**Outline**

Develop an understanding of how images and graphics are drawn and stored in a computer. Learn about the RGB colour space. Apply Python concepts related to lists and loops.

**Objectives**

* tbd

**Materials**

* tbd

**Level 1: Pixels & RGB**

* Create a new Repl for Python with Turtle.
* Copy and paste “Sample Program #1” from the listing at the end of this module.
* Run the program and examine the Turtle output
* Colours can be specified by using a combination of three numbers. These three numbers together define a “Pixel” point in a graphic image.
* What position is the number that controls the amount of red (r) in the pixel?

redColor = (255,0,0)

drawPixel(redColor)

drawPixel((128,0,0))

* What position is the number that controls the amount of green (g) in the pixel?greenColor (0,255,0)

drawPixel(greenColor)

drawPixel((0,128,0))

* What position is the number that controls the amount of blue (b) in the pixel?

blueColor = (0,0,266)

drawPixel(blueColor)

drawPixel((0,0,128))

* Colour number values can range from 0 to 255.
* What happens when the colour value is less than 255?

Different color than white

* What happens when the colour value is close to 0?

When it is close to 0 the color become very light

* Other shades of colours can be created using a combination of r,g,b number values.
* Create a pixel containing a shade of the colour orange.

orangeColor = (255,128,0)

drawPixel(orangeColor)

drawPixel((255,128,0))

* Create a pixel containing a shade of the colour yellow.

yellowColor = (255,255.0)

drawPixel(yellowColor)

drawPixel((255,257,0))

* Create a pixel containing a shade of your favorite colour.

darkblueColor = (0,0,204)

drawPixel(darkblueColor)

drawPixel((0,0,204))

orangeColor = (255,128,0)

drawPixel(orangeColor)

drawPixel((255,128,0))

yellowColor = (255,255.0)

drawPixel(yellowColor)

drawPixel((255,255,0))

greenColor = (0,255,0)

drawPixel(greenColor)

* Black, white, and shades of grey are created using combinations of equal r,g,b number values.
* Create a completely white pixel.

whiteColor = (255,255,255)

drawPixel(whiteColor)

drawPixel(255,255,255)

* Create a completely black pixel.

blackColor = (0,0,0)

drawPixel(blackColor)

drawPixel(0,0,0)

* Create a pixel containing a shade of middle grey.

**greyColor = (96,96,96)**

**drawPixel(greyColor)**

**Level 2: Images Using Pixels**

* Download the image “Resoultion\_284x177.jpg” from Topic B folder in the class repository.
* Open the image in a program like Paint or Photoshop.
* What is the size of this image? How many pixels does it contain? size=284 by 177
* Describe how the image looks (e.g. Can you see the pixels?) image looks blurry and we can see the pixels
* Zoom in the view to enlarge the image

* Create a new Repl for Python with Turtle.
* Copy and paste “Sample Program #2” from the listing at the end of this module.
* Run the program and examine the Turtle output
* Compare the program output to the “Resoultion\_16x16.jpg” image in question #2 above.
* Explain how the program code in lines 52 to 58 works. (i.e. The main program code.)
* How the program prints out pixels to produce and 8 by 8 resolution image.

The main program for 8 by 8 is you type up rpg 8 time in every row and its need to be 8 row

For 8 by 8

* How the program decides which colour information to use for each pixel.

It have a color code for every color.

* Explain the purpose of the code in lines 12 to 21
* How this code is related to the pixels produced by the main program.

pixelAddress = 0 tell python where to place for the pixel.

* The RGB value of the 19th pixel in the image

Is a different type of color for the value

* The RGB value of the pixel in the 5th column on the 4th row.

R 154 G 140 B 22

* Modify the main program to print the image at a resolution of 12 by 4 pixels.
* Show your modified image to Mr. Nestor.
* Explain your changes to the program code below.

# Each row contains eight pixels

for row in range (12) :

for column in range(4) :

drawPixel(pixelMemory[pixelAddress])

pixelAddress += 1

newRow()

The Upside down pixel

import turtle

myPen = turtle.Turtle()

# These variables track the position of the turtle pen

posX = 0

posY = 0

# These variables define the image information.

# Each pixel in the image has a (r,g,b) value

# The complete image is simply a list of pixels

pixelAddress = 0

pixelMemory = [

(15,15,5),(13,13,6),(8,10,3),(23,21,10),(32,33,16),(33,52,22),(32,54,21),(25,42,17),

(21,19,17),(20,18,9),(7,7,6),(58,65,11),(42,47,7),(11,8,6),(24,25,8),(21,28,10),

(25,19,5),(16,13,8),(28,28,12),(191,192,18),(205,202,21),(42,42,14),(11,11,4),(16,11,3),

(34,59,10),(35,47,15),(24,35,12),(156,139,26),(154,140,22),(28,43,10),(9,12,1),(19,22,5),

(42,88,15),(48,94,18),(98,120,49),(213,195,123),(109,134,66),(44,91,15),(52,86,22),(43,85,18),

(50,95,13),(63,104,39),(224,213,156),(255,225,140),(120,153,92),(41,99,17),(58,103,28),(42,98,17),

(35,86,13),(71,105,42),(223,208,144),(216,204,146),(100,134,82),(28,87,3),(39,83,12),(32,80,12),

(49,102,29),(57,109,33),(92,125,53),(66,103,36),(29,66,13),(32,76,17),(48,91,26),(47,93,23)

]

# This user defined function draws a single image pixel

def drawPixel(rgb) :

global posX

myPen.down()

myPen.color(rgb)

myPen.begin\_fill()

myPen.circle(8)

myPen.end\_fill()

myPen.up()

myPen.fd(18)

posX = posX + 18

# This user defined function starts a new row of pixels

def newRow() :

global posX

global posY

myPen.up()

myPen.lt(180)

myPen.forward(posX)

myPen.rt(90)

myPen.forward(18)

myPen.rt(90)

myPen.down()

posX = 0

posY = posY + 18

# THE MAIN PROGRAM CODE STARTS HERE

#

# Draw eight rows of the image.

# Each row contains eight pixels

for row in range (8) :

for column in range(8) :

drawPixel(pixelMemory[pixelAddress])

pixelAddress += 1

newRow()

**Level 3: Your Custom Image**

* Use and modify the sample pixel program code to create your own custom image.
* Create a larger resolution image than provided in the sample.
* Make sure the image is recognizable (or a clear pattern).
* Show your image to Mr. Nestor.
* List and explain your modified image code below.

**SAMPLE PROGRAM #1**

import turtle

myPen = turtle.Turtle()

# These variables track the position of the turtle pen

posX = 0

posY = 0

# This user defined function draws a single image pixel

def drawPixel(rgb) :

global posX

myPen.down()

myPen.color(rgb)

myPen.begin\_fill()

myPen.circle(8)

myPen.end\_fill()

myPen.up()

myPen.forward(18)

posX = posX + 18

# THE MAIN PROGRAM CODE STARTS HERE

#

redColor = (255,0,0)

drawPixel(redColor)

drawPixel((128,0,0))

greenColor = (0,255,0)

drawPixel(greenColor)

drawPixel((0,128,0))

blueColor = (0,0,266)

drawPixel(blueColor)

drawPixel((0,0,128))

**SAMPLE PROGRAM #2**

import turtle

myPen = turtle.Turtle()

# These variables track the position of the turtle pen

posX = 0

posY = 0

# These variables define the image information.

# Each pixel in the image has a (r,g,b) value

# The complete image is simply a list of pixels

pixelAddress = 0

pixelMemory = [

(15,15,5),(13,13,6),(8,10,3),(23,21,10),(32,33,16),(33,52,22),(32,54,21),(25,42,17),

(21,19,17),(20,18,9),(7,7,6),(58,65,11),(42,47,7),(11,8,6),(24,25,8),(21,28,10),

(25,19,5),(16,13,8),(28,28,12),(191,192,18),(205,202,21),(42,42,14),(11,11,4),(16,11,3),

(34,59,10),(35,47,15),(24,35,12),(156,139,26),(154,140,22),(28,43,10),(9,12,1),(19,22,5),

(42,88,15),(48,94,18),(98,120,49),(213,195,123),(109,134,66),(44,91,15),(52,86,22),(43,85,18),

(50,95,13),(63,104,39),(224,213,156),(255,225,140),(120,153,92),(41,99,17),(58,103,28),(42,98,17),

(35,86,13),(71,105,42),(223,208,144),(216,204,146),(100,134,82),(28,87,3),(39,83,12),(32,80,12),

(49,102,29),(57,109,33),(92,125,53),(66,103,36),(29,66,13),(32,76,17),(48,91,26),(47,93,23)

]

# This user defined function draws a single image pixel

def drawPixel(rgb) :

global posX

myPen.down()

myPen.color(rgb)

myPen.begin\_fill()

myPen.circle(8)

myPen.end\_fill()

myPen.up()

myPen.forward(18)

posX = posX + 18

# This user defined function starts a new row of pixels

def newRow() :

global posX

global posY

myPen.up()

myPen.left(180)

myPen.forward(posX)

myPen.left(90)

myPen.forward(18)

myPen.left(90)

myPen.down()

posX = 0

posY = posY + 18

# THE MAIN PROGRAM CODE STARTS HERE

#

# Draw eight rows of the image.

# Each row contains eight pixels

for row in range (8) :

for column in range(8) :

drawPixel(pixelMemory[pixelAddress])

pixelAddress += 1

newRow()