Heartbeat

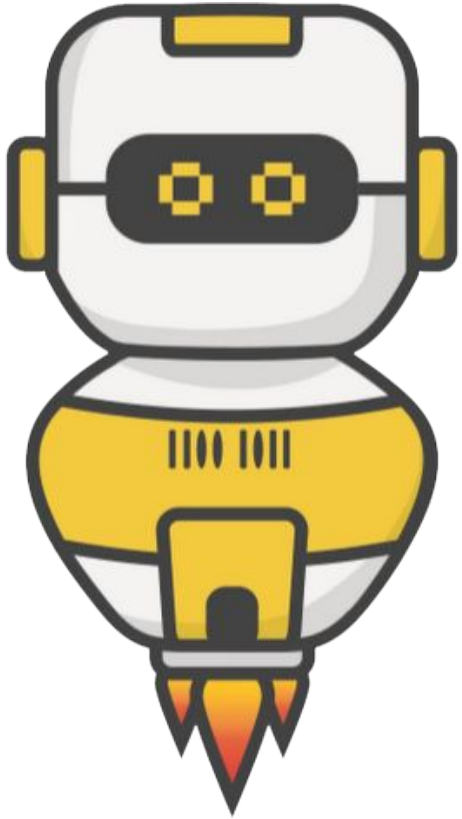
Mission 6

Pre-Mission Preparation

You have probably seen flashing traffic road signs or traffic lights.

In the Mission 6 log, answer the pre-mission preparation questions:

- Make a list of blinking indicators (like flashing traffic road signs)



FIRIA LABS

Mission 6: Heartbeat

In this project you'll give the CodeX a *beating heart.*

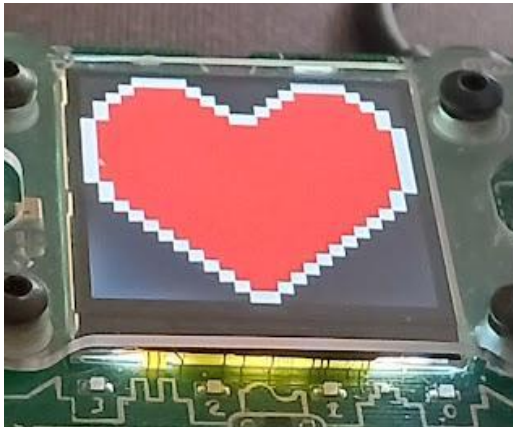
Okay, not a *real* heart - that would be a little too messy!

> **But** using the display you can give the CodeX its own *digital* heart, and even make it speed up and slow down just like your own heart does.

Objective #1: Lots of heart

Review programming concepts from your earlier missions.

Start by showing a heart image on the screen.



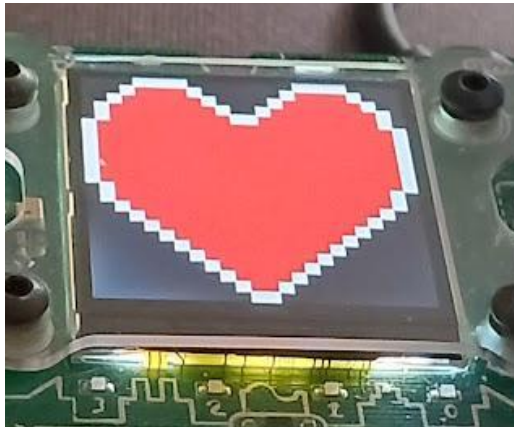
- You might recognize this as the same code as your first project.
- Don't worry, you're going to add a *lot* of new features soon!
-

FIRIA LABS

Mission Activity #1

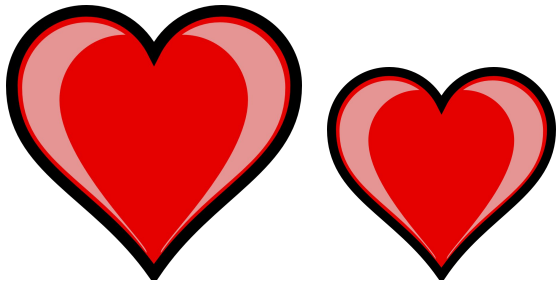
DO THIS:

- Start a new file named **Heart2**
- Show pics.HEART on the CodeX display
  - Use CodeTrek if you need help



Objective #2: Pump it UP

Now you will animate the heart to make it look like it is beating.



- You will need two heart images:
  - **pics.HEART**
  - **pics.HEART_SMALL**
- You need a **delay** variable to see both images
- You need to **import sleep** to use the **delay** variable

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Mission Activity #2

DO THIS:

- From time, import sleep
- Define a delay variable
- Show the first heart
  - Then sleep
- Show the second heart
  - Then sleep

```
from codex import *
from time import sleep

delay = 1

display.show(pics.HEART)
sleep(delay)
display.show(pics.HEART_SMALL)
sleep(delay)
```

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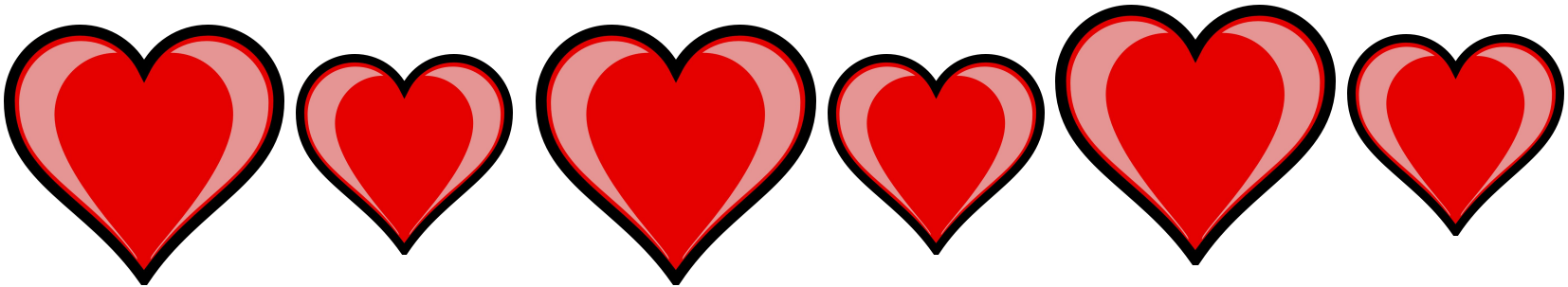
Objective #3: Repeat da beat

Now you have a heartbeat.

But one heartbeat isn’t an animation.

- You can repeat the code to repeat the heartbeat several times



FIRIA LABS

Mission Activity #3

DO THIS:

- Repeat the code for the large and small hearts at least **4** times

```
# one heartbeat
display.show(pics.HEART)
sleep(delay)
display.show(pics.HEART_SMALL)
sleep(delay)
# one heartbeat
display.show(pics.HEART)
sleep(delay)
display.show(pics.HEART_SMALL)
sleep(delay)
# one heartbeat
```

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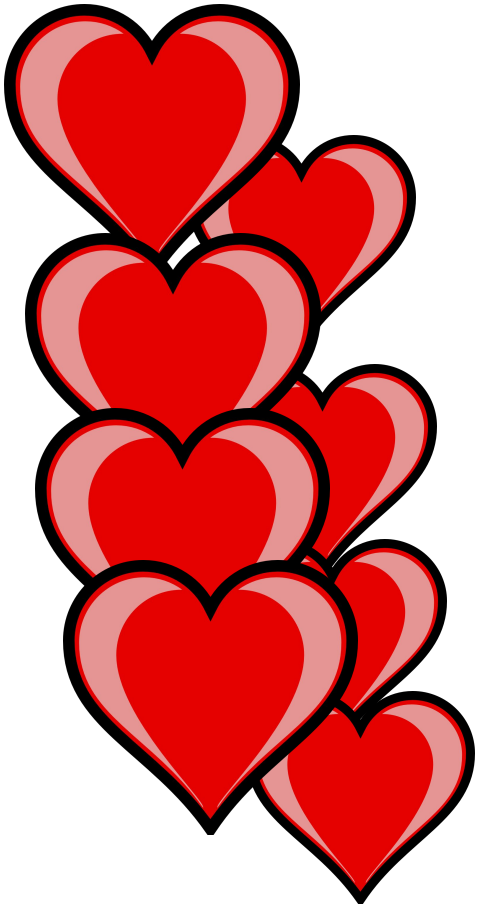
Objective #4: Hearts forever

Four beats is a good animation, but it ends.

We want our heart animation to run forever.

- You can’t just copy millions of times
- Tell the computer to repeat the code
- Repeating code without retyping is called a LOOP



FIRIA LABS

Mission Activity #4

DO THIS:

- Click on 

- Go to your Mission Log and answer the questions for Objective #4
- Click on 

- Go to your Mission Log and answer the questions for Objective #4

Mission Activity: Objective #4

Click on 

. Write the definition of "loop":

_____

Write a fact about loops: _____

_____

_____

Write the definition of "while loop":

_____

_____

Mission Activity: Objective #4 (continued)

Click on 

What is the result of a condition?

_____

Give an example of a condition:

_____

FIRIA LABS

Mission Activity #4

Modify your code

DO THIS:

- Delete all the repeated code except the first heartbeat
- Add a while loop to the code
  - Type a colon (:) at the end of the line
  - Indent the heartbeat code
  - Use the TAB key to indent your heartbeat code
- Run the code
  - You will need to click “STOP RUNNING” ■ to end the code.

```
from codex import *
from time import sleep

delay = 1

while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(delay)
    display.show(pics.HEART_SMALL)
    sleep(delay)
```

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Objective #5: Stop it!

A while loop that goes forever without stopping is an **infinite loop**.

- The condition is always TRUE
- Right now, the only way to stop the loop is to click the “**STOP**” button 

The heartbeat changes at the same speed, forever.

- Change the value of **delay** to change the speed of the heartbeat

FIRIA LABS

Mission Activity #5

DO THIS:

- Go to your Mission Log and write the definition for **infinite loop**.

Mission Activity: Objective #5

Write the definition of “infinite loop”: _____

_____

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Mission Activity #5

DO THIS:

- If your code is still running, click “STOP”
- Change the value of **delay** to 2
- Run the code
- Click “STOP”
- Change the value of **delay** to 0.5
- Run the code
- Click “STOP”
- OPTIONAL: try different values for **delay**

```
delay = 2

while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(delay)
    display.show(pics.HEART_SMALL)
    sleep(delay)
```

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Objective #6: Heart break

You still have an infinite loop.

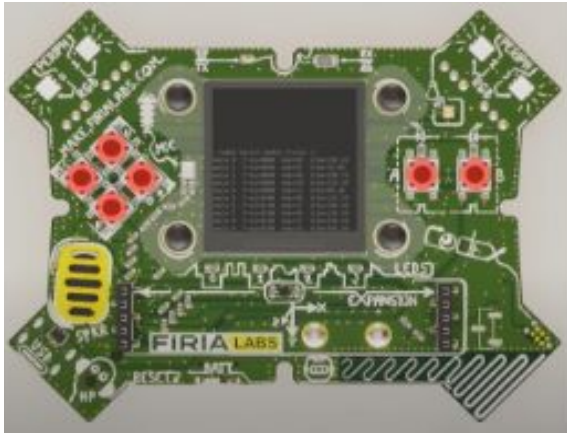
- Instead of clicking the “STOP” button, write code to stop the loop
- Use a **break** command
- The **break** command is used in an **if** statement
- Press a button to break out of the loop and stop the program

FIRIA LABS

Mission Activity #6

DO THIS:

- Click on CodeX buttons
- Go to your Mission Log and answer the questions for Objective #6



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Mission Activity #6

DO THIS:

- Add an if statement to the while loop to break out of the loop
  - Be careful with the indenting
  - Make sure to add a colon (:) after the if statement
- Run the code
- Press the “A” button to stop the code

```
while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(delay)
    display.show(pics.HEART_SMALL)
    sleep(delay)

    if buttons.was_pressed(BTN_A):
        break
```

FIRIA LABS

Objective #7: Explore the beat

Now your CodeX is interactive!

And your coding skills are growing.

- You learned about
  - Input -- using a button press
  - Branching -- if statements with a condition
- Now you CodeX can do something different when a button is pressed

FIRIA LABS

Objective #7: Explore the beat

Review the concepts

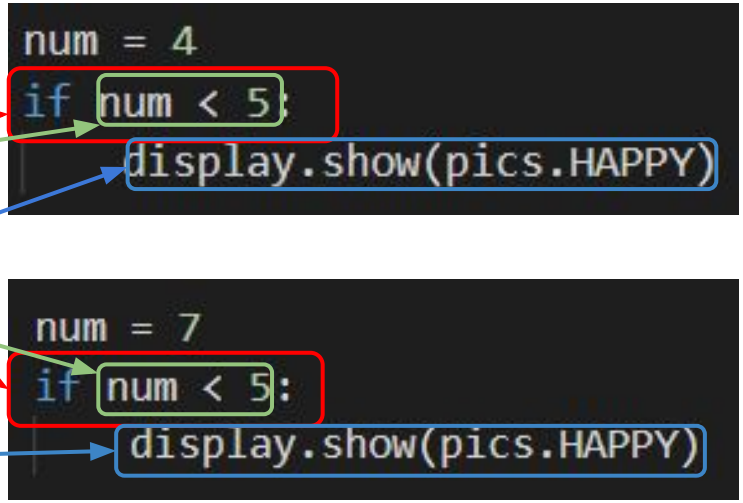
- Branching
  - Use an if statement
  - Has a condition
  - The condition can be True or False
  - If the condition is True, the indented code is executed
  - If the condition is False, the indented code is skipped

FIRIA LABS

Objective #7: Explore the beat

Review the concepts

- Branching Example:
  - Use an if statement
  - Has a condition
  - The condition can be True or False
  - If the condition is True, the indented code is executed
  - If the condition is False, the indented code is skipped



FIRIA LABS

Objective #7: Explore the beat

Review the concepts

- CodeX button input
  - Two different functions check for a CodeX button press
  - buttons.was_pressed(BTN_A)
    - Checks to see if BTN_A was pressed since the last check
  - buttons.is_pressed(BTN_A)
    - Checks to see if BTN_A is currently pressed
  - Both functions are a condition
  - Both functions can be used in an if statement
  - Both functions evaluate to True or False

FIRIA LABS

Objective #7: Explore the beat

Review the concepts

- Branching Example with input:
  - Use an if statement
  - Has a condition
  - The condition can be True or False

```
if buttons.was_pressed(BTN_A):
    display.show(pics.HAPPY)
```

  - If BTN_A was recently pressed, the indented code is executed
  - If a different button was recently pressed, the indented code is skipped

FIRIA LABS

Mission Activity #7

Experiment with the code

DO THIS:

- Click the debugger button
- Use the Step Over button to watch the branching
- You must step at least 8 times
- Go through the while loop one time
- Then press BTN_A and go through the loop again
- The code should break out of the loop and stop

Step Over

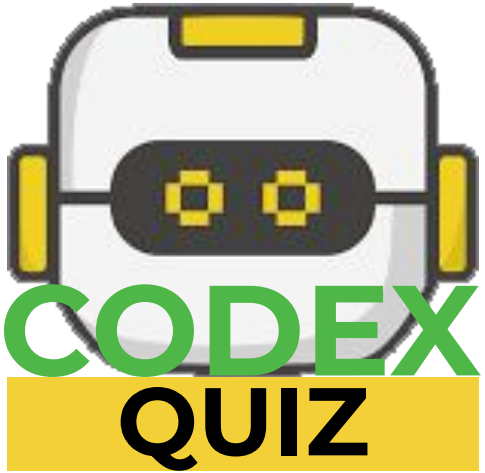
Stop

FIRIA LABS

Break-fast quiz

During this mission you have learned about branching and buttons for input

- Answer the 2 quiz questions



FIRIA LABS

Objective #8: Half a sleep

You can make the heart beat faster!

What controls the speed of the beat so far?

- The **delay** variable
- sleep()
- To beat faster, the **delay** variable needs to be a smaller value

FIRIA LABS

Objective #8: Half a sleep

But what is smaller than delay = 1?

- There isn’t an integer less than 1 that can be used for delay
- You need to use a real number, or decimal, like 0.5 or 0.75
- The decimal in the number is called a “floating point”
- The data type for a real number is **float**

FIRIA LABS

Objective #8: Half a sleep

Now you know five data types:

- Integer (Examples: 1, 54, 720)
- CodeX image (Examples: pics.HEART, pics.MUSIC)
- String (Examples: “Hello”, “Press A”, “cake”)
- Boolean (Values: True, False)
- Float (Examples: 0.5, 3.125, 49.02)

FIRIA LABS

Mission Activity #8

DO THIS:

- Set the value of delay to 1
- Use the float value 0.5 in the two sleep() commands
- Run the code
- After a few fast heartbeats, press BTN_A to stop the program

```
delay = 1

while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(0.5)
    display.show(pics.HEART_SMALL)
    sleep(0.5)

    if buttons.was_pressed(BTN_A):
        break
```

FIRIA LABS

Objective #9: Variable speed control

You can change the speed of the heartbeat by changing the value of the variable **delay**.

- You will need your **delay** variable
- You will need to use it in the **sleep()** command

FIRIA LABS

Mission Activity #9

DO THIS:

- Use the delay variable in the 2 sleep() commands
- Run the code
- After a few fast heartbeats, press BTN_A to stop the program

```
delay = 1

while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(delay)
    display.show(pics.HEART_SMALL)
    sleep(delay)

    if buttons.was_pressed(BTN_A):
        break
```

FIRIA LABS

Objective #10: Brake! not break

With a variable, your heartbeat speed is easy to change.

- You can change the speed while the program is running
- Use the buttons to change the value of delay
- Look at the code below:

```
if buttons.was_pressed(BTN_A):
    delay = delay + 0.2
```

FIRIA LABS

Objective #10: Brake!, not break

Look carefully at the indented code:

```
delay = delay + 0.2
```

- This doesn’t make sense in math, but it does make sense to a computer
- The original value of **delay** is 1, or 1.0
- Then 0.2 is added to the current value
- The new value is assigned to **delay**, like this:

```
delay = delay + 0.2
delay = 1.0 + 0.2
delay = 1.2
```

FIRIA LABS

Objective #10: Brake!, not break

```
if buttons.was_pressed(BTN_A):
    delay = delay + 0.2
```

- Adding a set amount, like 0.2, to a variable is called **increment**
- In this code, every time BTN_A is pressed, the delay will increase by 0.2
- A larger number for delay will slow down the heartbeat (a longer sleep)

FIRIA LABS

Mission Activity #10

Ready to try? Your first goal is to slow down the heartbeat.

DO THIS:

- Change the if statement
- Remove “break”
- Replace it by incrementing delay
- Run the code and press BTN_A a few times
- The heartbeat should slow down each time
- Press the STOP button to stop the program

```
delay = 1

while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(delay)
    display.show(pics.HEART_SMALL)
    sleep(delay)

    if buttons.was_pressed(BTN_A):
        delay = delay + 0.2
```

FIRIA LABS

Objective #11: Variable speed heart

You added code to slow down the heartbeat. Now add code to speed up the heartbeat.

- Use BTN_B
- The code will be almost the same as the if statement for BTN_A

```
if buttons.was_pressed(BTN_B):
    delay = delay - 0.2
```

FIRIA LABS

Objective #11: Variable speed heart

Look carefully at the indented code:

```
delay = delay - 0.2
```

- The original value of **delay** could be 1.0, or 1.2, or 1.4
- In this code, 0.2 is subtracted from the current value
- Then the new value is assigned to **delay**, like this:

```
delay = delay - 0.2
delay = 1.4 - 0.2
delay = 1.2
```

FIRIA LABS

Objective #11: Variable speed heart

```
if buttons.was_pressed(BTN_B):
    delay = delay - 0.2
```

- Subtracting a set amount, like 0.2, to a variable is called “decrement”
- In this code, every time BTN_B is pressed, the delay will decrease by 0.2
- A smaller number for delay will speed up the heartbeat

FIRIA LABS

Objective #11: Variable speed heart

- When you add the if statement, you can speed up and slow down the heartbeat with the press of two buttons
- But … be careful!
- Pressing BTN_B several times can give a 0 or negative value for delay
- The sleep() function must have a positive value!
- So, an error will occur if BTN_B is pressed too many times.

FIRIA LABS

Mission Activity #11

DO THIS:

- Go to your Mission Log and complete the questions for Objective #10 and Objective #11

Mission Activity: Objective #10 & 11

Give an example of code that will increment:

_____

Given an example of code that will decrement:

_____

FIRIA LABS

Mission Activity #11

Complete the second goal to speed up the heartbeat.

DO THIS:

- Add an if statement for BTN_B to decrement delay
- Run the code and press BTN_A a few times and BTN_B a few times
- The heartbeat should slow down and speed up
- Press BTN_B enough times to cause an error and stop the program

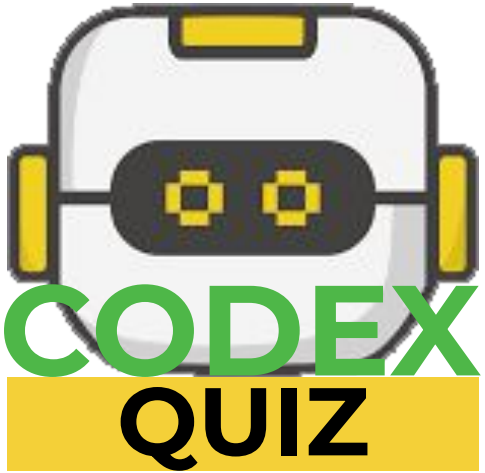
```
delay = 1

while True:
    # one heartbeat
    display.show(pics.HEART)
    sleep(delay)
    display.show(pics.HEART_SMALL)
    sleep(delay)

    if buttons.was_pressed(BTN_A):
        delay = delay + 0.2

    if buttons.was_pressed(BTN_B):
        delay = delay - 0.2
```

FIRIA LABS

Heartfelt Recap quiz

During this mission you have learned about changing the value of delay to change the heartbeat.

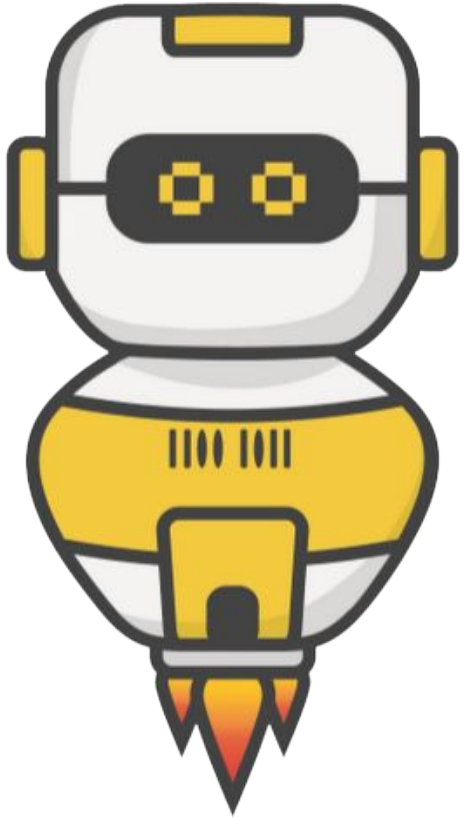
- Answer the 2 quiz questions



FIRIA LABS

Post-Mission Reflection

- Read the “completed mission” message and click to complete the mission
- Complete the Mission 6 Log



Clearing your CodeX

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