Personal Billboard

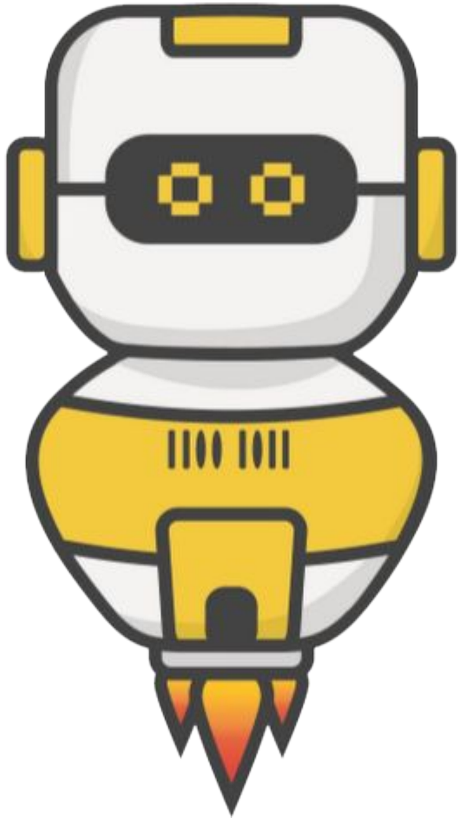
Mission 7

FIRIA LABS

Pre-Mission Preparation

Have you ever made a sign to post on a door or wall? How about a name badge to wear? Or a cap or t-shirt with a message or slogan on it?

- If you could show what you like or your mood by displaying something, what would you display? (example: a color, an image, a slogan, etc.)
- What type of clothing would you display your message on?



Mission 7: Personal Billboard

In this project you'll use the CodeX display and buttons to make a *billboard* that shows others how you're feeling, a fun picture, or a short message.

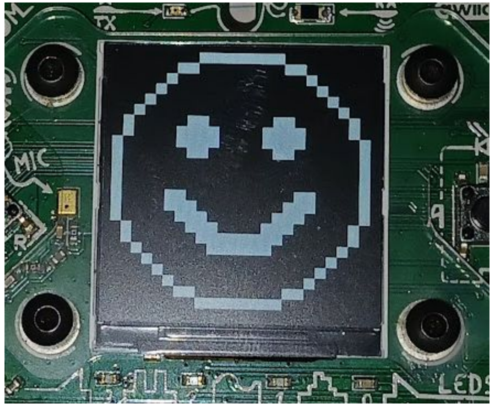
> On battery power, you could make the CodeX into a *wearable* electronic **badge** or a **portable sign** for a wall or desk!

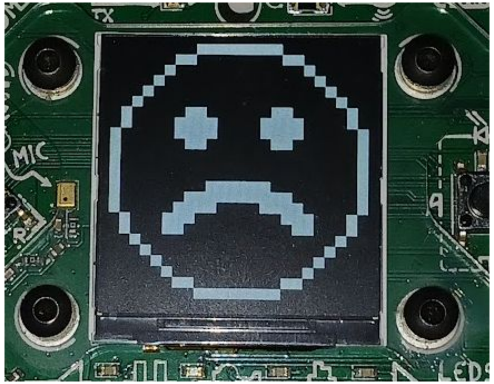
Objective #1: Image selector

The CodeX has several built-in images. You have used them since Mission 2.

You learned about using buttons for input in Mission 6.

- Start this project by writing code that will:
    - Display the HAPPY face when BTN_L is pressed
    - Display the SAD face when BTN_R is pressed

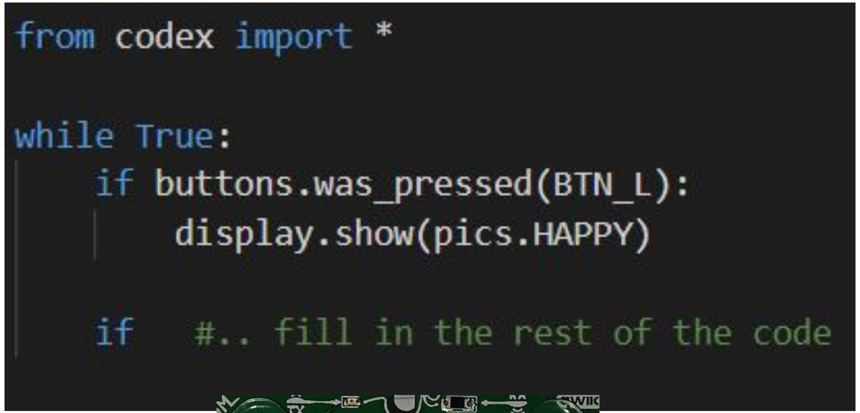




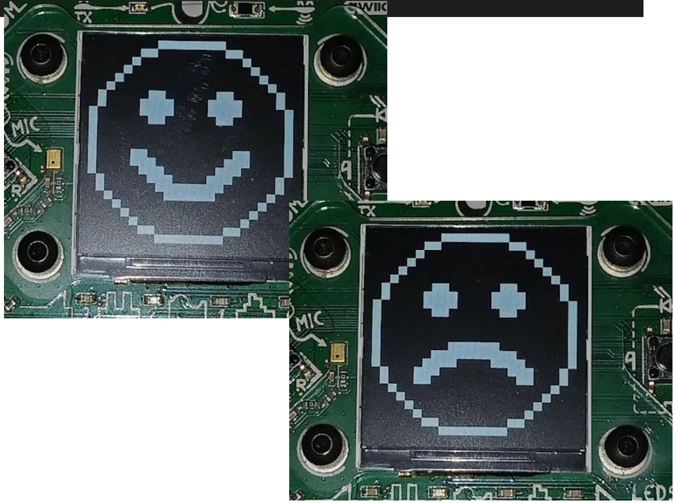
Mission Activity #1

DO THIS:

- Start a new file named **Billboard**
- Import codex
- Use a while True: loop
- Show pics.HAPPY if BTN_L was pressed
- Show pics.SAD if BTN_R was pressed
    - Use CodeTrek if you need help



```
from codex import *

while True:
    if buttons.was_pressed(BTN_L):
        display.show(pics.HAPPY)

    if   #.. fill in the rest of the code
```



Objective #2: Select more images

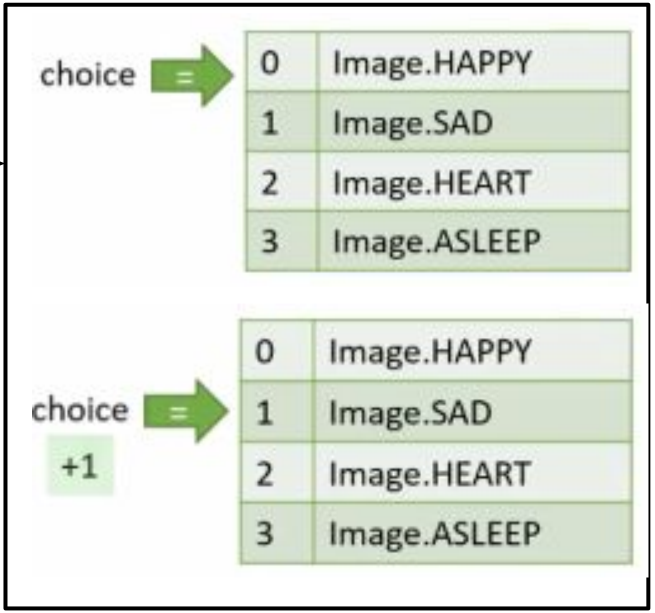
You will use the CodeX to display your mood, so you need more than two pictures!

- You will still use the LEFT and RIGHT buttons to scroll through the pictures
- So you need some way to keep track of which picture to display
- You will use the variable **choice** to keep track of which image to display, and update **choice** with the buttons

Objective #2: Select more images

You can use a number to keep track of the images like this:

A number like this is called an **index**. It is like using your finger to point to the image!



0	Image.HAPPY
1	Image.SAD
2	Image.HEART
3	Image.ASLEEP

0	Image.HAPPY
1	Image.SAD
2	Image.HEART
3	Image.ASLEEP

Objective #2: Select more images

To compare a number to a specific value, use **==**

- **choice == 1**

Use this comparison in an if statement to display an image

- Use an if statement for each picture
- You will have 4 additional if statements
- Use HAPPY, SAD, and two more pictures

Concept:
Comparison operator

= assigns a value
count = 1

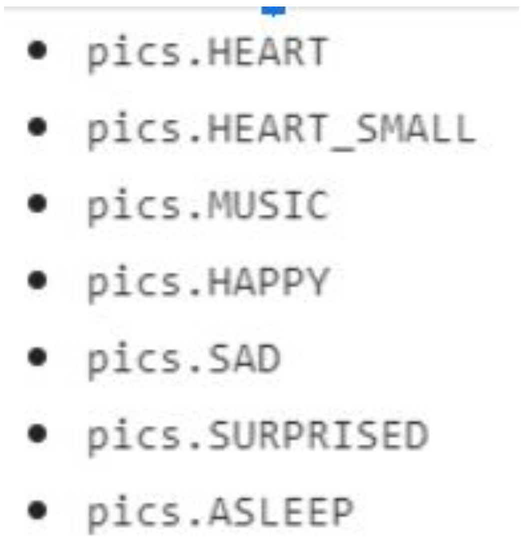
== compares two values to see if they are the same
if choice == 1

Comparison operators:

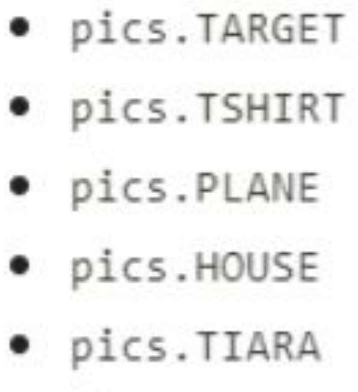
Greater than	>
Less than	<
Greater than or equal to	>=
Less than or equal to	<=
Equal to	==
Not equal to	!=

Objective #2: Select more images

Built-in images you can use:



- pics.HEART
- pics.HEART_SMALL
- pics.MUSIC
- pics.HAPPY
- pics.SAD
- pics.SURPRISED
- pics.ASLEEP

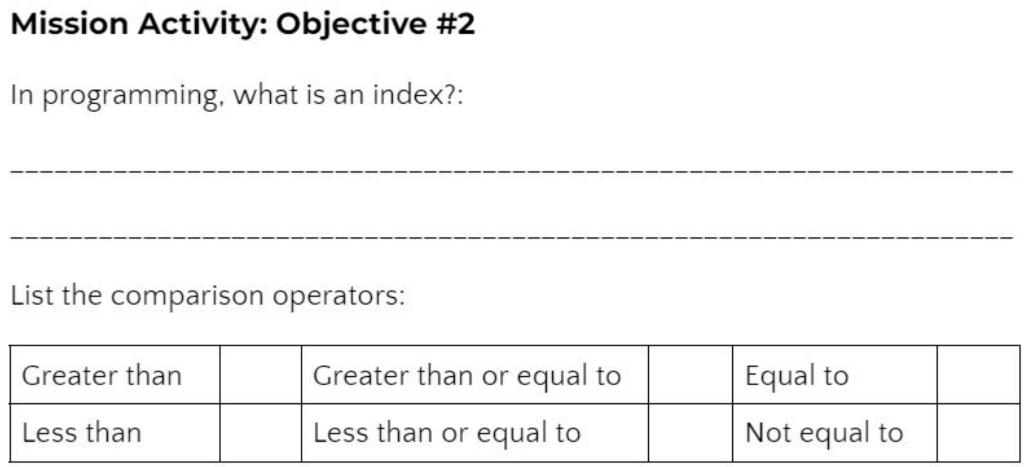


- pics.TARGET
- pics.TSHIRT
- pics.PLANE
- pics.HOUSE
- pics.TIARA

Mission Activity #2

DO THIS:

- Go to your Mission Log and answer the questions about index and comparison operators



Mission Activity: Objective #2

In programming, what is an index?:

____

____

List the comparison operators:

Greater than		Greater than or equal to		Equal to	
Less than		Less than or equal to		Not equal to	

Mission Activity #2

DO THIS:

- Define the variable choice and assign it the value 0
- Write an if statement to display HAPPY (if choice == 0:)
- Write an if statement to display SAD (if choice == 1:)
- Write an if statement to display another pic (if choice == 2:)
- Write an if statement to display another pic (if choice == 3:)
- Change the **`if buttons.was_pressed(BTN_R)`** code to increment choice (**choice = choice + 1**)

Try to do the code on your own, and then check your work with the next slide.

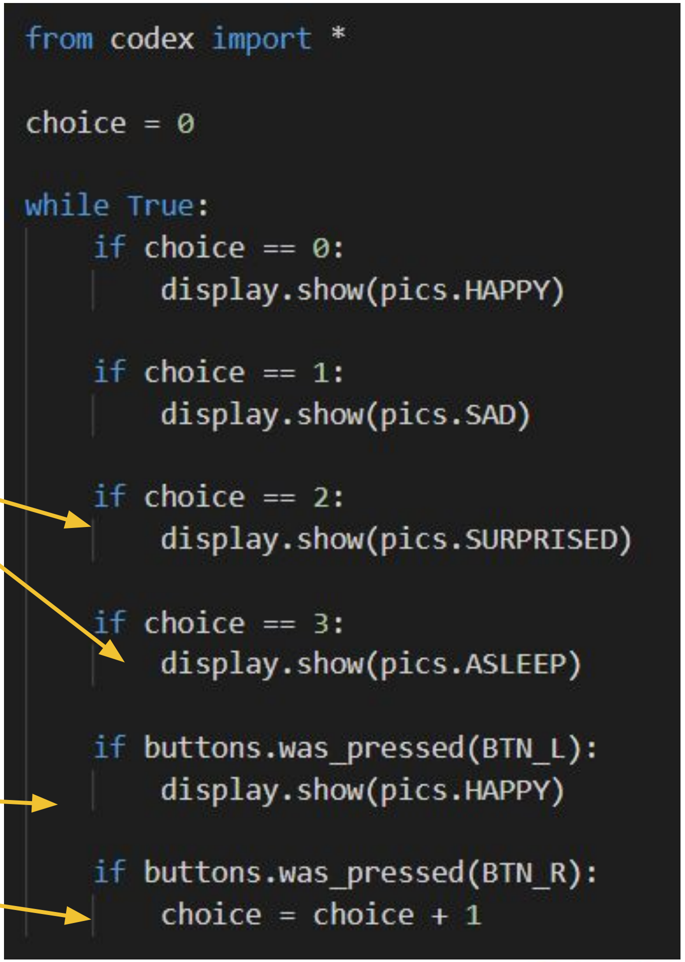
Mission Activity #2

Your code should look like this:

The last two pictures will be the ones you chose.

BTN_L isn't changed

BTN_R **increments** choice



```
from codex import *

choice = 0

while True:
    if choice == 0:
        display.show(pics.HAPPY)

    if choice == 1:
        display.show(pics.SAD)

    if choice == 2:
        display.show(pics.SURPRISED)

    if choice == 3:
        display.show(pics.ASLEEP)

    if buttons.was_pressed(BTN_L):
        display.show(pics.HAPPY)

    if buttons.was_pressed(BTN_R):
        choice = choice + 1
```

Objective #3: Scroll both directions

In Mission 6, you learned about increment and decrement

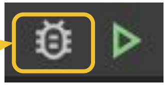
- Increment:
  - Increase the value of a variable by a set amount
  - Example: num = num + 1
- Decrement:
  - Decrease the value of a variable by a set amount
  - Example: num = num - 1

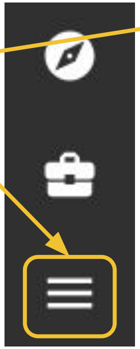
You will change the code for BTN_L to decrement choice so you can scroll the opposite way.

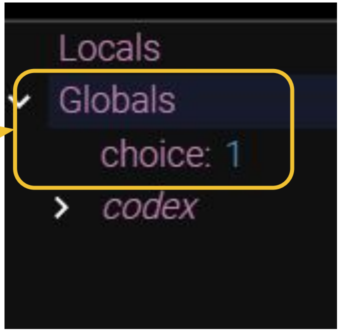
Objective #3: Scroll both directions

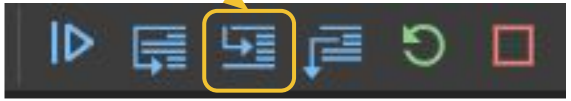
Another awesome feature of the debugger is that you can watch your variables and track their values while the code is running.

- Start the debugger
- Open the console panel
- Watch the variables as you step through the code





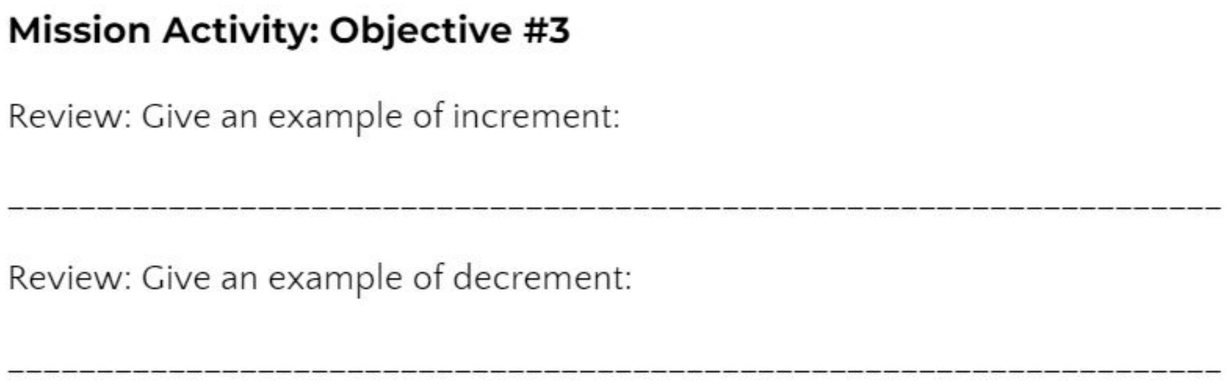

Locals
Globals
choice: 1
codex



Mission Activity #3

DO THIS:

- Go to your Mission Log and review “increment” and “decrement” from Mission 6



Mission Activity: Objective #3

Review: Give an example of increment:

____

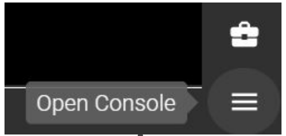
Review: Give an example of decrement:

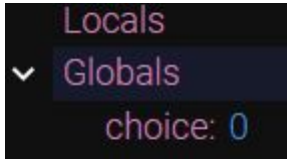
____

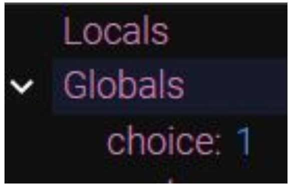
Mission Activity #3

DO THIS:

- Change the code for BTN_L to decrement **choice** by 1
- Start the debugger
- Open the console panel
- Use the **Step In** button to run the code.
    - Click several times, and then press BTN_R. Check the value of choice.
    - Click several more times, and then press either BTN_R or BTN_L. Check the value of choice.
    - Continue as long as you want until you understand the code.
    - Then STOP the code.



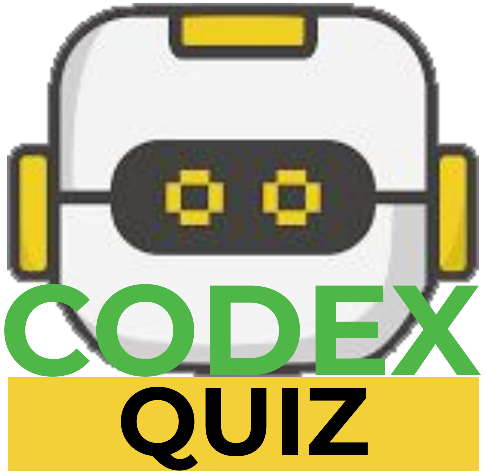

Locals
Globals
choice: 0


Locals
Globals
choice: 1

Billboard checkpoint

During this mission you have learned to use an index, review increment and decrement the counter, and used the debugger.

- Answer the 3 quiz questions about the Objectives 1-3



Objective #4: Wrap around

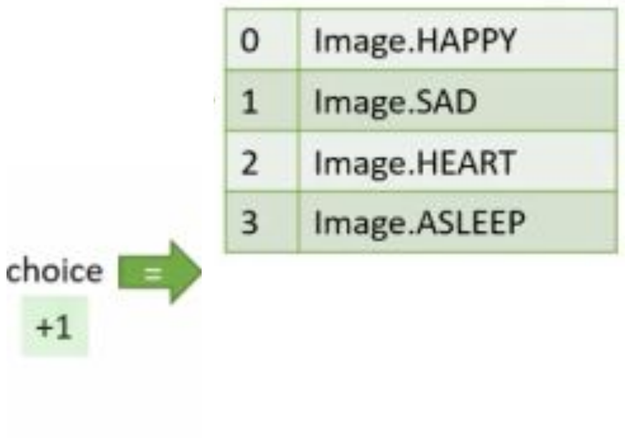
You probably noticed that if you keep pressing BTN_R, it stops at the last image.

- The value of **choice** keeps increasing, but the image stays the same.
- Also, pressing BTN_L many times keeps the first image on the screen.
- The value of **choice** decreases, but the image stays the same.

Objective #4: Wrap around

- There are no if statements for **choice == 4** or **choice == -1**
- So the last image displayed remains on the screen

Can you improve the program and avoid this problem?

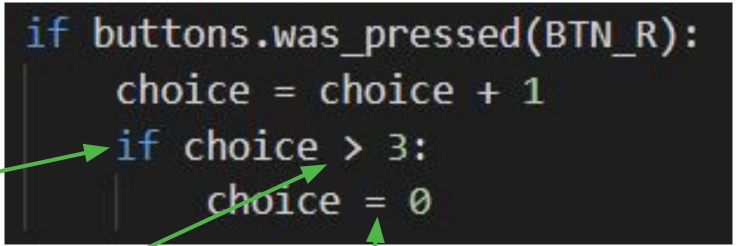


0	Image.HAPPY
1	Image.SAD
2	Image.HEART
3	Image.ASLEEP

Objective #4: Wrap around

Instead of adding more images or **if statements**, make the value of **choice** wrap-around to the first value.

- Use an **if statement** to know when to wrap around.
- Use a comparison operator.
- You can have an if statement inside an if statement -- just be careful with the indenting



```
if buttons.was_pressed(BTN_R):
    choice = choice + 1
    if choice > 3:
        choice = 0
```

NOTE: you are assigning a value, so use **=** *and not* **==**

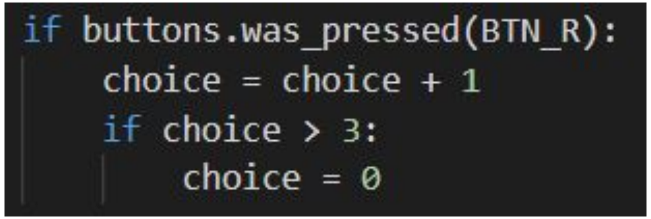
Objective #4: Wrap around

The second if statement causes the value of choice to wrap-around, and start over.

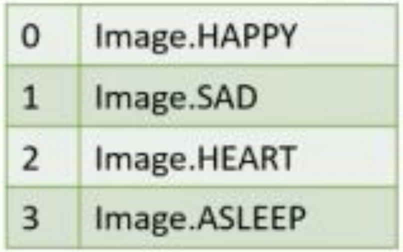
- The last index is 3
- The first index is 0

What will the if statement look like to wrap-around BTN_L?

- The value of choice will need to be the LAST index if less than 0.



```
if buttons.was_pressed(BTN_R):
    choice = choice + 1
    if choice > 3:
        choice = 0
```

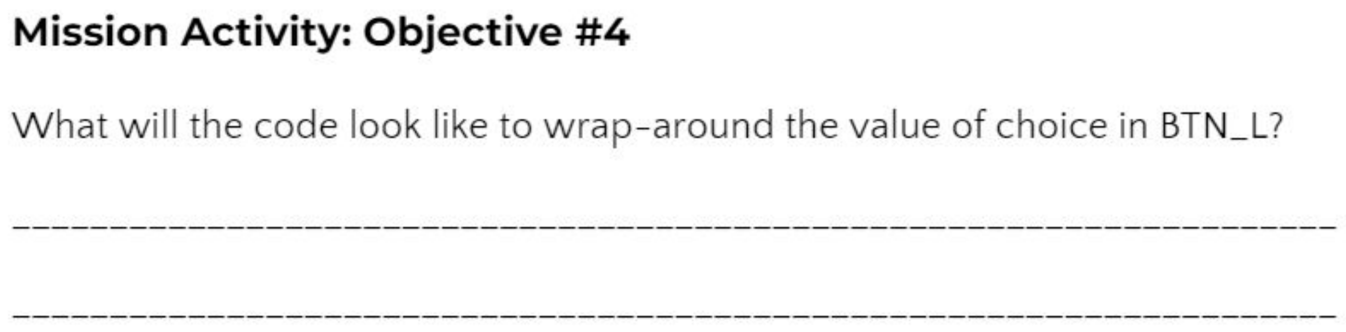


0	Image.HAPPY
1	Image.SAD
2	Image.HEART
3	Image.ASLEEP

Mission Activity #4

DO THIS:

- Go to your Mission Log and write down what you think the code should look like to wrap-around the value of choice in BTN_L



Mission Activity: Objective #4

What will the code look like to wrap-around the value of choice in BTN_L?

____

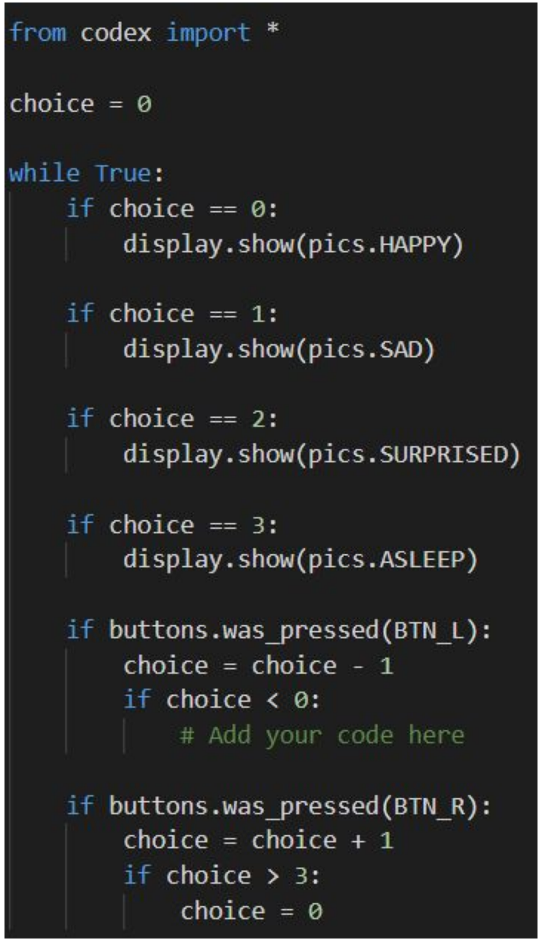
____

Mission Activity #4

Modify your code

DO THIS:

- Add an if statement to BTN_R so the value of choice wraps around
- Add an if statement to BTN_L so the value of choice wraps around
- Test your code
- Then stop the code



```python
from codex import *

choice = 0

while True:
    if choice == 0:
        display.show(pics.HAPPY)

    if choice == 1:
        display.show(pics.SAD)

    if choice == 2:
        display.show(pics.SURPRISED)

    if choice == 3:
        display.show(pics.ASLEEP)

    if buttons.was_pressed(BTN_L):
        choice = choice - 1
        if choice < 0:
            # Add your code here

    if buttons.was_pressed(BTN_R):
        choice = choice + 1
        if choice > 3:
            choice = 0
```

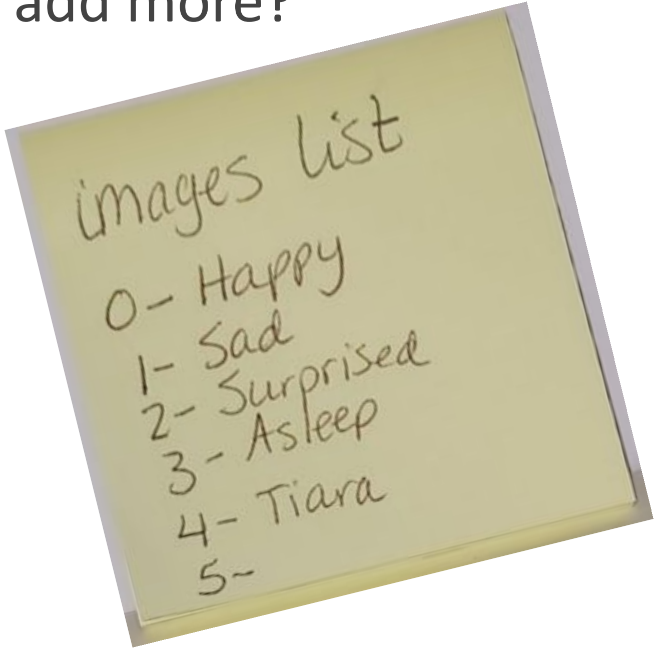
Objective #5: Image list

Four pictures is nice, but what if you want to add more?

That is a lot of typing!

- Every new image needs an if statement
- Your code can get very long very quickly!

Instead, you can make a list!



images list

0- Happy

1- Sad

2- Surprised

3- Asleep

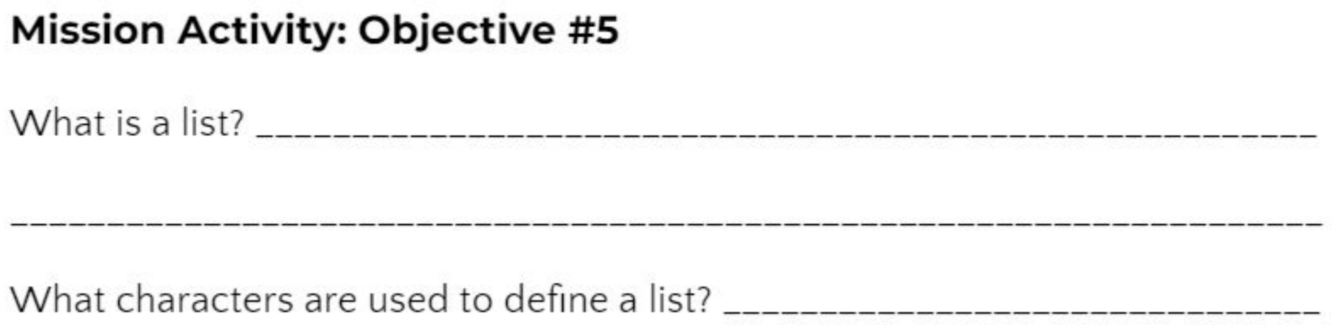
4- Tiara

5-

Mission Activity #5

DO THIS:

- Click on list in the instructions panel
- Go to your Mission Log and answer the questions about **list**



Mission Activity: Objective #5

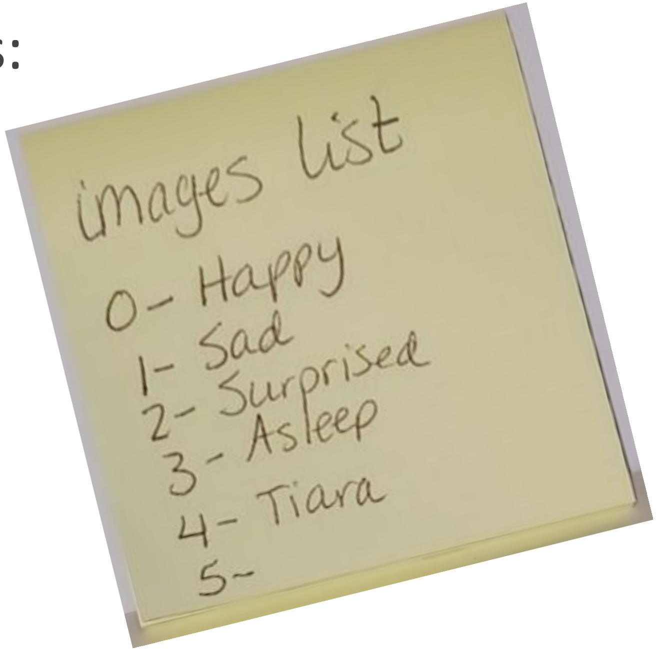
What is a list? ____

____

What characters are used to define a list? ______________________________

Objective #5: Image list

- A list is a type!
- Now you know six data types:
    - Integer
    - CodeX image
    - String
    - Boolean
    - Float
    - List



images list
0- Happy
1- Sad
2- Surprised
3- Asleep
4- Tiara
5-

Objective #5: Image list

- The order of the items in the list is important
- Each item has an index (number) assigned
- The first index is always 0
- The last index is always 1 less than the number of items

INDEX	ITEM
0	HAPPY
1	SAD
2	SURPRISED
3	ASLEEP
4	TIARA
5	PLANE

NOTE: This list has 6 items, so the index is 0, 1, 2, 3, 4, and 5

FIRIA LABS

Objective #5: Image list

Things you can do with a list:

- Create a list (use [ ])

  my_list = [pics.HAPPY, pics.SAD, pics.SURPRISED, pics.ASLEEP, pics.TIARA]

- Access an item in the list (use [ ])

  my_image = my_list[1]
  my_image = pics.SAD

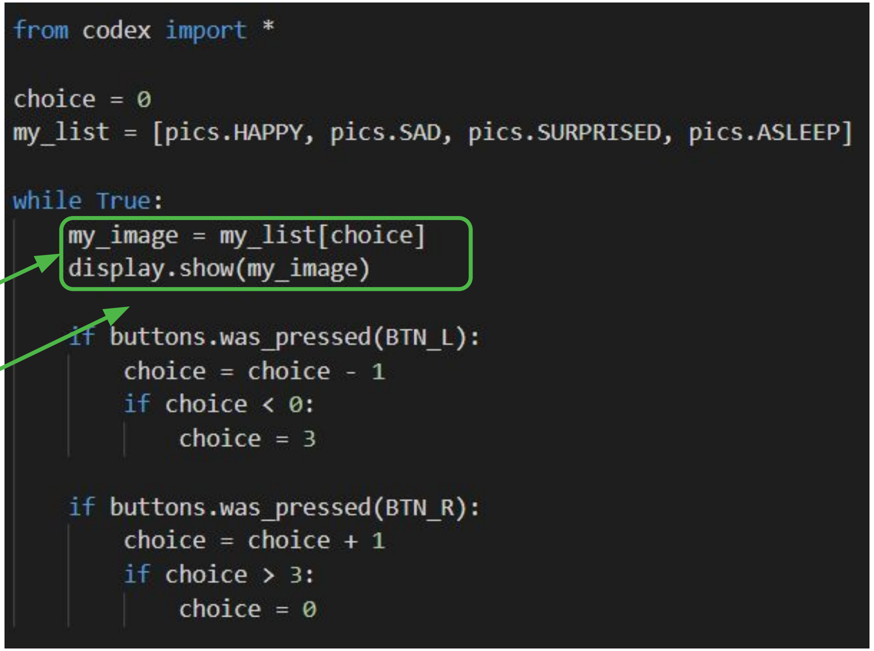
  my_image = my_list[choice]
  my_image = whatever image is at the current value of **choice**

INDEX	ITEM
0	HAPPY
1	SAD
2	SURPRISED
3	ASLEEP
4	TIARA

Mission Activity #5

DO THIS:

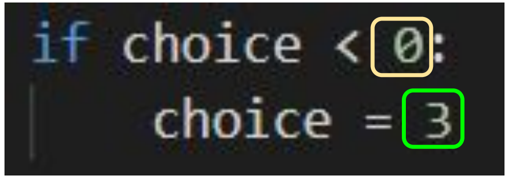
- Add a list to your code
  - Use the same four images
- Change the code to access the list
  - Add two lines of code to access the list using choice for the index
  - Delete the four if statements that displayed the images
  - Leave the if statements for BTN_L and BTN_R



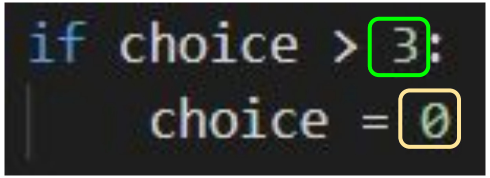
```
from codex import *

choice = 0
my_list = [pics.HAPPY, pics.SAD, pics.SURPRISED, pics.ASLEEP]

while True:
    my_image = my_list[choice]
    display.show(my_image)

    if buttons.was_pressed(BTN_L):
        choice = choice - 1
        if choice < 0:
            choice = 3

    if buttons.was_pressed(BTN_R):
        choice = choice + 1
        if choice > 3:
            choice = 0
```

Objective #6: No magic numbers

- With four images in your list, the index numbers are
  - 0, 1, 2, 3
- You use these numbers for wrap-around



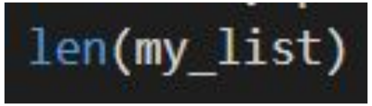
```
if choice < 0:
    choice = 3
```



```
if choice > 3:
    choice = 0
```

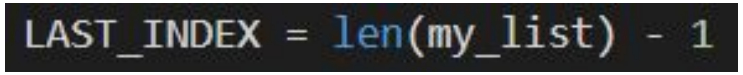
- If you added another image, the last index would be **4**, not **3**.
- You would have to change **3** to **4** everywhere in the code!
- These literals are called “magic numbers”

Objective #6: No magic numbers

- Magic numbers make the code harder to maintain, and harder to read and understand.
- The magic number in this program is the last index of the list
- So …
- Use a built-in function! 

```
len(my_list)
```

This code will give the length of the list, which is the number of items in the list.

- ***Remember:*** the last index is always one less than the number of items 

```
LAST_INDEX = len(my_list) - 1
```

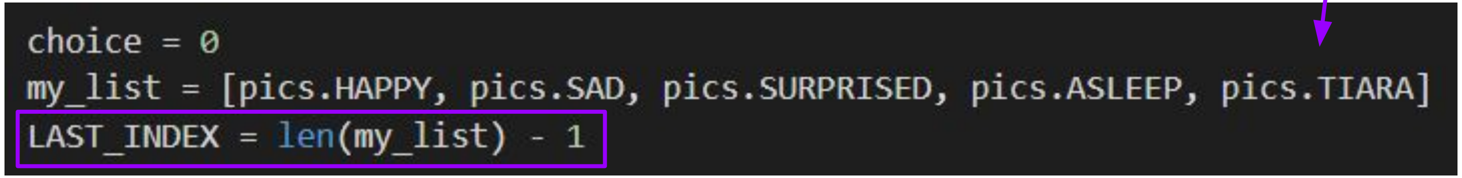
Mission Activity #6

Now you can add more images

DO THIS:

- Add another image to your list
    - A list of images is on slide 9
- Create a variable for **LAST_INDEX**

You can choose the image you want to add



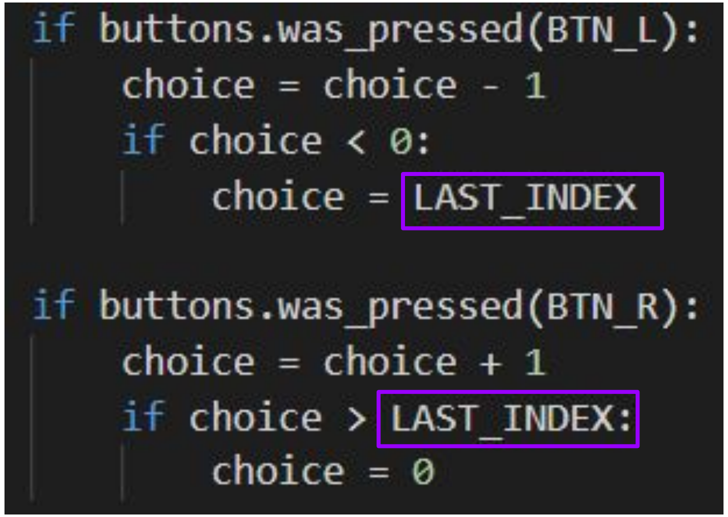
```
choice = 0
my_list = [pics.HAPPY, pics.SAD, pics.SURPRISED, pics.ASLEEP, pics.TIARA]
LAST_INDEX = len(my_list) - 1
```

- *Continued on next slide*

Mission Activity #6

DO THIS:

- Use the **LAST_INDEX** variable in the code:

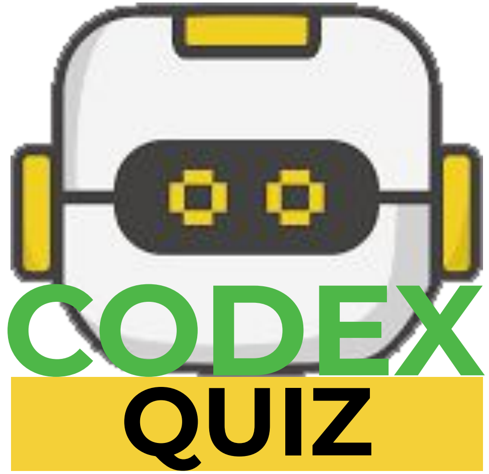


```
if buttons.was_pressed(BTN_L):
    choice = choice - 1
    if choice < 0:
        choice = LAST_INDEX

if buttons.was_pressed(BTN_R):
    choice = choice + 1
    if choice > LAST_INDEX:
        choice = 0
```

List len quiz

During this mission you have learned about lists and using an index to access its items.

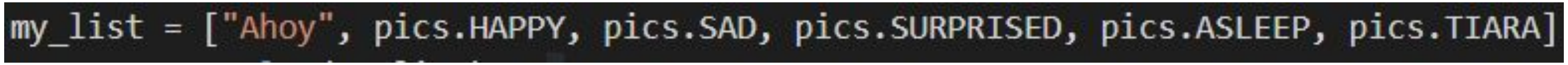
- Answer the quiz question about the list index



Objective #7: Text time!

Images are expressive … but text can say so much more!

- You can use a string variable to create a message or slogan
- Remember: a string data type uses quotation marks: “..”
  - my_message = “Meh”
  - my_message = “Having a great day”
- You also include a string message in your list
  - display.show(my_message) will display the text string

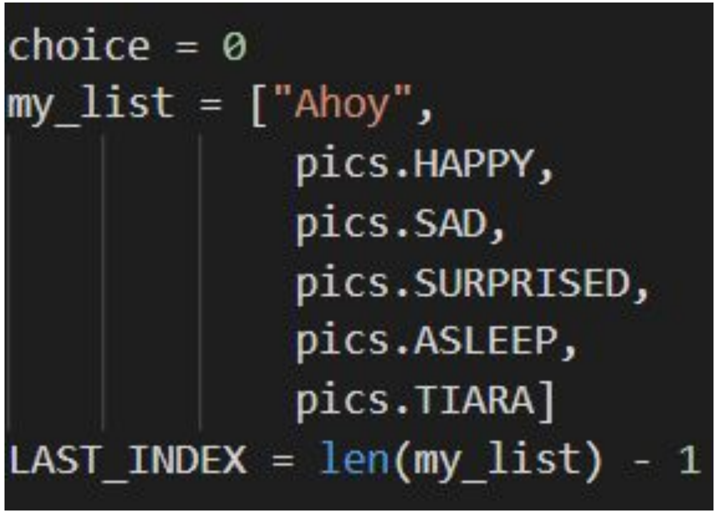


```
my_list = ["Ahoy", pics.HAPPY, pics.SAD, pics.SURPRISED, pics.ASLEEP, pics.TIARA]
```

Mission Activity #7

DO THIS:

- Add a text string to your list
- ***OPTIONAL:*** Your list can look like this to make it easier to read.

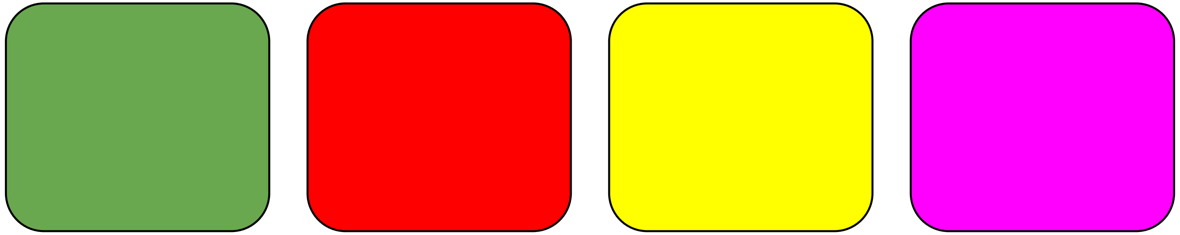


```
choice = 0
my_list = ["Ahoy",
            pics.HAPPY,
            pics.SAD,
            pics.SURPRISED,
            pics.ASLEEP,
            pics.TIARA]
LAST_INDEX = len(my_list) - 1
```

Objective #8: Green with envy

What if you're neither HAPPY nor SAD? ...and text just isn't describing you?

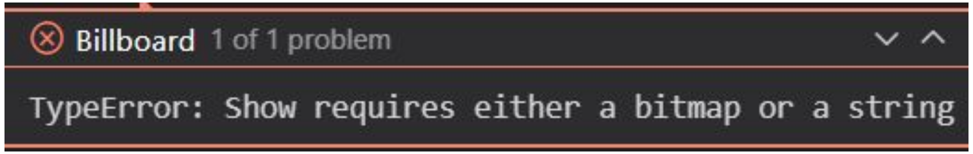
- Sometimes you just need a ***color.***
- Maybe you are GREEN with envy!
- Wouldn't it be cool to fill the display with a color?
- Try it out!



Mission Activity #8

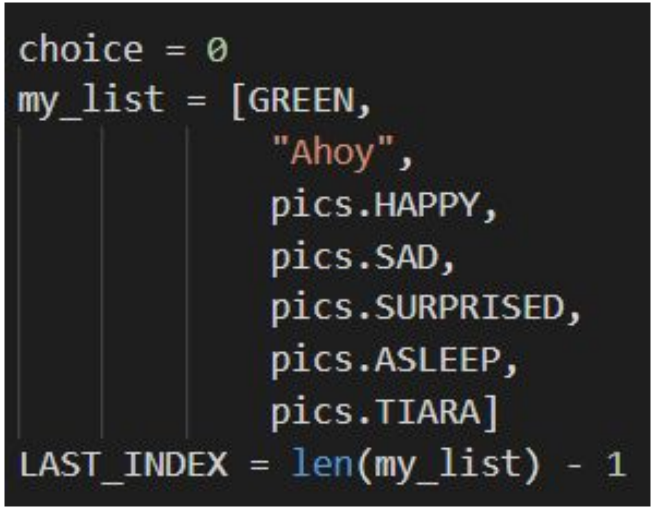
DO THIS:

- Add GREEN to the list
- Run the program
- Get an error?
- Find out why in the next objective



Billboard 1 of 1 problem

```
TypeError: Show requires either a bitmap or a string
```



```
choice = 0
my_list = [GREEN,
           "Ahoy",
           pics.HAPPY,
           pics.SAD,
           pics.SURPRISED,
           pics.ASLEEP,
           pics.TIARA]
LAST_INDEX = len(my_list) - 1
```

Objective #9: Fill ‘er up

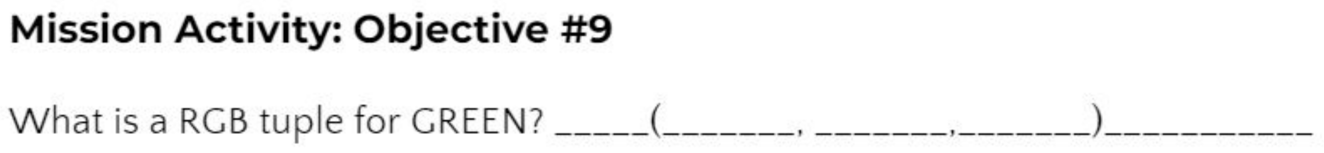
GREEN isn’t an image or a string. What type is it?

- Colors in the codex library are actually tuples!
- A **tuple** is like a list that can't be changed.
- CodeX color tuples have three integer values: (red, green, blue)
- You learned about RGB values in Mission 3
- What do you think the tuple for GREEN is?

Mission Activity #9

DO THIS:

- Go to the Mission Log and write your guess for the RGB tuple of GREEN



Mission Activity: Objective #9

What is a RGB tuple for GREEN? _____(_______, _______,_______)__________

Objective #9: Fill ‘er up

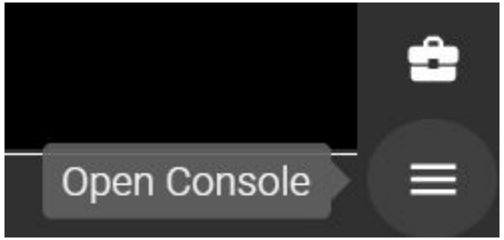
display.show() doesn’t work with colors, but **display.fill()** does!

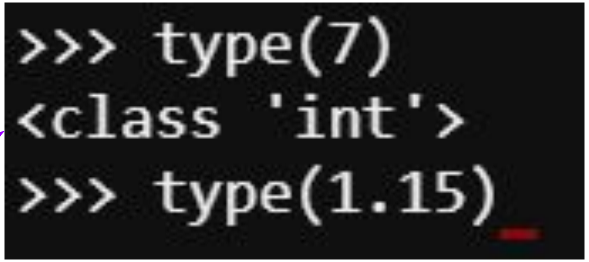
- You just have to know when to use **display.show()** and when to use **display.fill()**
- You need to check for the **type**
- You can use the console panel to help you

Mission Activity #9

DO THIS:

- Open the console panel. You can type commands directly into the console.
- Check the type of several values:
  - type(7) -> ‘int’
  - type(1.15)
  - type(True)
  - type([1, 2, 3])
- The type is shown like this:
- Now get the type of a color
  - type((0, 255, 0))

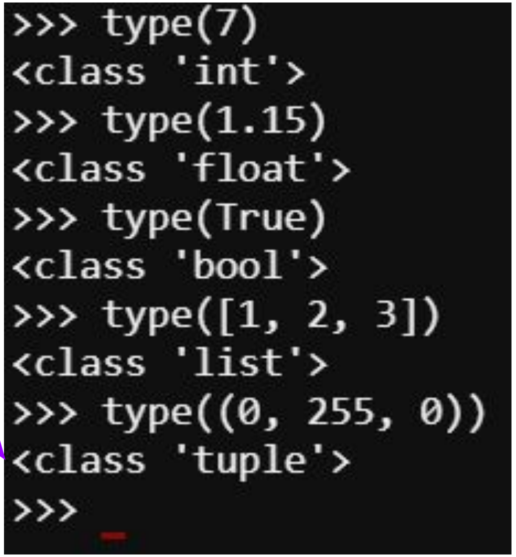




```
>>> type(7)
<class 'int'>
>>> type(1.15)
```

Objective #9: Fill ‘er up

- The type of a color is ‘tuple’
- You can use this information in your code
- If the type is ‘tuple’,
  use display.fill().
  Else
  use display.show()

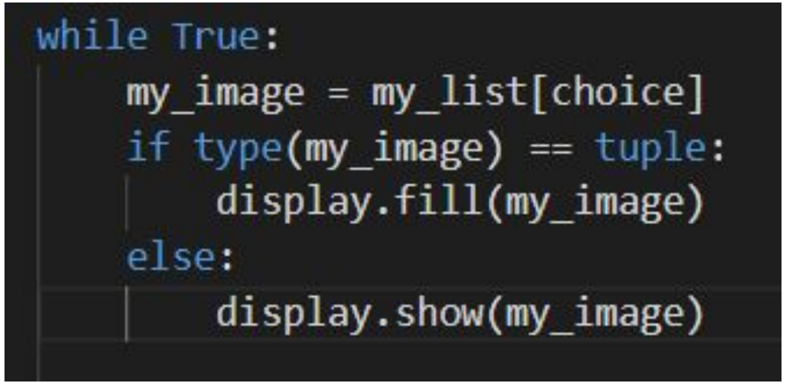


```
>>> type(7)
<class 'int'>
>>> type(1.15)
<class 'float'>
>>> type(True)
<class 'bool'>
>>> type([1, 2, 3])
<class 'list'>
>>> type((0, 255, 0))
<class 'tuple'>
>>>
```

Mission Activity #9

DO THIS:

- Add an if statement to the code that compares the current my_image to a tuple.
- If it is, use display.fill().
- Else use display.show()
- Run the code. You should get colors, text and images!

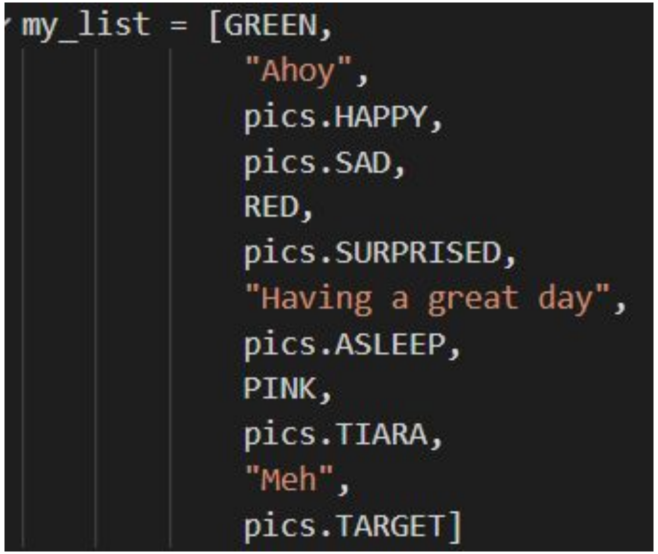


```
while True:
    my_image = my_list[choice]
    if type(my_image) == tuple:
        display.fill(my_image)
    else:
        display.show(my_image)
```

Mission Activity #9

DO THIS:

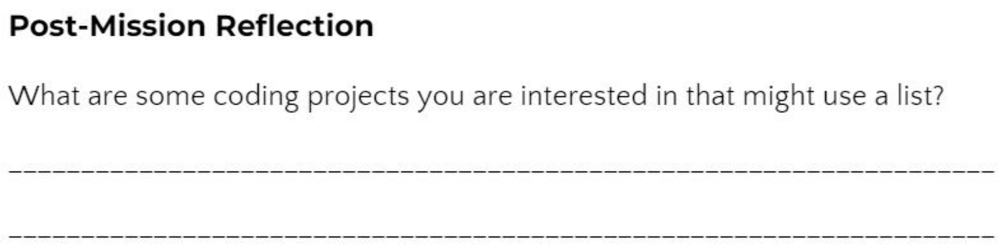
- Add more colors, text or images to your list.
- Run the code.
- No matter how many items you have, the code should work without making any other changes.
- Pretty cool, Right!
- Now you can display your mood by stopping on the color, text, or image that represents you.



```
my_list = [GREEN,
           "Ahoy",
           pics.HAPPY,
           pics.SAD,
           RED,
           pics.SURPRISED,
           "Having a great day",
           pics.ASLEEP,
           PINK,
           pics.TIARA,
           "Meh",
           pics.TARGET]
```

Post-Mission Reflection

- Read the “completed mission” message and click to complete the mission
- Complete the Mission 7 Log

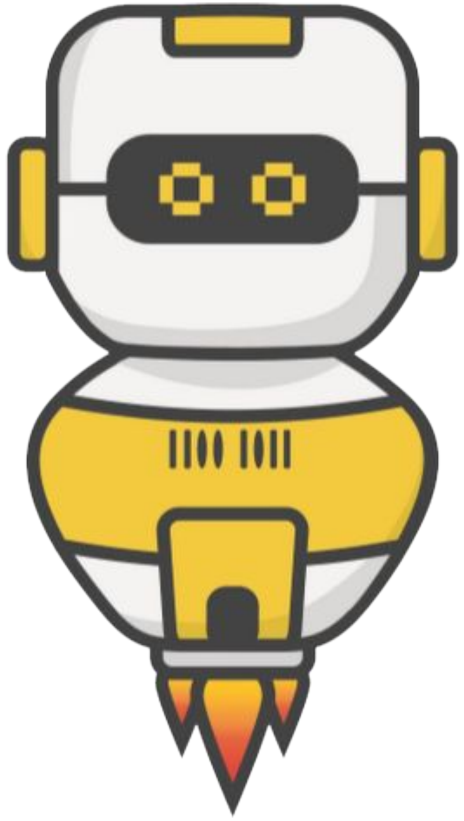


Post-Mission Reflection

What are some coding projects you are interested in that might use a list?

____

____



Clearing your CodeX

Go to FILE -- BROWSE FILES
Select the “**Clear**” file and open it
Run the program to clear the CodeX