AND (y >= 1 AND y <= 3))

gameBoard[y, x] ← playerSymbol


// Check for a win
FOR i ← 1 TO 3
  IF i = 1
    THEN
      FOR j ← 1 TO 3
        IF j = 1
          THEN
            IF (gameBoard[i, j] = gameBoard[i + 1, j + 1] AND
              gameBoard[i, j] = gameBoard[i + 2, j + 2]) OR
              (gameBoard[i, j] = gameBoard[i, j + 1] AND
              gameBoard[i, j] = gameBoard[i, j + 2]) // checking row
              THEN
                gameOver ← true
                victor ← currentPlayer
            ENDIF
          ELSE
            IF j = 3
              THEN
                IF gameBoard[i, j] = gameBoard[i + 1, j - 1] AND
                gameBoard[i, j] = gameBoard[i + 2, j - 2]
```

// checking diagonal

// checking reverse diagonal

```
            THEN
                gameOver ← true
                victor ← currentPlayer
        ENDIF
    ENDIF
ENDIF
```

```
IF gameBoard[i,j] = gameBoard[i+1,j] AND
   gameBoard[i,j] = gameBoard[i+2,j]
    THEN                    //checking each column
        gameOver ← true
        victor ← currentPlayer
ENDIF
NEXT j
```



```
ELSE
    IF gameBoard[i,0] = gameBoard[i,1] AND
       gameBoard[i,0] = gameBoard[i,2]
        THEN                //checking rows 2 and 3
            gameOver ← true
            victor ← currentPlayer
    ENDIF
ENDIF
NEXT i
// Check complete
turn ← turn + 1
UNTIL gameOver = true

OUTPUT "The winner of this game is :" victor
```

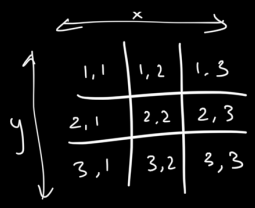
Some of the working behind the checking mechanism:

7:55 PM Sat 9 Jan

Notes

Suggested Title: 131 Edit

9 January 2021 at 6:27 PM



1, 3

FOR (i = 1 ; i < 4 ; i++)
  FOR (j = 1, j < 4 ; j++)
    if board (i, j) is occupied

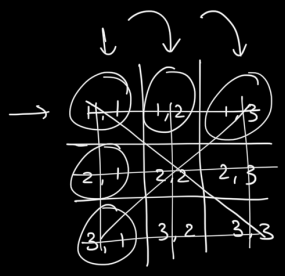
① check if i, j+1 and i, j+2 also contain the same char

② check if i+1, j and i+2, j also contain the same char

③ If i == j AND i <> 2
  check if MOD(i+1)3, MOD(j+1)3 and MOD(i+2)3, MOD(j+2)3 also contain the same char

  else if
    i <> 2 AND j <> 2 THEN
    check if

Too lengthly



Checking Mechanism

```
FOR i ← 1 TO 3
  IF i = 1 THEN
    FOR j ← 1 TO 3
    IF j = 1 THEN
      check i+1, j+1 and i+2, j+2
      check i, j+1 and i, j+2
    ELSE IF j = 3 THEN
      check i+1, j-1 and i+2, j-2
    ENDIF
    check i+1, j and i+2, j
  ENDFOR
ELSE
  check i, j+1 and i, j+2
ENDIF
```

Board Setup and Function Definitions

PYTHON CODE

```
#Bassam Ahmed's version of Python TicTacToe
gameBoard = [
    ['_', '_', '_'],
    ['_', '_', '_'],
    ['_', '_', '_']
]

def displayBoard():
    row = ''
    print("Current Board: ")
    print("=======================")
    print("\n")
    print("    ", 1, "    ", 2, "    ", 3, "\n")
    for x in range(3):
        for y in range(3):
            row = row + "   " + gameBoard[x][y] + "   "
        print(x + 1, row)
        print("\n")
        row = ''
    print("=======================")

def playerExecutesTurn():
    while True:
        x = int(input("Enter row number: "))
        x -= 1
        y = int(input("Enter column number:"))
        y -= 1
        if (0 <= y <= 2) and (0 <= x <= 2):
            if gameBoard[x][y] == '_':
                gameBoard[x][y] = playerSymbol
                displayBoard()
                print("\n")
                break
        print("invalid coordinate pair entered")


def checkingMechanism(gameBoard):
    for i in range(3):
        if i == 0:
            for j in range(3):
                if j == 0:
                    if ((gameBoard[i][j] == gameBoard[i+1][j+1] == gameBoard[i+2][j+2]) and
(gameBoard[i][j]!= '_')) or ((gameBoard[i][j] == gameBoard[i][j+1] == gameBoard[i][j+2]) and
(gameBoard[i][j] != '_')):
                        return True
                else:
                    if j == 2:
                        if (gameBoard[i][j] == gameBoard[i+1][j-1] == gameBoard[i+2][j-2]) and
(gameBoard[i][j] != '_'):
                            return True
                if (gameBoard[i][j] == gameBoard[i+1][j] == gameBoard[i+2][j]) and (gameBoard[i][j] !=
'_'):
                    return True
        else:
            if (gameBoard[i][0] == gameBoard[i][1] == gameBoard[i][2]) and (gameBoard[i][0] != '_'):
                return True
```

The Main part of the code:

```
playerOne = str(input("Enter the name for Player 1: \n"))
print("The symbol for", playerOne, "is O")
playerTwo = str(input("Enter the name for Player 2: \n"))
print("The symbol for", playerTwo, "is X")

displayBoard()
turn = 1
gameOver = False
while turn < 10:
    if turn % 2 == 0:
        currentPlayer = playerTwo
        playerSymbol = 'X'
    else:
        currentPlayer = playerOne
        playerSymbol = 'O'
    print(currentPlayer, "'s turn: \n")
    playerExecutesTurn()
    newGameOver = checkingMechanism(gameBoard)
    if newGameOver:
        gameOver = True
        print("The winner of this game is: ", currentPlayer)
        break
    turn += 1


if not gameOver:
    print("This game is a draw")
```