COMP1021
Introduction to Computer Science

Creating Turtles

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Outcomes

- After completing this presentation, you are expected to be able to:
  1. Create new turtle objects
  2. Read information about each turtle object

The Turtle

```
import turtle
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
turtle.left(120)
turtle.done()
```

- So far, we have seen lots of code like this
- One turtle was used
- The turtle is actually a *turtle object*
- (We will discuss objects later in the course)
- Actually, we can make lots of turtle objects
- There's always one turtle object, which we sometimes call the *default turtle* – that's what we have been using since the start of the course

Creating a New Turtle Object

- This is how you create a new turtle object:

```
newTurtle = turtle.Turtle()
```

- After the above code `newTurtle` is a new turtle
- After you create the new turtle you can use all the techniques you know about e.g.

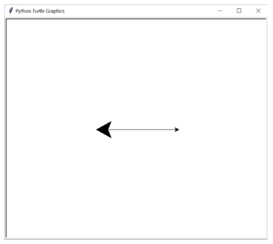
```
newTurtle.forward(100)
newTurtle.left(90)
newTurtle.color("red")
```

  and so on

Simple Example

```
import turtle
turtle.forward(100)
```
Use the default turtle

```
t=turtle.Turtle()
t.shapesize(4, 4)
t.left(180)
t.forward(100)
```
Create a new turtle, make it bigger, rotate it 180 degrees, move it forward



```
turtle.done()
```
Need this at the end

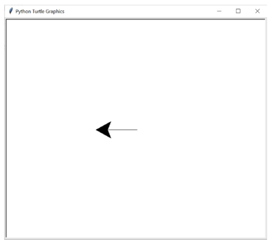
You can see 2 turtles in the turtle window

- Don’t forget that turtles always start in the middle of the screen

Hiding the Default Turtle

```
import turtle
turtle.hideturtle()
```
Sometimes you only want the newly created turtle(s) – you can hide the default turtle

```
t=turtle.Turtle()
t.shapesize(4, 4)
t.left(180)
t.forward(100)
```
Create a new turtle, make it bigger, rotate it 180 degrees, move it forward



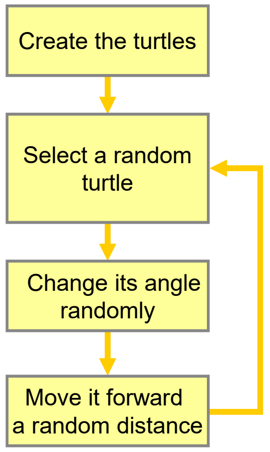
```
turtle.done()
```
Need this at the end

You can see 1 turtle in the turtle window

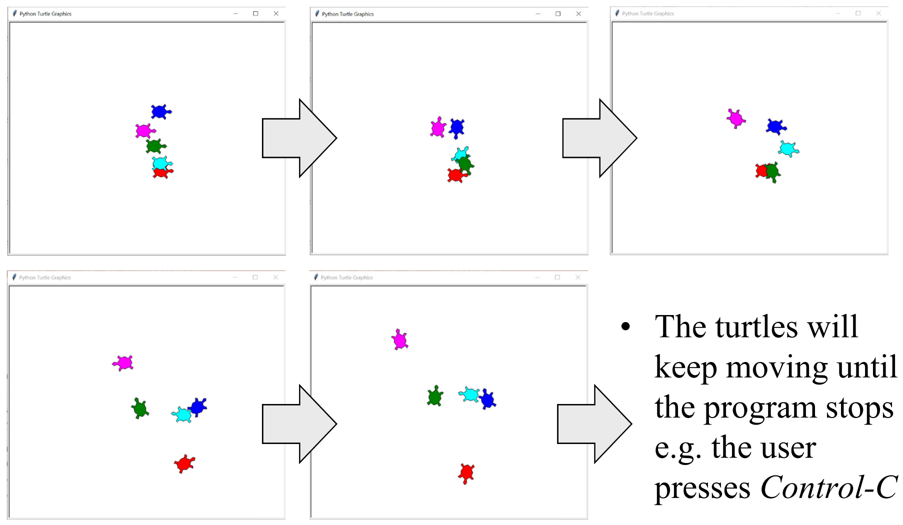
- Don’t forget that turtles always start in the middle of the screen

A Demonstration Using 5 Turtles

- Now we will build a demonstration which creates and uses 5 turtles
  - Most of the properties of the 5 turtles are the same, except for the colour
- After making the turtles, an infinite loop is used:
  - One of the turtles is randomly selected
  - That turtle has its angle changed randomly
  - That turtle is moved forward a random distance



Running The Program



- The turtles will keep moving until the program stops e.g. the user presses *Control-C*

Using a List

- To better manage the turtles we store them in a list
- We start with an empty list:

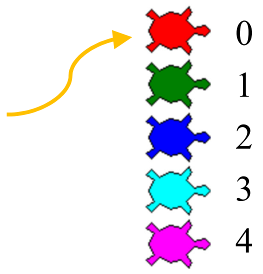
```
allTurtles = []
```

- Then, after we create each new turtle, we add it to the list of turtles using `append` :

```
newTurtle = turtle.Turtle()
allTurtles.append(newTurtle)
```

Accessing Turtles in a List

- As you know, we can retrieve something from a list by using the index e.g. `listname[2]`
- This is true whatever is in the list, even a turtle
- For example, to access the first item in the list we can use `allTurtles[0]`



A Function To Create 1 Turtle

```
# Create a new turtle, set its parameters, add it to the list
def createOneTurtle(thisColor):
    thisTurtle = turtle.Turtle()   # Make a new turtle object
    thisTurtle.fillcolor(thisColor)# Set the color of the turtle
    thisTurtle.shape("turtle")     # Change to "turtle" shape
    thisTurtle.shapesize(2, 2)     # Make the turtle twice as big
    thisTurtle.up()                # Do this so no line drawn
    thisTurtle.goto(random.randint(-80, 80),
                    random.randint(-80, 80)) # Starting position
    allTurtles.append(thisTurtle)  # Append the turtle to the list
```

- This function creates one turtle object
- The turtle is added to a list, so it can be easily accessed and managed later
- See the next slide for examples of how the function is used

Creating all the Turtles

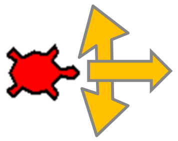
```
def createOneTurtle(thisColor):
    . . .  see previous slide . . .

# The main part of the program
allTurtles = [] # An empty list
createOneTurtle("red")
createOneTurtle("green")
createOneTurtle("blue")
createOneTurtle("cyan")
createOneTurtle("magenta")
. . .
```

Create 5 turtles, each with a different colour

- For our demonstration program we create 5 turtle objects, using the function shown on the previous slide

Changing a Turtle

- To make a fun effect we repeatedly select a random turtle, change it to a random angle, and move it a random distance



```
def changeOneTurtle():
    index = random.randint(0, 4)
    allTurtles[index].left(
        random.randint(-90, 90) ) # Change angle
    allTurtles[index].forward(
        random.randint(10, 15) )  # Move forward

# The main part of the program
. . .
while True:
    changeOneTurtle() # Repeatedly change a turtle
```

Getting Information From a Turtle

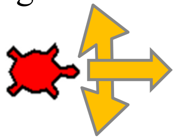
- If you have a turtle object called e.g. `thisTurtle` then you can get information from it like this:

`result = thisTurtle.xcor()`	Get the x position value
`result = thisTurtle.ycor()`	Get the y position value
`result = thisTurtle.position()`	Get both x and y
`result = thisTurtle.heading()`	Get the turtle angle
`result = thisTurtle.fillcolor()`	Get the fill color
`result = thisTurtle.speed()`	Get the speed
`result = thisTurtle.shape()`	Get the shape

... other information can also be extracted from a turtle object ...

Showing Turtle Information

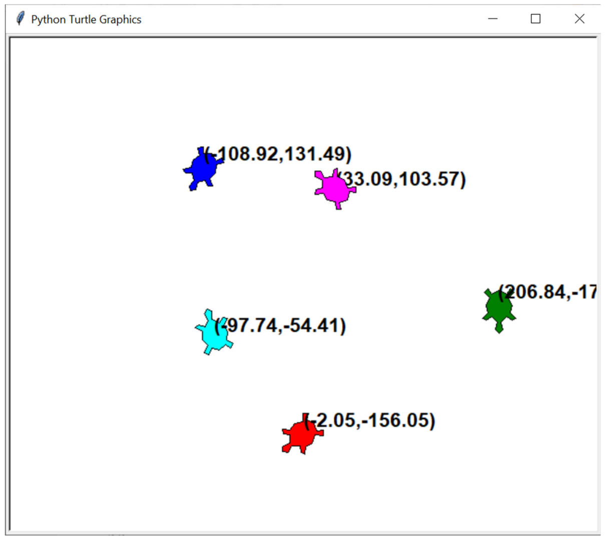
- Let's extend the previous example so that the position of the turtle is shown after it is changed:



```
def changeOneTurtle():
    index = random.randint(0, 4)
    allTurtles[index].left(
        random.randint(-90, 90) ) # Change angle
    allTurtles[index].forward(
        random.randint(10, 15) )  # Move forward
    allTurtles[index].clear() # Clear previous text
    allTurtles[index].write( \
      str( allTurtles[index].position() ), \
      font=("Arial", 16, "bold") ) # Show position
```

These 2 lines of code are added

Example Program Display



```
(-108.92,131.49)
(33.09,103.57)
(206.84,-17
(-97.74,-54.41)
(-2.05,-156.05)
```