

SELECTED ACTIVITIES

1. **Creating grayscale and color images using the “Binary Image Generator”** (binary colors, open play)
2. **Connecting color images with RGB Hex and decimal values**
3. **Processing Real images through the AOLME library by defining image Coordinates plane** (coordinates, grouping, blocks, share and modify-’debug’), **arrays, and ranges with python** (debug, program, share and modify-DMI)



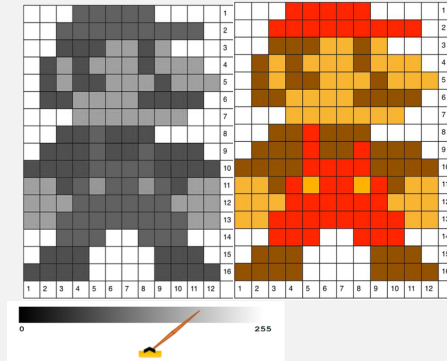
6.1. Creating Images w/ the “Image Generator”

What's the value for your favorite color?

Have you ever mixed colors?

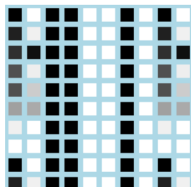
1. Use the Raspberry Pi, go to folder: /pi/AOLME/Session 4/
Open the “Image Generator” and set it to ‘Grayscale’

Grayscale images are created with tones or values that go from 00-FF or 0-255. **Which value is the darkest?**
What's your favorite gray tone?

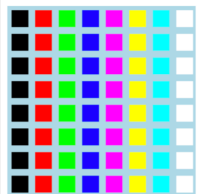


In the columns ‘j’ enter 4-5 gray tones and talk about how each is formed.

3. Create a gray and a color image. After developing each image, scroll down to the Python code and find out how the **images** and **code** are related.



```
[0x30, 0x0F, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0xFF, 0x30, 0x0F], # i=2  
[0x50, 0xEE, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0xFF, 0x50, 0xEE], # i=3  
[0x50, 0xCC, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0xFF, 0x50, 0xCC], # i=4  
[0xA0, 0xAA, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0xFF, 0xA0, 0xAA], # i=5  
[0xF0, 0xFF, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0xFF, 0xF0, 0xFF], # i=6  
[0xFF, 0xFF, 0x00, 0x00, 0xFF, 0xFF, 0x00, 0xFF, 0xFF, 0xFF], # i=7
```



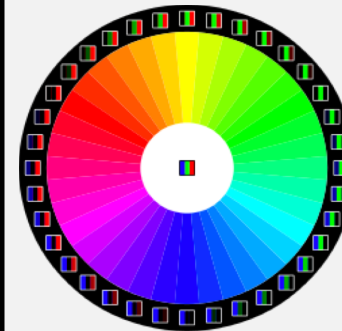
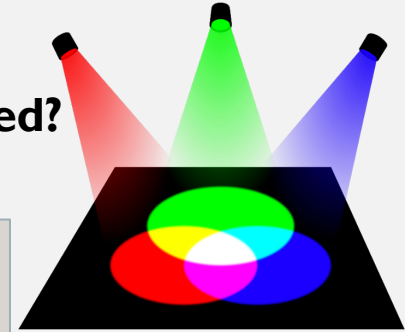
```
# Definition of the image using a 2D Python array  
img = [[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=0  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=1  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=2  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=3  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=4  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=5  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=6  
[0x000000, 0xFF0000, 0x00FF00, 0x0000FF, 0xFF00FF, 0x00FFFF, 0x00FFFF, 0x00FFFF], # i=7
```

2. Colors are developed through the combination of three color components: **Red**, **Green**, and **Blue**. The value given to each component determines the **RGB** combination and the final color.

Why does this RGB value gives you red?

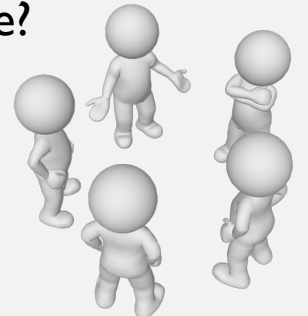
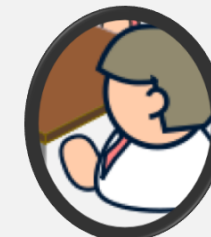
“FF0000” = (255, 0, 0) = red

Set image generator in color, create 4-5 colors and talk about how each color is formed.

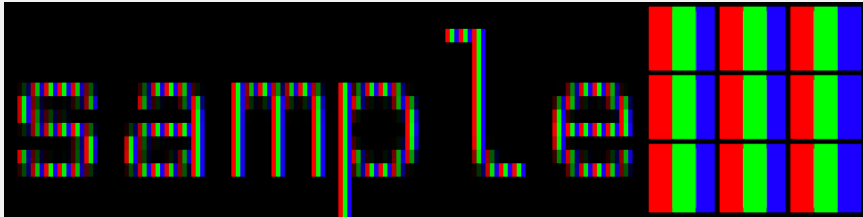


4. **Discuss & Write:** How do you make and represent a color? How are gray tones and colors different? How are the color codes of the images related to the columns and rows in the coordinate plane?

You can change the matrix sizes (e.g., 8x8, 10x10) in the image generator!

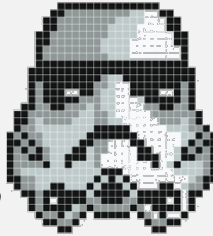


6.2. Images & Numbers



What would subpixels for grayscale images look like?

1. Look closely at the 'sample' image, see how each letter is created by pixels and each pixel is composed of smaller subpixels. The subpixels have color components that can be adjusted to make a color. Full **RGB** values make white, why?



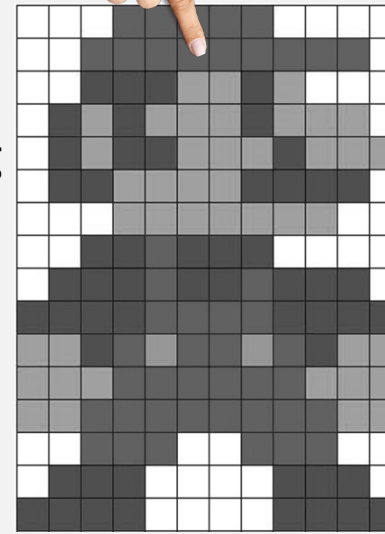
3. With a partner select 3 numbers in Mario's matrix and convert them into binary & hexadecimal #s. Solve them in your notebook.

Decimal number	Binary number								Hexadecimal number
power	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
number	128	64	32	16	8	4	2	1	
76									
109									
253									

I think 76 is 1001100₂ and 4C₁₆



2. Computers read image colors using hex #s. See how each pixel in Mario's image has a value.



How is coordinate or matrix of codes linked to Mario's image and color? What does a 97 mean?

255	255	255	97	97	97	97	97	255	255	255	255	0
255	255	97	97	97	97	97	97	97	97	97	255	1
255	255	79	79	79	160	160	79	160	255	255	255	2
255	79	160	79	160	160	160	79	160	160	255	255	3
255	79	160	79	79	160	160	160	79	160	160	160	4
255	79	79	160	160	160	160	79	79	79	255	255	5
255	255	255	160	160	160	160	160	160	160	255	255	6
255	255	79	79	97	79	79	79	255	255	255	255	7
255	79	79	79	97	79	79	97	79	79	255	255	8
79	79	79	79	97	97	97	97	79	79	79	79	9
160	160	79	97	151	97	97	151	97	79	160	160	10
160	160	160	97	97	97	97	97	97	160	160	160	11
160	160	97	97	97	97	97	97	97	97	160	160	12
255	255	97	97	97	255	255	97	97	97	255	255	13
255	79	79	79	255	255	255	255	79	79	79	255	14
79	79	79	79	255	255	255	255	79	79	79	79	15
0	1	2	3	4	5	6	7	8	9	10	11	

What colors do hex codes on the left represent? Why?

Hexadecimal Color Pixel: "RRGGBB"



● **RGB** = _____

● **RGB** = _____

● **RGB** = _____

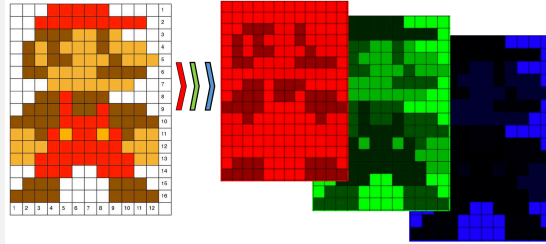
4. Discuss & Write: Why are hex numbers (not binary) used in Python code? In a grayscale you enter only one hex # per gray tone, why do you need 3 hex #s to program a color? Name 3 colors and develop their hex codes.

6.3. Processing Real-life Images with Python

1. Take a group picture of your team and upload it onto the folder with AOLME.py. Name the image file with a short name related to your team! Open IDLE and create a new file. To run the program click on play or hit the f5 key, when done save and name your file.



The **RGB** components determine the colors in your image.



2. As a team, look, type the codes on the right, and predict and see what they do. Instead of using the name 'pets' use the name of your image file. Write what you find out. Test the 6 options!!!

```
(a) from AOLME import *
pets = read_img('pets.jpg')
show_comps(pets)
(b) from AOLME import *
pets = read_img('pets.jpg')
show_img(pets)
(c) from AOLME import *
pets = read_img('pets.jpg')
img_size(pets)
(d) from AOLME import *
pets = read_img('pets.jpg')
rotate_img(pets, 180)
(e) from AOLME import *
pets = read_img('pets.jpg')
save_img(pets, 'my_pets.jpg')
```

What do these codes do?

response

```
>>>
# of rows: 3002
# of cols: 2849
>>>
```

```
from AOLME import *
pets = read_img('pets.jpg')
gray_pets = make_img_gray(pets)
```

What if you change degrees?

3. Let's process & change images.

Codes for changes at the pixel level

How'd you change the **RGB** values?

Code to change ranges.

```
from AOLME import *
pets = read_img('pets.jpg')
color = get_pixel(pets, [0,0])
print color
>>> [ 58 117 163]
>>>
pets = read_img('pets.jpg')
put_pixel(pets, [0,0], [0,0,0])
color = get_pixel(pets, [0,0])
>>> [0 0 0]
>>>
from AOLME import *
pets = read_img('pets.jpg')
pixel_range = [0,500,0,500]
put_pixel_group(pets, pixel_range, [0,0,0])
show_img(pets)
```

Position: Row-column

Array

Why do the # of arguments vary?

First argument Second argument Third argument

How are arrays & positions related?



4. As team, take a flashdrive and borrow a picture from another time and come up with ideas to design and process that image. When done, share it with the team you got the picture from. Take turns typing in the codes. Save all the work that you do!