Python Turtle

Lesson 6

Topics

- Boolean logic and how it is used in Python
- Boolean comparisons and how to use then
- Boolean operators and how to use them
- complex conditional statements

Part 1:

Boolean logic

Boolean Introduction

Boolean all about `True` and `False` values:

- Boolean variables → either `True` or `False`
- Comparison operators → return `True` or `False`
- Boolean operators → return either `True` or `False`

`True` and `False` special values

Testing **turthiness** → testing if something is `True` or `False`

Comparison operators

Conditions test truthiness using comparison operators

Operator	Meaning
`==`	checks if two values are the same (equal to)
`!=`	checks if two values are not the same (not equal to)
`>`	checks if the left value is greater than the right value
`<`	checks if the left value is less than the right value
`>=`	checks if the left value is greater than or equal to the right value
`<=`	checks if the left value is less than or equal to the right value

New file → Save as `lesson_6_pt_1.py`

```python
print("jeff" == "jeff")  # equal to
print(1 != 1)  # not equal to
print(500 > 300)  # greater than
print(100 >= 250)  # greater than or equal to
print("a" < "q")  # less than
print(-30 <= 3)  # less than or equal to
```

PRIMM:

- **Predict** the six values then **run** the code

Literals (magic numbers) or variables does not matter

```python
score = 10
print(score > 5)
```

- **Predict** if → `True` or `False`
- **Run** the code and check

Boolean Operations

Boolean operators → complete operations on Boolean values

Return a single `True` or `False` value

Useful for creating complex condition tests

There are three Boolean operators:

- `and`
- `or`
- `not`

`not` operator

`not` operator reverses the Boolean value

- `not True` → `False`
- `not False` → `True`

```python
print("not True is:", not True)
print("not False:", not False)
```

- **Predict** and **run** the code

`and` operator

`and` operators → `True` if **all** values are `True`

```python
print("True and True is:", True and True)
print("True and False is:", True and False)
print("False and True is:", False and True)
print("False and False is:", False and False)
print("True and True and True is:", True and True and True)
print("True and True and False is:", True and True and False)
```

- **Predict** and **run** the code

- `print("True and True is:", True and True)`
  - `True and True` → all values are `True` → `True`
- `print("True and False is:", True and False)`
  - `True and False` → not all values are `True` → `False`
- `print("False and True is:", True and False)`
  - `False and True` → not all values are `True` → `False`
- `print("False and False is:", True and False)`
  - `False and False` → not all values are `True` → `False`
- `Line 5`: `print("True and True and True is:", True and True and True)`
  - `True and True and True` → all values are `True` → `True`
- `print("True and True and False is:", True and True and False)`
  - `True and True and False` → not all values are `True` → `False`

The `or` operator

`or` → the inverse of `and` operator

`or` operator → `True` if **any one** value is `True`

```python
print("True or True is:", True or True)
print("True or False is:", True or False)
print("False or True is:", False or True)
print("False or False is:", False or False)
print("True or True or True is:", True or True or True)
print("True or False or False is:", True or False or False)
```

- **Predict** and **run** the code

- `print("True or True is:", True or True)`
  - `True or True` → at least one value is `True` → `True`
- `Line 2`: `print("True or False is:", True or False)`
  - `True or False` → at least one value is `True` → `True`
- `Line 3`: `print("False or True is:", True or False)`
  - `False or True` → at least one value is `True` → `True`
- `Line 4`: `print("False or False is:", True or False)`
  - `False or False` → no values are `True` → `False`
- `Line 5`: `print("True or True or True is:", True or True or True)`
  - `True or True or True` → at least one value is `True` → `True`
- `Line 6`: `print("True or True or False is:", True or True or False)`
  - `True or True or False` → at least one value is `True` → `True`

Using Boolean operators

Returning `True` or `False` from other `True` and `False` values → not that useful

Comparison operators return Boolean values

Boolean operators + comparison operators → complex conditionals

```
print(7 < 8 and "a" < "o")
```

- **Predict** and **run** the code

- `print(7 < 8 and "a" < "o")`
  - first → complete the comparison operations from left to right
    - `7 < 8` → `True`
    - `"a" < "o"` → `True`
  - code is now → `print(True and True)`
    - `True and True` → `True`
  - prints `True` to **Shell**

Combining multiple comparison operations:

- need comparisons on **both sides** of the Boolean operator
- `10 > 5 and 10 > 13` is **not** the same as `10 > 5 and 13`.

Part 2

Mouse input in Turtle

Something new with Turtle → help understand Boolean logic

Accepted mouse input from user

Following code will be used for exercise

Need to explore it first.

```python
import turtle

## Prepare the windows and turtle ##
def set_scene():
    turtle.setup(800, 600)

    ## Respond to mouse click (signal) ##
    turtle.onscreenclick(draw_dot)

    ## Set up the grid ##
    my_ttl.speed(0)
    for i in range(4):
        my_ttl.forward(400)
        my_ttl.back(400)
        my_ttl.right(90)
    my_ttl.penup()
```

```python
## Reaction to signal (slot) ##
def draw_dot(x, y):
    print(x, y)
    color = "orange"
    size = 10
    my_ttl.goto(x, y)
    my_ttl.dot(size, color)


## Main Program
my_ttl = turtle.Turtle()
set_scene()
my_ttl.hideturtle()
```

Predict and **run** the code

Code breakdown in in the order executed:

- `## Main Program`
  - `my_ttl = turtle.Turtle()` → create a Turtle object and names it `my_ttl`
  - `set_scene()` calls the `set_scene()` function
  - `my_ttl.hideturtle()` make the turtle invisible
- `set_scene` function
  - `def set_scene()` → defines `set_scene` function
  - `turtle.setup(800, 600)` → creates a `800` x `600` window
  - `turtle.onscreenclick(draw_dot)` → if a mouse click is detected:
    - calls the `draw_dot` function and coordinates of mouse click
  - `my_ttl.speed(0)` → turtle speed `0` → don't see the turtle move
  - `for i in range(4):` → `for` loop to draw four lines making the quadrants
  - `penup` → prevents drawing line to mouse click coordinates

- `draw_dot` function
  - `def draw_dot(x, y):` → defines the `draw_dot` function
    - accepts two arguments `x` and `y`
    - `turtle.onscreenclick()` always passes coordinates as `x` and `y`
  - `print(x, y)` → prints coordinates to help you plan your code)
  - `color = "orange"` → assigns `"orange"` to `color`
  - `Line 23`: assigns `10` to the variable `size`
  - `Line 24`: sends the turtle to the `x` and `y` coordinates
  - `Line 25`: `my_ttl.dot(size, color)` draws a dot at the turtle position of size `size` and colour `color`

Exercises

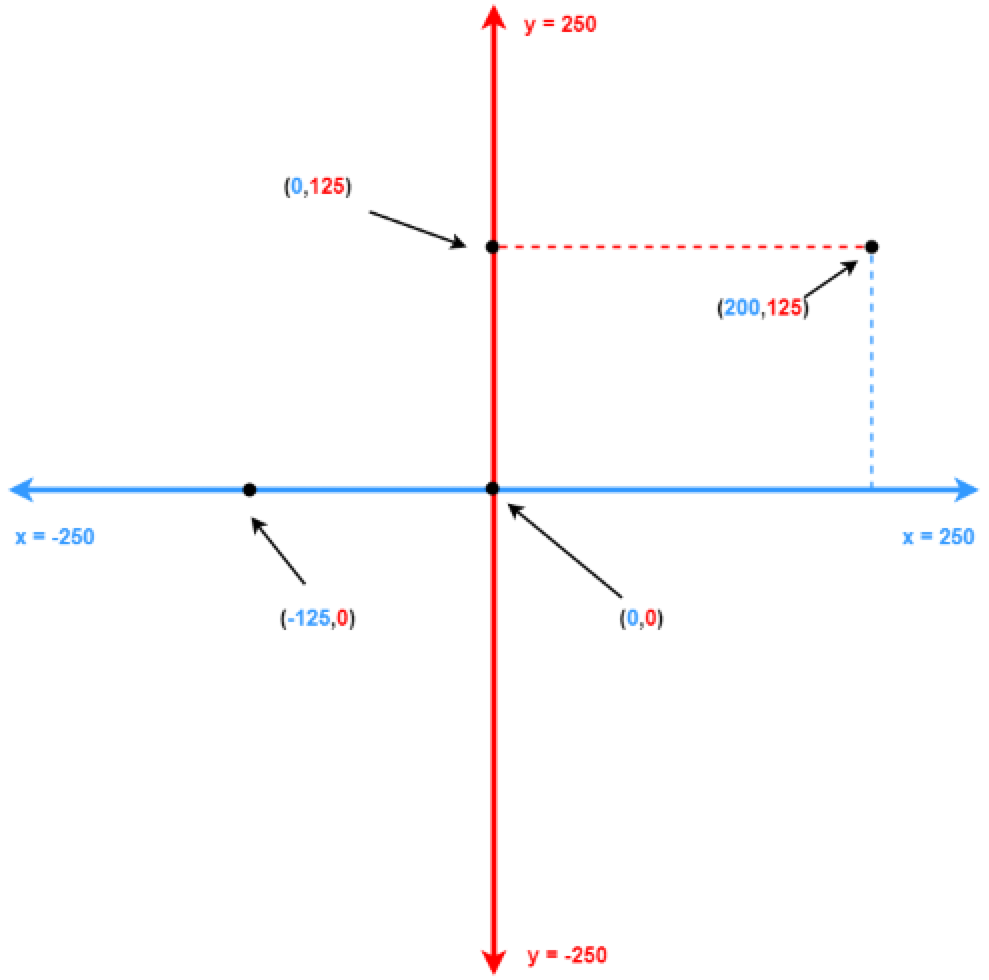
Exercises are the **make** component of the PRIMM model

Complete exercises 1 to 3

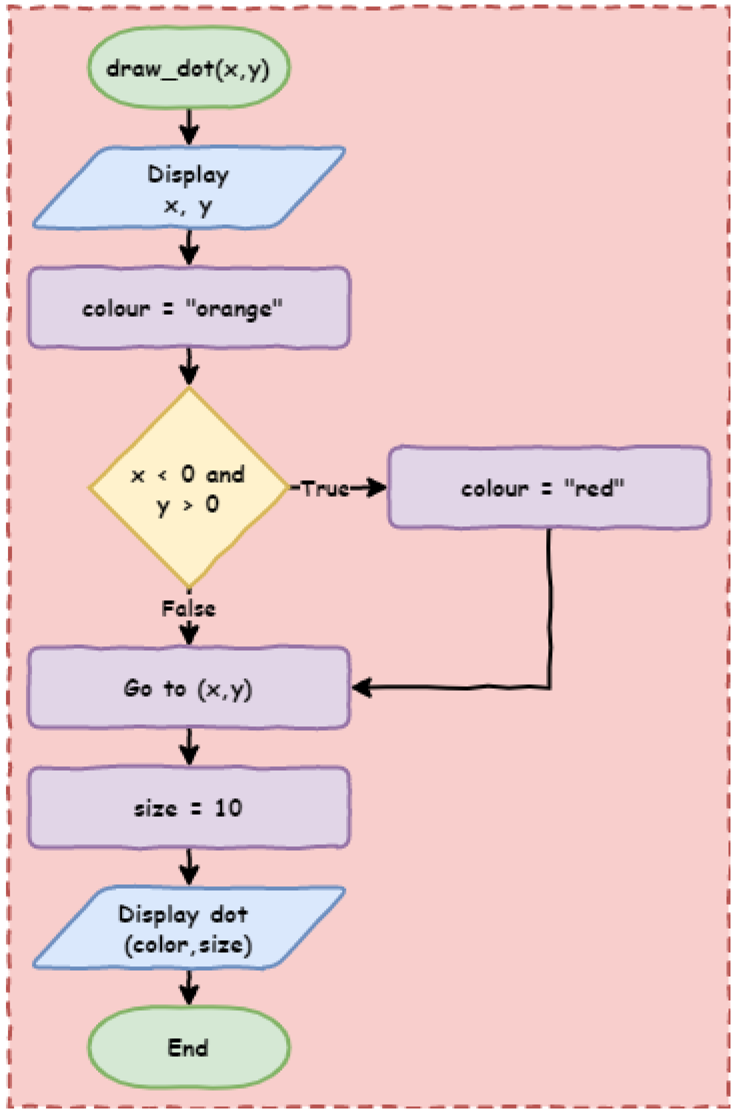
To do this your will need to use:

- `if` … `elif` … `else` statements
- Boolean comparisons
- Boolean operations

You will need to remember how coordinates work in Turtle



To help, here is the flowchart for the `draw_dot` function:


draw_dot(x,y)
Display x, y
colour = "orange"
x < 0 and y > 0
True
colour = "red"
False
Go to (x,y)
size = 10
Display dot (color,size)
End