INT213

Python Programming

Tic Tac Toe

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Acknowledgment

I would like to express my special thanks of gratitude to my teacher "Dr. SukhvirKaur" for their able guidance and support in completing my Project. It was a great privilege and honor to work and study under his guidance. I would also like to extend my gratitude to my mate for being supportive throughout the whole project.

Introduction

Tic Tac Toe is one of the most played games and is the best time killer game that you can play anywhere with just a pen and paper.

The game is played by two individuals. First, we draw a board with a 3×3 square grid. The first player chooses 'X' and draws it on any of the square grid, then it's the chance of the second player to draw 'O' on the available spaces. Like this, the players draw 'X' and 'O' alternatively on the empty spaces until a player succeeds in drawing 3 consecutive marks either in the horizontal, vertical or diagonal way. Then the player wins the game otherwise the game draws when all spots are filled.

Pygame is a great library that will allow us to create the window and draw images and shapes on the window. This way we will capture mouse coordinates and identify the block where we need to mark 'X' or 'O'.

To implement this game, we will use the basic concepts of Python and Pygame which is a Python library for building cross-platform games. It contains the modules needed for computer graphics and sound libraries. To install the library, you can use pip installer from the command line:

```
pip install pygame
```

Steps to build Tic Tac Toe program in Python:

- Create the display window for our game.
- Draw the grid on the canvas where we will play Tic Tac Toe.
- Draw the status bar below the canvas to show which player's turn is it and who wins the game.
- When someone wins the game or the game is a draw then we reset the game.

We need to run our game inside an infinite loop. It will continuously look for events and when a user presses the mouse button on the grid we will first get the X and Y coordinates of the mouse. Then we will check which square the user has clicked. Then we will draw the appropriate 'X' or 'O' image on the canvas.

- ## *Initializing game components*

Importing the pygame library and the time library because we will use the **time.sleep()** method to pause the game at certain positions. Then we initialize all the global variables that we will use in our Tic Tac Toe game.

```
import pygame as pg,sys
from pygame.locals import *
import time


#initialize global variables
XO = 'x'
winner = None
draw = False
width = 400
height = 400
white = (255, 255, 255)
line_color = (10,10,10)

#TicTacToe 3x3 board
TTT = [[None]*3,[None]*3,[None]*3]
```

Here, the TTT is the main 3×3 Tic Tac Toe board and at first, it will have 9 None values. The height and width of the canvas where we will play the game is 400×400.

• *Initializing Pygame window*

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- We use the pygame to create a new window where we'll play our Tic Tac Toe game. So we initialize the pygame with the **pg. init()** method and the window display are set with a width of 400 and a height of 500. We have reserved 100-pixel space for displaying the status of the game.
- The **pg. the display.set_mode()** initializes the display and we reference it with the screen variable. This screen variable will be used whenever we want to draw something on the display.
- The pg. the display.set_caption method is used to set a name that will appear at the top of the display window.

```
#initializing pygame window
pg.init()
fps = 30
CLOCK = pg.time.Clock()
screen = pg.display.set_mode((width, height+100),0,32)
pg.display.set_caption("Tic Tac Toe")
```

• *Load and transform images*

The Python project uses many images like the opening image that will display when the game starts or resets. The X and O The game is complete and ready to play. Save the source code with the **tictactoe.py** file name and run the file images that we will draw when the user clicks on the grid. We load all the images and resize them so that they will fit easily in our window.

```
#loading the images
opening = pg.image.load('tic tac opening.png')
x_img = pg.image.load('x.png')
o_img = pg.image.load('o.png')

#resizing images
x_img = pg.transform.scale(x_img, (80,80))
o_img = pg.transform.scale(o_img, (80,80))
opening = pg.transform.scale(opening, (width, height+100))
```

- ***Define the functions***

Now we create a function that will start the game. We will also use this function when we want to restart the game. In pygame, the **blit()** function is used on the surface to draw an image on top of another image.
So we draw the opening image and after drawing, we always need to update the display with **pg. the display. update()**. When the opening image is drawn, we wait for 1 second using **time. sleep(1)** and fill the screen with white color.
Next, we draw 2 vertical and horizontal lines on the white background to make the 3×3 grid. In the end, we call the **draw_status()** function

```
def game_opening():
    screen.blit(opening,(0,0))
    pg.display.update()
    time.sleep(1)
    screen.fill(white)

    # Drawing vertical lines
    pg.draw.line(screen,line_color,(width/3,0),(width/3, height),7)
    pg.draw.line(screen,line_color,(width/3*2,0),(width/3*2, height),7)
    # Drawing horizontal lines
    pg.draw.line(screen,line_color,(0,height/3),(width, height/3),7)
    pg.draw.line(screen,line_color,(0,height/3*2),(width, height/3*2),7)
    draw_status()
```

The **draw_status()** function draws a black rectangle where we update the status of the game show which player's turn is it and whether the game ends or draws

.

```
def draw_status():
    global draw

    if winner is None:
        message = XO.upper() + "'s Turn"
    else:
        message = winner.upper() + " won!"
    if draw:
        message = 'Game Draw!'

    font = pg.font.Font(None, 30)
    text = font.render(message, 1, (255, 255, 255))

    # copy the rendered message onto the board
    screen.fill ((0, 0, 0), (0, 400, 500, 100))
    text_rect = text.get_rect(center=(width/2, 500-50))
    screen.blit(text, text_rect)
    pg.display.update()
```

The **check_win()** function checks the Tic Tac Toe board to see all the marks of 'X' and 'O'. It calculates whether a player has won the game or not. They can either win when the player has marked 3 consecutive marks in a row, column, or diagonally. This function is called whenever we draw a mark 'X' or 'O' on the board.

```
def check_win():
    global TTT, winner,draw

    # check for winning rows
    for row in range (0,3):
        if ((TTT [row][0] == TTT[row][1] == TTT[row][2]) and(TTT [row][0] is not None)):
            # this row won
            winner = TTT[row][0]
            pg.draw.line(screen, (250,0,0), (0, (row + 1)*height/3 -height/6),\
                         (width, (row + 1)*height/3 - height/6 ), 4)
            break

    # check for winning columns
    for col in range (0, 3):
        if (TTT[0][col] == TTT[1][col] == TTT[2][col]) and (TTT[0][col] is not None):
            # this column won
            winner = TTT[0][col]
            #draw winning line
            pg.draw.line (screen, (250,0,0),((col + 1)* width/3 - width/6, 0),\
                       ((col + 1)* width/3 - width/6, height), 4)
            break

    # check for diagonal winners
    if (TTT[0][0] == TTT[1][1] == TTT[2][2]) and (TTT[0][0] is not None):
        # game won diagonally left to right
        winner = TTT[0][0]
        pg.draw.line (screen, (250,70,70), (50, 50), (350, 350), 4)

    if (TTT[0][2] == TTT[1][1] == TTT[2][0]) and (TTT[0][2] is not None):
        # game won diagonally right to left
        winner = TTT[0][2]
        pg.draw.line (screen, (250,70,70), (350, 50), (50, 350), 4)

    if(all([all(row) for row in TTT]) and winner is None ):
        draw = True
    draw_status()
```

```
def drawXO(row,col):
    global TTT,XO
    if row==1:
        posx = 30
    if row==2:
        posx = width/3 + 30
    if row==3:
        posx = width/3*2 + 30

    if col==1:
        posy = 30
    if col==2:
        posy = height/3 + 30
    if col==3:
        posy = height/3*2 + 30
    TTT[row-1][col-1] = XO
    if(XO == 'x'):
        screen.blit(x_img,(posy,posx))
        XO= 'o'
    else:
        screen.blit(o_img,(posy,posx))
        XO= 'x'
    pg.display.update()
    #print(posx,posy)
    #print(TTT)
```

The **userClick()** function is triggered every time the user presses the mouse button. When the user clicks the mouse, we first take the x and y coordinates of where the mouse is clicked on the display window, and then if that place is not occupied we draw the ‘XO’ on the canvas. We also check if the player wins or not after drawing ‘XO’ on the board.

```
def userClick():
    #get coordinates of mouse click
    x,y = pg.mouse.get_pos()

    #get column of mouse click (1-3)
    if(x<width/3):
        col = 1
    elif (x<width/3*2):
        col = 2
    elif(x<width):
        col = 3
    else:
        col = None

    #get row of mouse click (1-3)
    if(y<height/3):
        row = 1
    elif (y<height/3*2):
        row = 2
    elif(y<height):
        row = 3
    else:
        row = None
    #print(row,col)

    if(row and col and TTT[row-1][col-1] is None):
        global XO

        #draw the x or o on screen
        drawXO(row,col)
        check_win()
```

The last function is the reset_game(). This will restart the game and we also reset all the variables to the beginning of the game.

```
def reset_game():
    global TTT, winner,XO, draw
    time.sleep(3)
    XO = 'x'
    draw = False
    game_opening()
    winner=None
    TTT = [[None]*3,[None]*3,[None]*3]
```

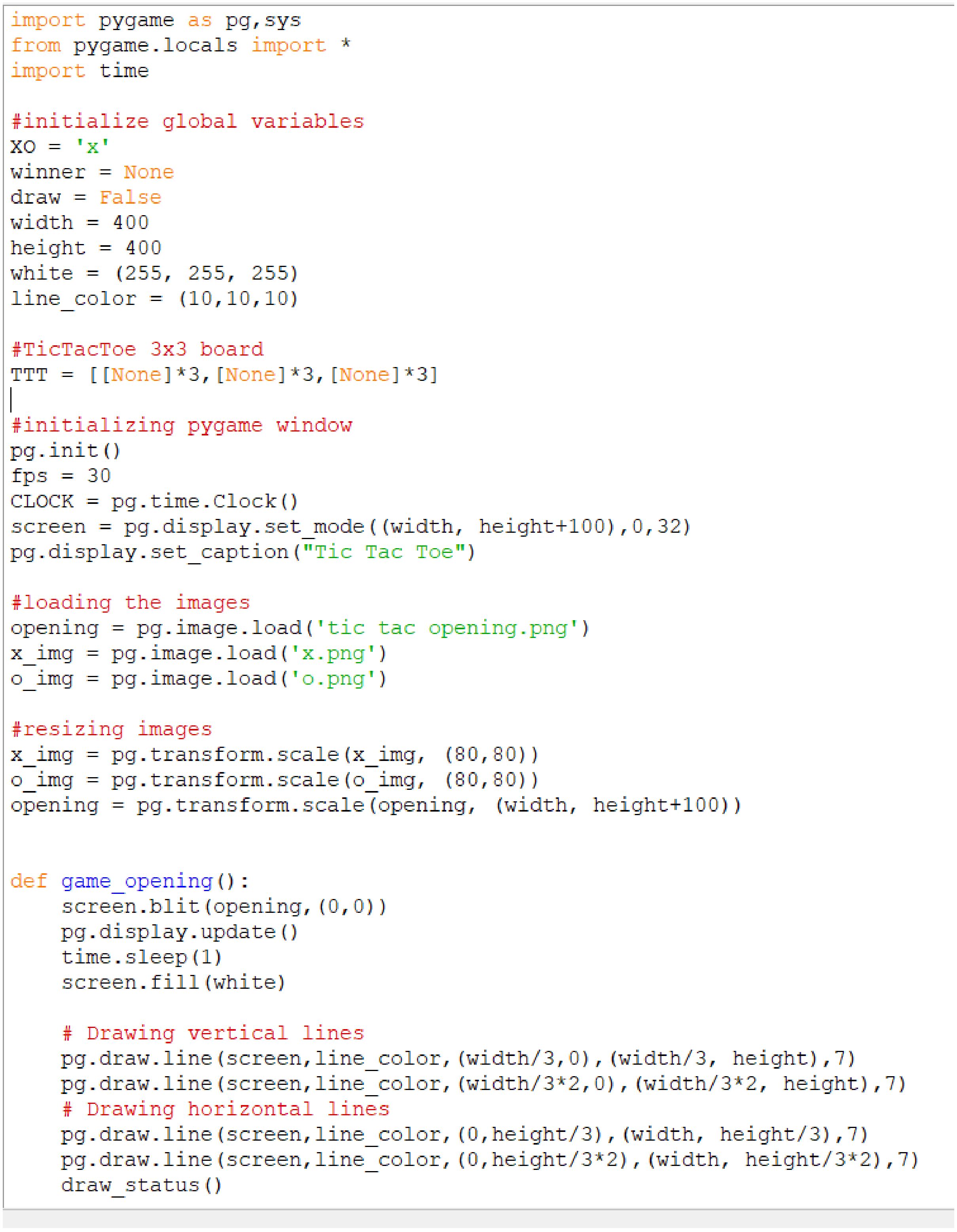
Run the tic tac toe game forever

To start the game, we will call the **game_opening()** function. Then, we run an infinite loop and continuously check for any event made by the user. If the user presses the mouse button, the MOUSEBUTTONDOWN event will be captured and then we will trigger the **userClick()** function. Then if the user wins or the game draws, we reset the game by calling **the reset_game()** function. We update the display in each iteration and we have set the frames per second to 30.

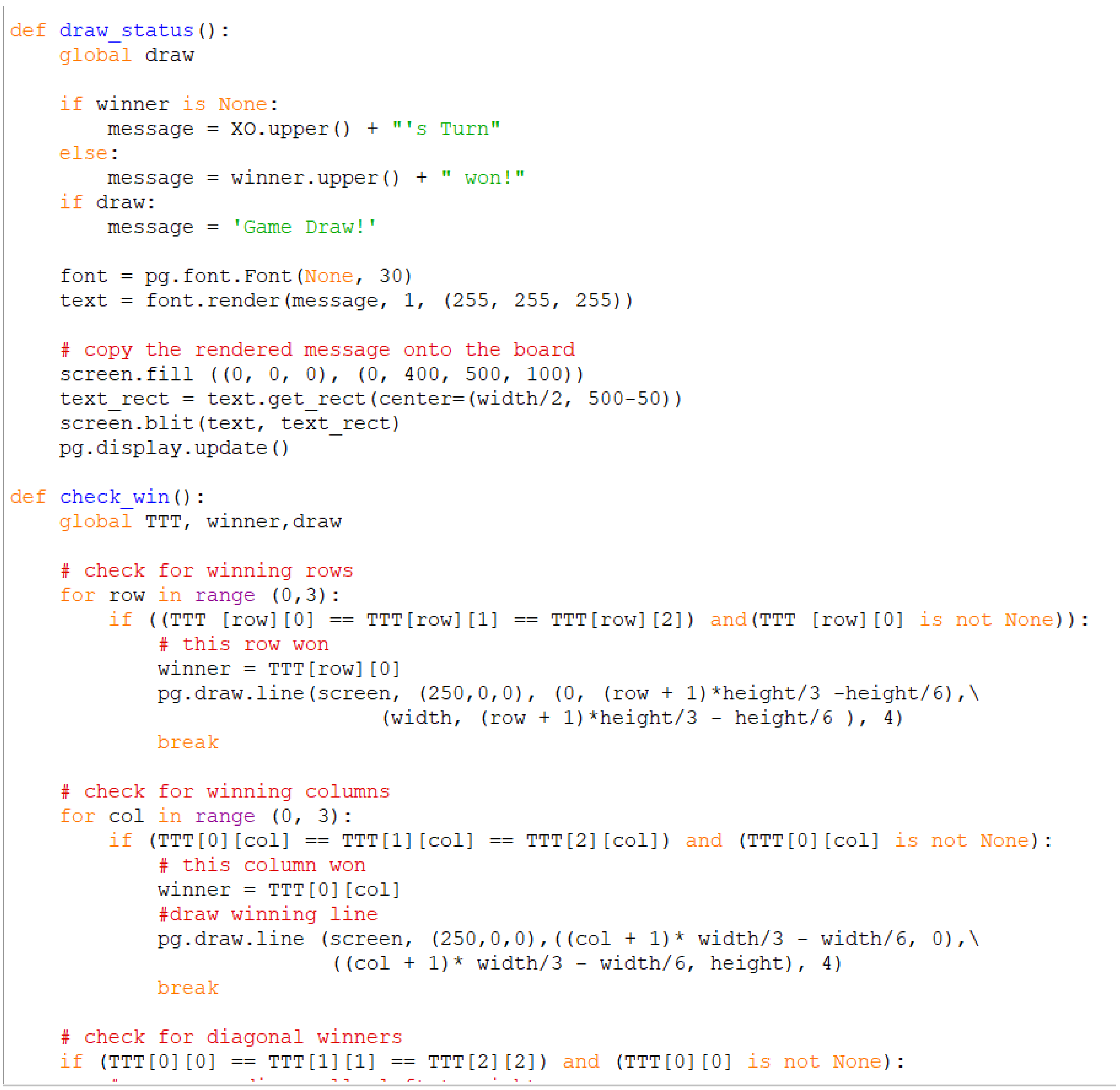
```
game_opening()

# run the game loop forever
while(True):
   for event in pg.event.get():
      if event.type == QUIT:
         pg.quit()
         sys.exit()
      elif event.type == MOUSEBUTTONDOWN:
         # the user clicked; place an X or O
         userClick()
         if(winner or draw):
            reset_game()

   pg.display.update()
   CLOCK.tick(fps)
```

The game is complete and ready to play. Save the source code with the **tictactoe.py** file name and run the file

FULL CODE

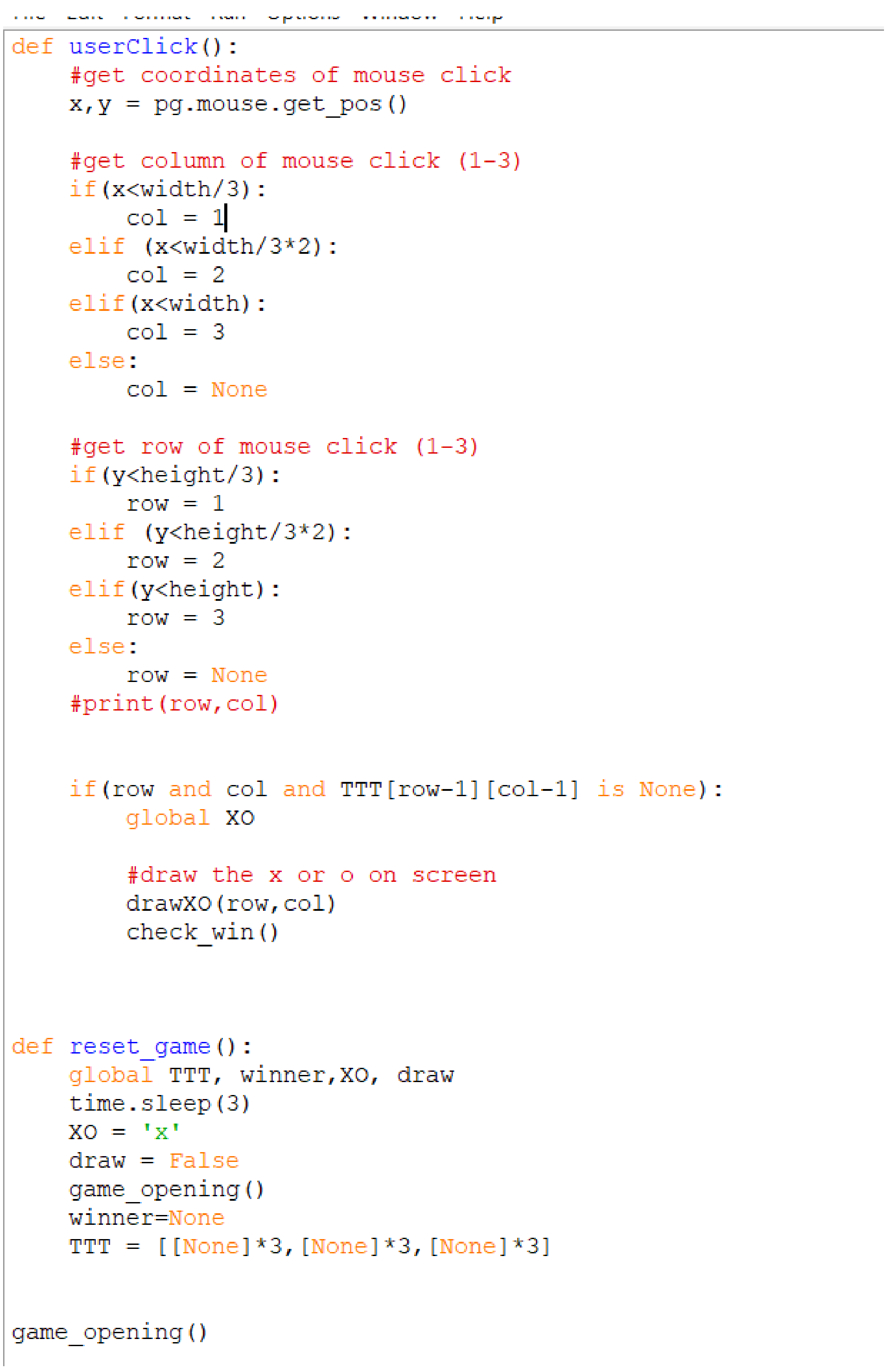


```python
import pygame as pg,sys
from pygame.locals import *
import time

#initialize global variables
XO = 'x'
winner = None
draw = False
width = 400
height = 400
white = (255, 255, 255)
line_color = (10,10,10)

#TicTacToe 3x3 board
TTT = [[None]*3,[None]*3,[None]*3]

#initializing pygame window
pg.init()
fps = 30
CLOCK = pg.time.Clock()
screen = pg.display.set_mode((width, height+100),0,32)
pg.display.set_caption("Tic Tac Toe")

#loading the images
opening = pg.image.load('tic tac opening.png')
x_img = pg.image.load('x.png')
o_img = pg.image.load('o.png')

#resizing images
x_img = pg.transform.scale(x_img, (80,80))
o_img = pg.transform.scale(o_img, (80,80))
opening = pg.transform.scale(opening, (width, height+100))


def game_opening():
    screen.blit(opening,(0,0))
    pg.display.update()
    time.sleep(1)
    screen.fill(white)

    # Drawing vertical lines
    pg.draw.line(screen,line_color,(width/3,0),(width/3, height),7)
    pg.draw.line(screen,line_color,(width/3*2,0),(width/3*2, height),7)
    # Drawing horizontal lines
    pg.draw.line(screen,line_color,(0,height/3),(width, height/3),7)
    pg.draw.line(screen,line_color,(0,height/3*2),(width, height/3*2),7)
    draw_status()
```



```
def draw_status():
    global draw

    if winner is None:
        message = XO.upper() + "'s Turn"
    else:
        message = winner.upper() + " won!"
    if draw:
        message = 'Game Draw!'

    font = pg.font.Font(None, 30)
    text = font.render(message, 1, (255, 255, 255))

    # copy the rendered message onto the board
    screen.fill ((0, 0, 0), (0, 400, 500, 100))
    text_rect = text.get_rect(center=(width/2, 500-50))
    screen.blit(text, text_rect)
    pg.display.update()

def check_win():
    global TTT, winner,draw

    # check for winning rows
    for row in range (0,3):
        if ((TTT [row][0] == TTT[row][1] == TTT[row][2]) and(TTT [row][0] is not None)):
            # this row won
            winner = TTT[row][0]
            pg.draw.line(screen, (250,0,0), (0, (row + 1)*height/3 -height/6),\
                                  (width, (row + 1)*height/3 - height/6 ), 4)
            break

    # check for winning columns
    for col in range (0, 3):
        if (TTT[0][col] == TTT[1][col] == TTT[2][col]) and (TTT[0][col] is not None):
            # this column won
            winner = TTT[0][col]
            #draw winning line
            pg.draw.line (screen, (250,0,0),((col + 1)* width/3 - width/6, 0),\
                              ((col + 1)* width/3 - width/6, height), 4)
            break

    # check for diagonal winners
    if (TTT[0][0] == TTT[1][1] == TTT[2][2]) and (TTT[0][0] is not None):
```

```
    # check for diagonal winners
    if (TTT[0][0] == TTT[1][1] == TTT[2][2]) and (TTT[0][0] is not None):
        # game won diagonally left to right
        winner = TTT[0][0]
        pg.draw.line (screen, (250,70,70), (50, 50), (350, 350), 4)


    if (TTT[0][2] == TTT[1][1] == TTT[2][0]) and (TTT[0][2] is not None):
        # game won diagonally right to left
        winner = TTT[0][2]
        pg.draw.line (screen, (250,70,70), (350, 50), (50, 350), 4)

    if(all([all(row) for row in TTT]) and winner is None ):
        draw = True
    draw_status()


def drawXO(row,col):
    global TTT,XO
    if row==1:
        posx = 30
    if row==2:
        posx = width/3 + 30
    if row==3:
        posx = width/3*2 + 30

    if col==1:
        posy = 30
    if col==2:
        posy = height/3 + 30
    if col==3:
        posy = height/3*2 + 30
    TTT[row-1][col-1] = XO
    if(XO == 'x'):
        screen.blit(x_img,(posy,posx))
        XO= 'o'
    else:
        screen.blit(o_img,(posy,posx))
        XO= 'x'
    pg.display.update()
    #print(posx,posy)
    #print(TTT)



def userClick():
    #get coordinates of mouse click
```



```python
def userClick():
    #get coordinates of mouse click
    x,y = pg.mouse.get_pos()

    #get column of mouse click (1-3)
    if(x<width/3):
        col = 1
    elif (x<width/3*2):
        col = 2
    elif(x<width):
        col = 3
    else:
        col = None

    #get row of mouse click (1-3)
    if(y<height/3):
        row = 1
    elif (y<height/3*2):
        row = 2
    elif(y<height):
        row = 3
    else:
        row = None
    #print(row,col)


    if(row and col and TTT[row-1][col-1] is None):
        global XO

        #draw the x or o on screen
        drawXO(row,col)
        check_win()



def reset_game():
    global TTT, winner,XO, draw
    time.sleep(3)
    XO = 'x'
    draw = False
    game_opening()
    winner=None
    TTT = [[None]*3,[None]*3,[None]*3]


game_opening()
```

```
    #get row of mouse click (1-3)
    if(y<height/3):
        row = 1
    elif (y<height/3*2):
        row = 2
    elif(y<height):
        row = 3
    else:
        row = None
    #print(row,col)


    if(row and col and TTT[row-1][col-1] is None):
        global XO

        #draw the x or o on screen
        drawXO(row,col)
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    time.sleep(3)
    XO = 'x'
    draw = False
    game_opening()
    winner=None
    TTT = [[None]*3,[None]*3,[None]*3]


game_opening()

# run the game loop forever
while(True):
    for event in pg.event.get():
        if event.type == QUIT:
            pg.quit()
            sys.exit()
        elif event.type == MOUSEBUTTONDOWN:
            # the user clicked; place an X or O
            userClick()
            if(winner or draw):
                reset_game()

    pg.display.update()
    CLOCK.tick(fps)
```
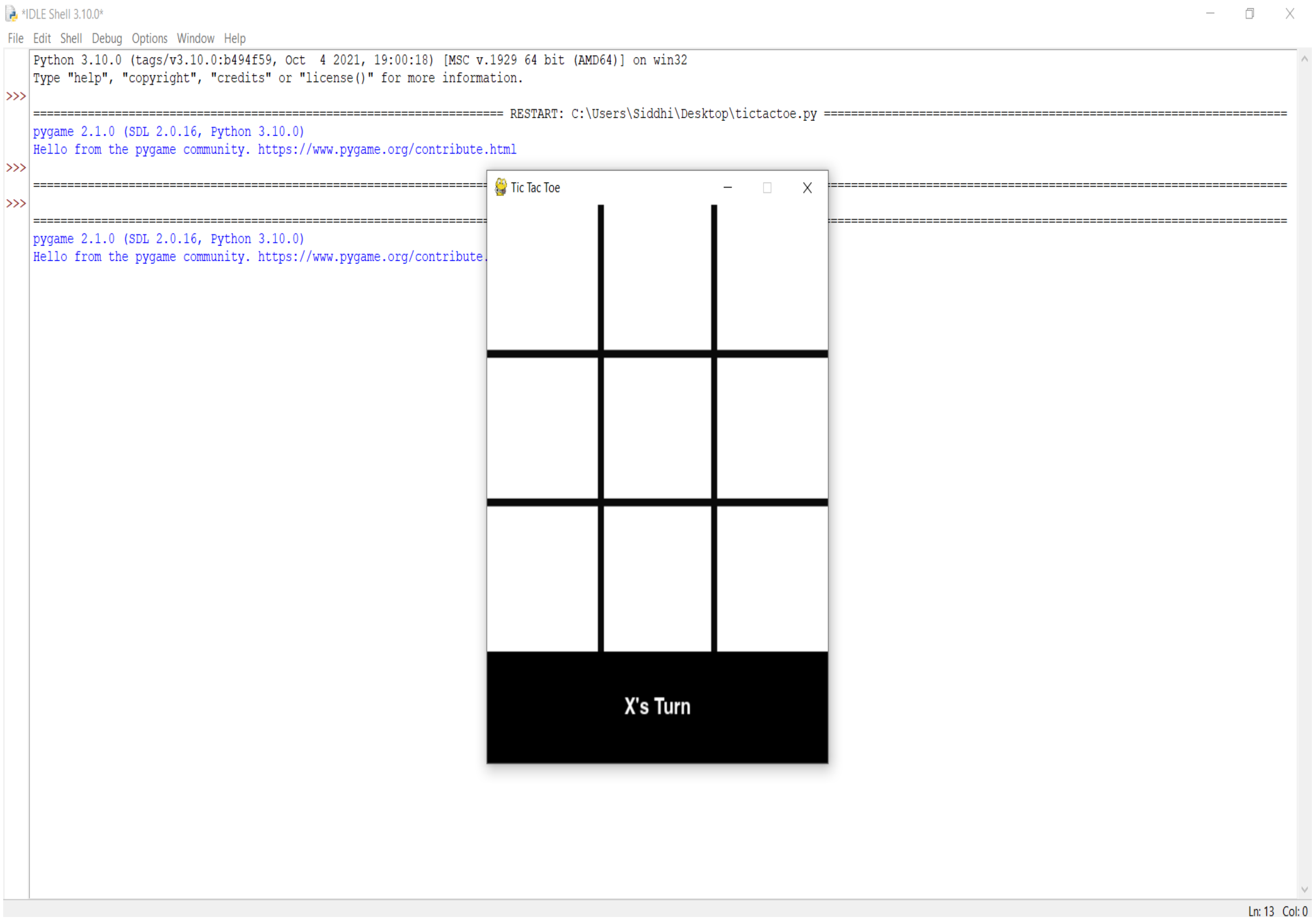

OUTPUT



```
Python 3.10.0 (tags/v3.10.0:b494f59, Oct  4 2021, 19:00:18) [MSC v.1929 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
==================================================================== RESTART: C:\Users\Siddhi\Desktop\tictactoe.py ====================================================================
pygame 2.1.0 (SDL 2.0.16, Python 3.10.0)
Hello from the pygame community. https://www.pygame.org/contribute.html
>>>
==================================================================
>>>
==================================================================
pygame 2.1.0 (SDL 2.0.16, Python 3.10.0)
Hello from the pygame community. https://www.pygame.org/contribute.
```

Reference

1. https://pypi.org
2. https://www.python.org/doc
3. https://www.youtube.com
4. https://stackoverflow.com
5. https://pypi.org/project/pygame/
6. https://pypi.org/project/times/