Mission 10:
Reaction Tester

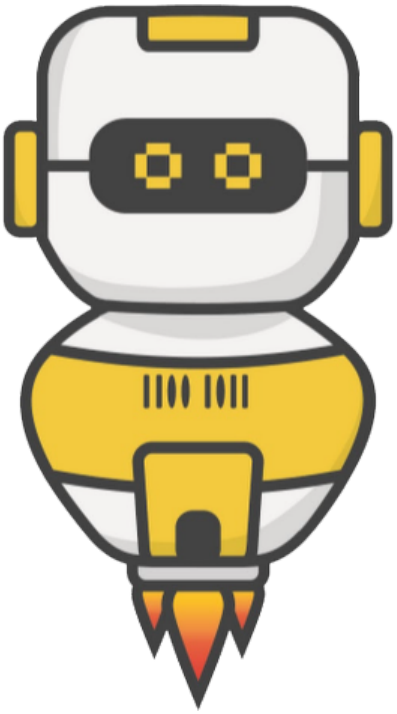
Student Workbook

FIRIA LABS

Mission 10: Reaction Tester

Create a game to measure a player's reaction time!

Let's get physical!



In the last mission, the program used functions, parameters and arguments. For this mission, you tap into the power of CodeX by using the built-in capabilities of its powerful clock.

Go to the Mission 10 Log and fill out the Pre-Mission preparation.

- In this mission you will use a computer clock to measure time. What are some things you use a timer for?

Mission 10: Reaction Tester

How fast is your reaction time?
In this project you will make a device to measure your reaction time. This project will:

- Give a 3-2-1 countdown
- Wait a random delay
- Turn the pixels GREEN
- Measure the reaction time for the button press
- Loop and do the countdown again

Mission 10: Get started

- Go to https://make.firialabs.com/ and log in.
- Go to Mission 10 
- Click **NEXT** and start Mission 10.

Objective #1: Milliseconds

This mission will require you to turn on all the pixels the same color.

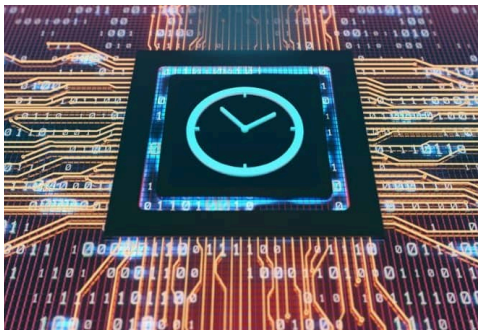
The code so far turned on a single pixel at a time:

- pixels.set(0, RED)

Using a list, there is an easier way:

- **`pixels.set([RED, RED, RED, RED])`**
- Do you notice the list with four items?
- The **`pixels.set()`** command needs parenthesis, and the list needs [ ]
- Make sure you use both, in the correct order

Objective #1: Milliseconds



CodeX's powerful clock can work in milliseconds -- that's 1,000 times per second!

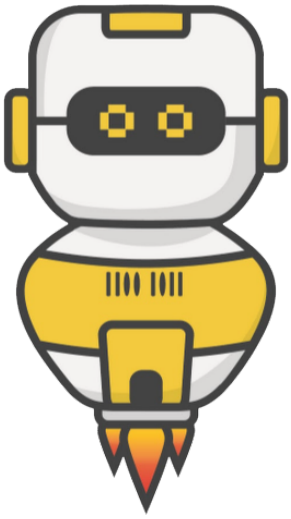
You will want a random time in milliseconds, so you just have to do a little math.

`random.randrange(1, 5)` gives a random number between 1 and 4

`random.randrange(1000, 5000)` gives a random number between 1000 and 4999.

- This gives you a good range of milliseconds, but sleep() uses seconds
- 1000 milliseconds = 1 second, so
- Divide the random number by 1000!

Objective #1: Milliseconds



DO THIS:

- Start a new file named **Reaction_Time**
- Import the codex module
- Import the random module
- Import the time module
- Turn all pixels BLACK
- Get a random number using 1000 and 5000 as the range
- Divide the random number by 1000
- Use the random number in sleep()
- Turn all pixels GREEN

Reaction_Time

```
1   from codex import *
2   import random
3   import time
4
5   pixels.set([BLACK, BLACK, BLACK, BLACK])
6
7   ms = random.randrange(1000, 5000)
8   delay_time = ms / 1000
9   sleep(delay_time)
10
11  pixels.set([GREEN, GREEN, GREEN, GREEN])
12
```

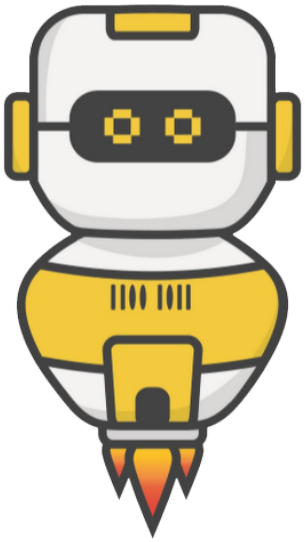
Objective #2: The Countdown

To make this into a game, you want to give a countdown.

- This will let the player know the game is starting.
- It also indicates when to start the timer.

- Use `display.clear()` to clear the display
- Use `display.print()` to countdown from 3 to 2 to 1 (with a sleep delay in between)
- You can scale the number bigger on the display for easy viewing
  - `display.print("3", scale=6)`
  - `sleep(1)`

Objective #2: Click to flick



DO THIS:

- Clear the display & the pixels
  - Set all pixels to BLACK
- Countdown from 3 to 2 to 1
- Clear the screen again
- Then continue the rest of your code to get a random number and light all pixels GREEN

```
from codex import *
import random
from time import sleep

# clear screen and countdown
display.clear()
pixels.set([BLACK, BLACK, BLACK, BLACK])
display.print("3", scale=6)
sleep(1)
display.print("2", scale=6)
sleep(1)
display.print("1", scale=6)
sleep(1)
display.clear()

# get random delay time
ms = random.randrange(1000, 5000)
delay_time = ms / 1000
sleep(delay_time)

# turn pixels GREEN
pixels.set([GREEN, GREEN, GREEN, GREEN])
```

Objective #3: The Fourth Dimension

Computers relay on electronic clock circuits

- Clock circuits are used to move through code
- They are used as time delays in the sleep() command
- When you turn on CodeX, its clock is continuously running.

So far you have used the time module for sleep()

- The time module also has a function that returns the current time on the computer clock

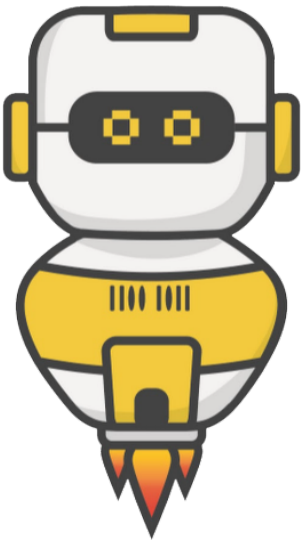
If you want to use more than one function from a module, you need to import the entire library, not just one function

- `from time import sleep`
- This imports only one function
- `import time`
- This imports the entire library

Objective #3: Fun functions

When you import the entire library, you must reference it when calling one of its functions.

- `time.sleep(1)`
- `time.ticks_ms()`
- This returns the current time
- It returns a value, so the value needs to be assigned to a variable
- `start_time = time.ticks_ms()`



DO THIS:

- Go to your Mission Log and answer the question about importing a module

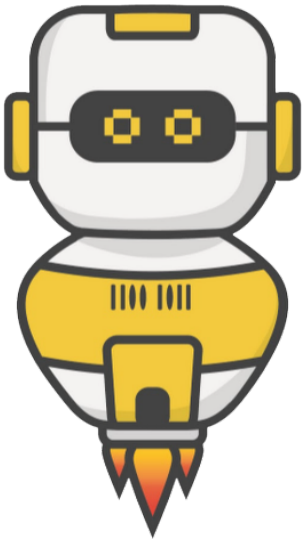
Mission Activity: Objective #3

If you import an entire module, how does the code change when you access a function? _____

_____

_____

Objective #3: Fun functions



DO THIS:

- Change from
  time import sleep to `import time`
- Change all the sleep(1) commands to
  `time.sleep(1)` commands
  - HINT: There are four sleep() commands

After the pixels turn GREEN:

- Assign **start_time** the value from
  `time.ticks_ms()`
- Wait until BTN-A was pressed
- Assign **end_time** the value from
  `time.ticks_ms()`
- Print **start_time** and **end_time**

```
from codex import *
import random
import time

# clear screen and countdown
display.clear()
pixels.set([BLACK, BLACK, BLACK, BLACK])
display.print("3", scale=6)
time.sleep(1)
display.print("2", scale=6)
time.sleep(1)
display.print("1", scale=6)
time.sleep(1)
display.clear()

# get random delay time
ms = random.randrange(1000, 5000)
delay_time = ms / 1000
time.sleep(delay_time)
```

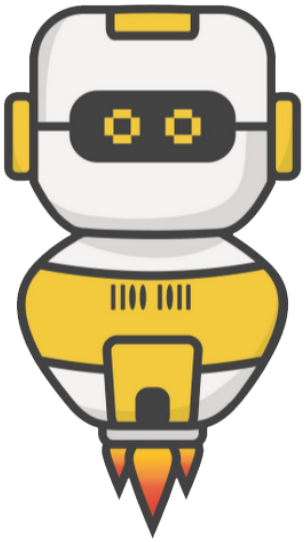
```
# turn pixels GREEN
pixels.set([GREEN, GREEN, GREEN, GREEN])

# get start and end time
start_time = time.ticks_ms()
while True:
    if buttons.was_pressed(BTN_A):
        break
end_time = time.ticks_ms()

display.print(start_time)
display.print(end_time)
```

Objective #4: Time Differential

You have the **start_time** and **end_time**.

The reaction time is the difference of the two variables.

- You can just subtract the two:
  - reaction_time = end_time - start_time
- OR use another time module function that finds the difference:
  - reaction_time = time.ticks_diff(end_time, start_time)



DO THIS:

- Go to your Mission Log and answer the question about functions in the time module

Mission Activity: Objective #4

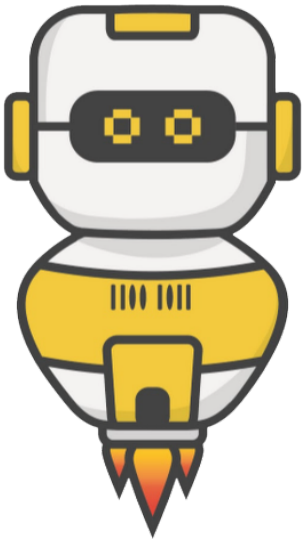
List three functions available in the time module:

_____

_____

_____

Objective #4: Time Differential



DO THIS:

- Assign **reaction_time** the difference between **end_time** and **start_time**
- Change the **display.print()** statements to print the **reaction_time** instead of start_time and end_time

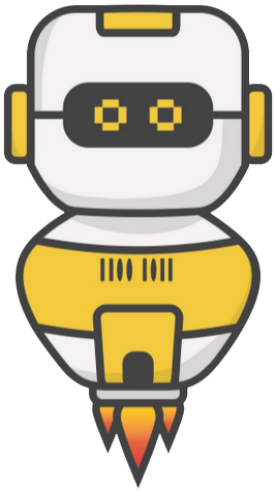
```
# get start and end time
start_time = time.ticks_ms()
while True:
    if buttons.was_pressed(BTN_A):
        break
end_time = time.ticks_ms()

reaction_time = time.ticks_diff(end_time, start_time)

display.print("Reaction Time:")
display.print(reaction_time)
display.print("milliseconds")
```

Objective #5: Let's Keep Playing

Great job so far! The reaction game is fun, but what if you want to play more than once?

- Make the game wait for a button press, and then play again
- You will need an infinite loop with most of the code in it
- You will need to wait for a button press after displaying the reaction time
- You already have code for waiting for a button press, so you can copy and paste it

Objective #5: Let's Keep Playing



DO THIS:

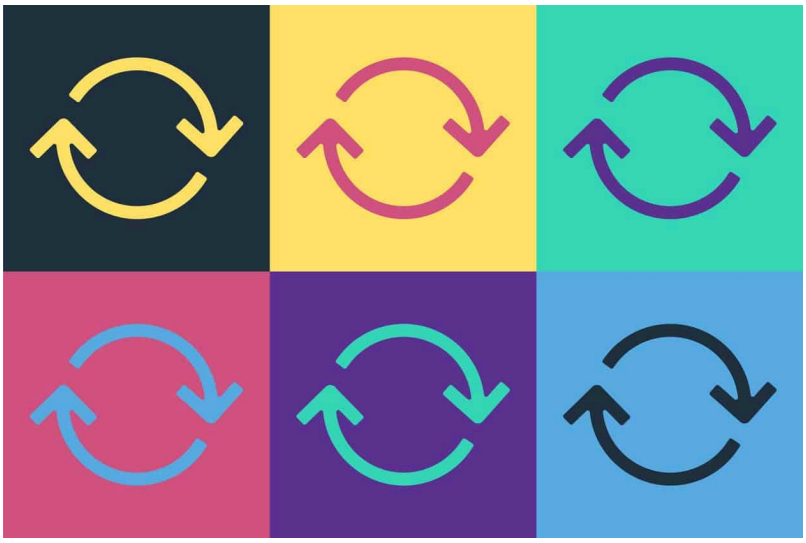
- Add an infinite loop after the import statements
- Indent all the code inside the loop
- Add another wait loop at the beginning of the loop

```
import time

while True:
    display.print("Press Button A")
    while True:
        if buttons.was_pressed(BTN_A):
            break

    # clear screen and countdown
    display.clear()
    pixels.set([BLACK, BLACK, BLACK, BLACK])
    display.print("3", scale=6)
    time.sleep(1)
    display.print("2", scale=6)
    time.sleep(1)
    display.print("1", scale=6)
    time.sleep(1)
    display.clear()

    # get random delay time
    ms = random.randrange(1000, 5000)
    delay_time = ms / 1000
    time.sleep(delay_time)

    # turn pixels GREEN
    pixels.set([GREEN, GREEN, GREEN, GREEN])

    # get start and end time
    start_time = time.ticks_ms()
    while True:
        if buttons.was_pressed(BTN_A):
```

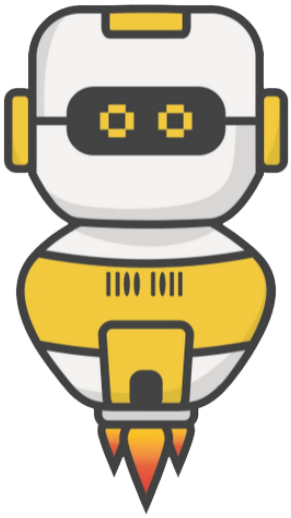
Objective #6: Reduce Repetition

Take a look at your code. Do you notice a block of code that is repeated?

- You learned in Mission 9 that you can write a function instead of copy-paste or repeating code, you can write a function instead.
- There are two places in your code that wait for BTN-A to be pressed



Objective #6: Reduce Repetition

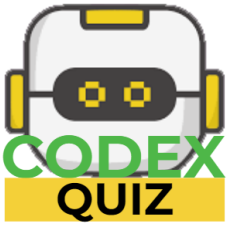


DO THIS:

- Write a **wait_button()** function.
  - HINT: A function goes near the top of your code
- Delete the code that waits in the while loop.
- Call the **wait_button()** function two times in the while loop.

```
from codex import *
import random
import time

def wait_button():
    while True:
        if buttons.was_pressed(BTN_A):
            break
while True:
    display.print("Press Button A")
    wait_button()

    # clear screen and countdown
    display.clear()
```

```
# get start and end time
start_time = time.ticks_ms()
wait_button()
end_time = time.ticks_ms()
```



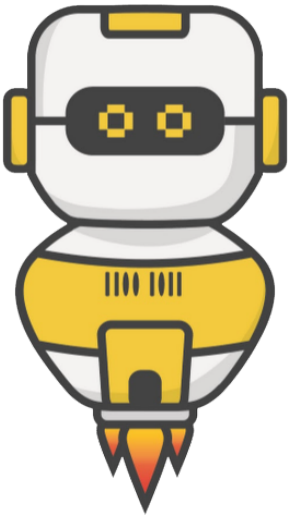
Mission Quiz: Quiz Timing

Test your skills by **taking the quiz**.

Objective #7: No Cheating

Fix a bug. Oh no! Players are pressing the button during the delay and getting ultra fast times.

- The buttons.was_pressed() is always listening
- Even during the random delay
- Solve this problem by resetting the buttons.was_pressed() just before starting the timer



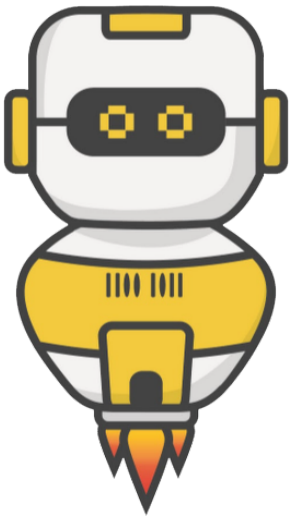
DO THIS:

- Reset **buttons.was_pressed(BTN_A)** just before the pixels turn GREEN

```
# turn pixels GREEN
buttons.was_pressed(BTN_A)
pixels.set([GREEN, GREEN, GREEN, GREEN])
```

Mission Complete

You have completed the tenth mission.



Do this:

- Read your “Completed Mission” message
- Complete your Mission 10 Log
    - Post-Mission Reflection
- Get ready for your next mission!

Wait! Before you go ... Clear the CodeX

Go to FILE -- BROWSE FILES

Select the “**Clear**” file and open it

Run the program to clear the CodeX

Okay. Now you can go.