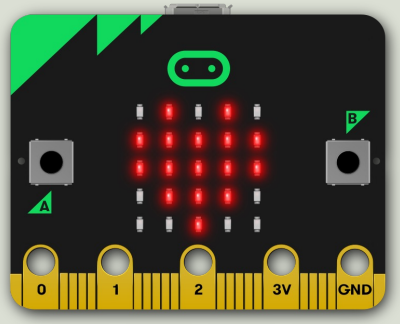
https://www.halvorsen.blog




# micro:bit

Hans-Petter Halvorsen

# Contents

# Introduction to micro:bit

Hans-Petter Halvorsen

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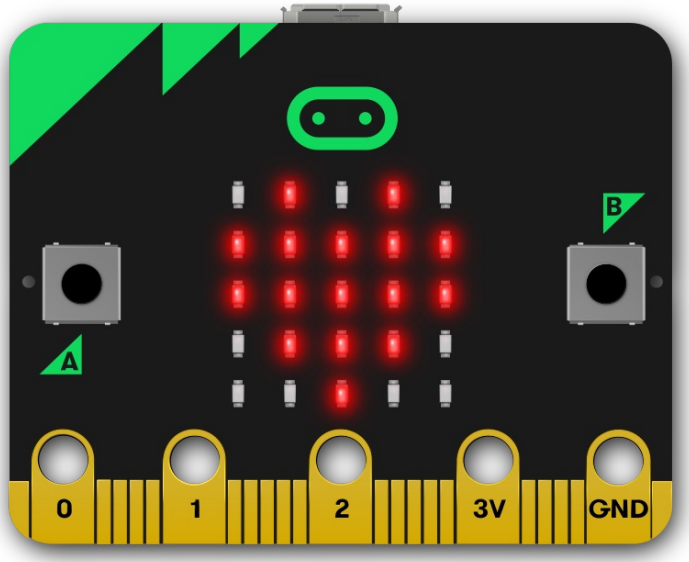
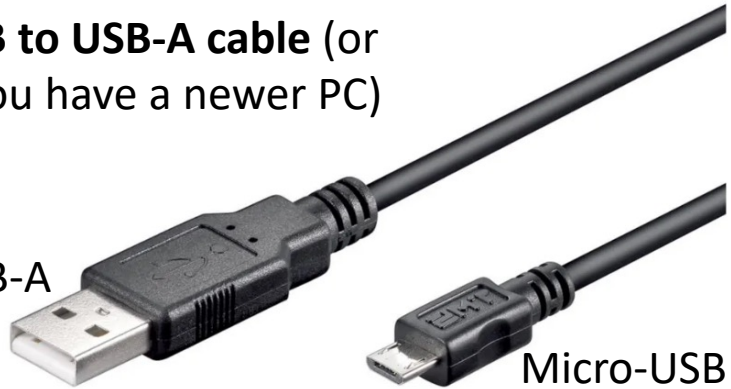
# What do you need?



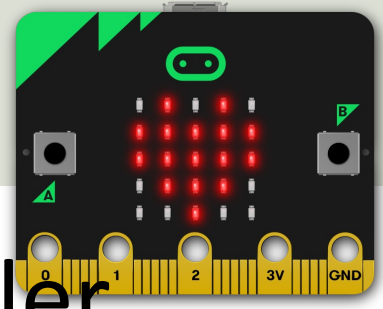

**micro:bit**

**Micro-USB to USB-A cable** (or USB-C if you have a newer PC)




A PC

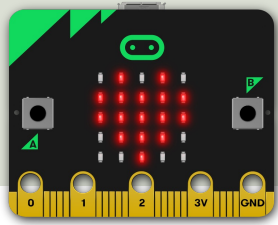
# micro:bit




- micro:bit is a small microcontroller
- micro:bit is smaller than a credit card
- Price is about 150-400NOK ($15-30)
- It can be used by kids and students to learn programming and technology
- micro:bit has Bluetooth but not WiFi

https://microbit.org

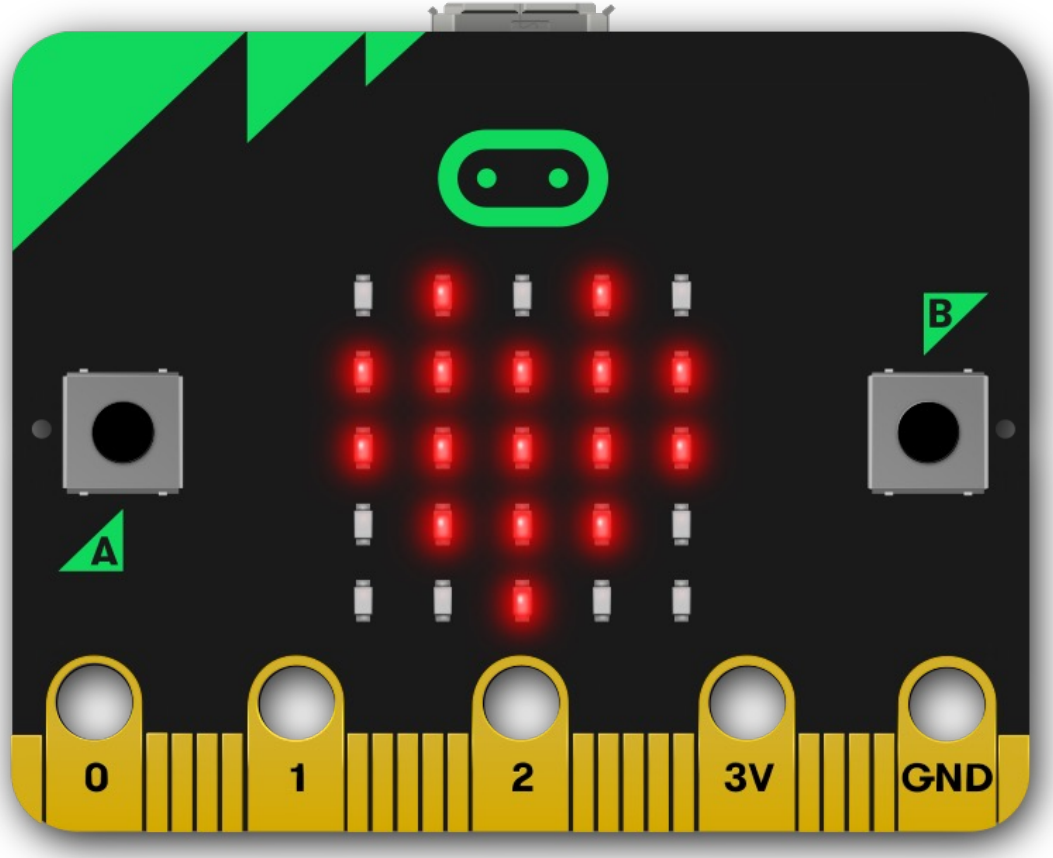
# micro:bit and Programming




- micro:bit can run a special version of Python called **MicroPython**
- MicroPython is a down-scaled version of Python
- You can use different code editors and Programming Languages
  - Scratch, Microsoft MakeCode, Python, Swift Playground, etc.
- This Tutorial will use Python/MicroPython

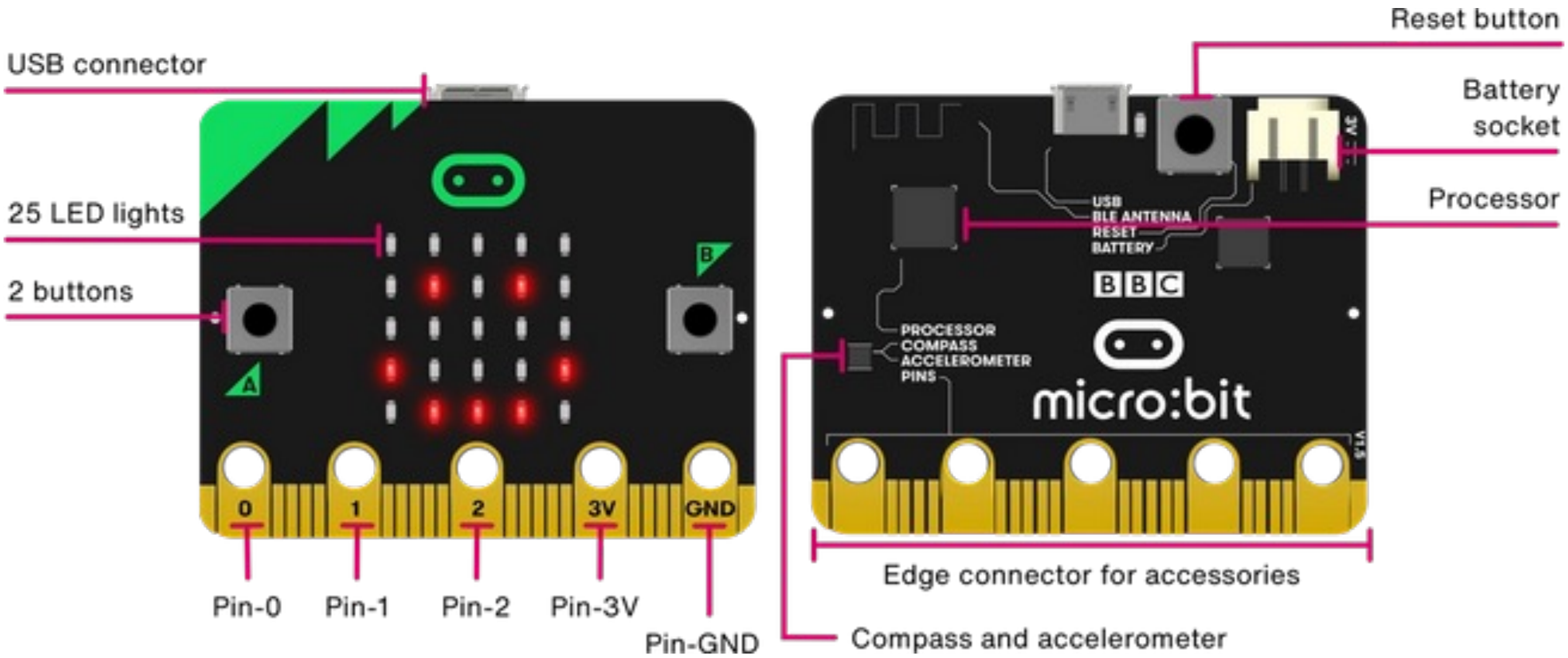
https://microbit.org

# micro:bit



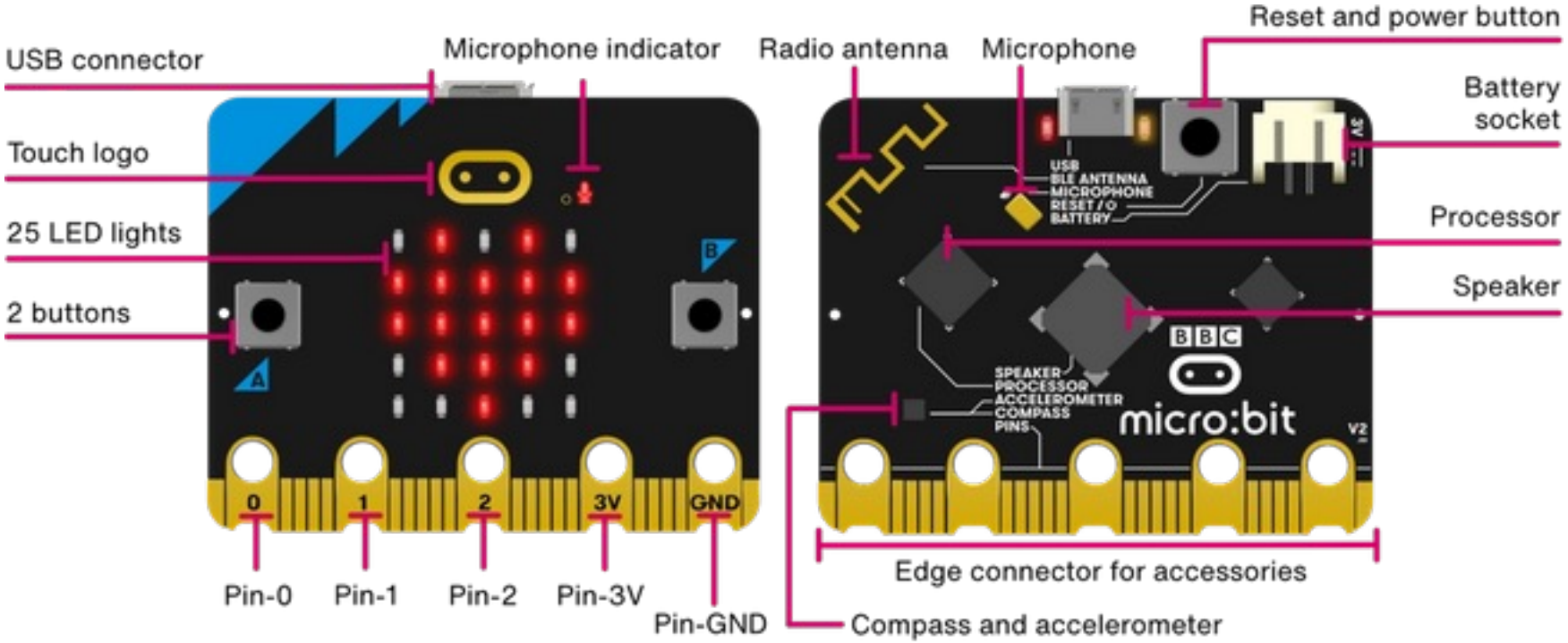

https://microbit.org

# Original micro:bit




https://microbit.org

# New micro:bit (micro:bit v2)



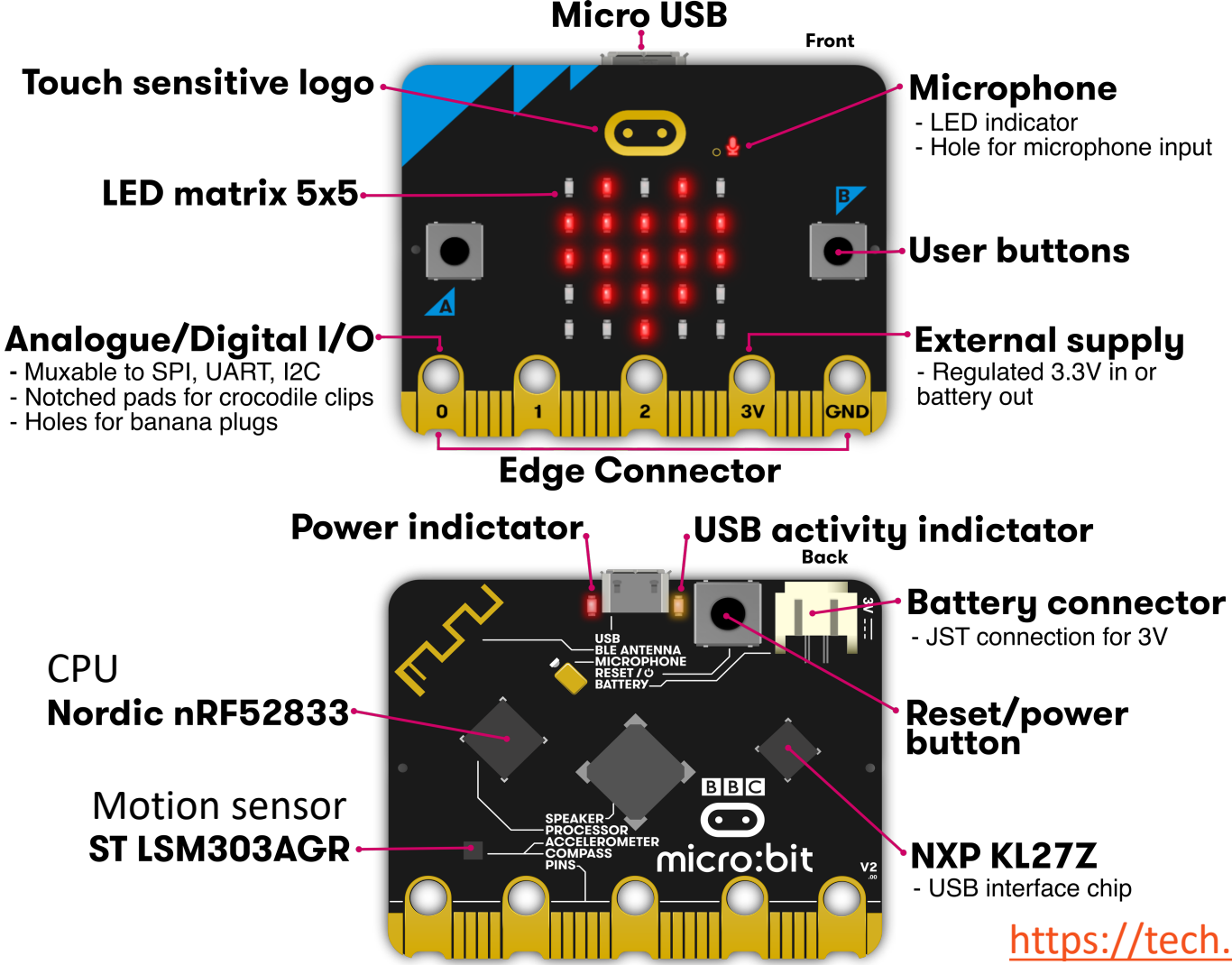

https://youtu.be/pIUJ4kvJ_QU

https://microbit.org

# micro:bit Features

- USB Communication and Powered by micro-USB or JST Battery Connection
- Sensors: Motion, Temperature, Light, Magnetism, Microphone and Touch
- Push Buttons
- Lots of Analog/Digital Input/Output Pins
- Speaker
- Wireless Radio Communication
- Bluetooth Communication
- SPI, I2C and UART
- Pulse Width Modulation (PWM)

https://microbit.org




https://tech.microbit.org/hardware/

# micro:bit and Python

Hans-Petter Halvorsen

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# Python

- Python is a fairly old Programming Language (1991) compared to many other Programming Languages like C# (2000), Swift (2014), Java (1995), PHP (1995).
- Python has during the last 10 years become more and more popular.
- Today, Python has become one of the most popular Programming Languages.

# micro:bit and Python

- The combination of the micro:bit Hardware and the Python Programming Language is very powerful
- micro:bit runs a special version of MicroPython
- MicroPython is a down-scaled version of Python
- You can use different Python Editors; e.g., Mu Python Editor or the Online Python Editor, etc.

# MicroPython

https://micropython.org

- MicroPython is a small and efficient implementation of the Python 3 programming language
- MicroPython includes a small subset of the Python standard library
- MicroPython is optimized to run on microcontrollers and in constrained environments
- https://microbit-micropython.readthedocs.io/

# micro:bit Python Documentation

- micro:bit Python User Guide
  https://microbit.org/get-started/user-guide/python/
- micro:bit MicroPython documentation
  https://microbit-micropython.readthedocs.io

# Python Editors

Hans-Petter Halvorsen

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# micro:bit Python Editors

Here are some Editors:

- Online Editor (used in your Browser)
  https://python.microbit.org
- Mu Python Editor
  https://codewith.mu

This Tutorial will mainly use the Mu Python Editor

# Online Python Editor

Hans-Petter Halvorsen

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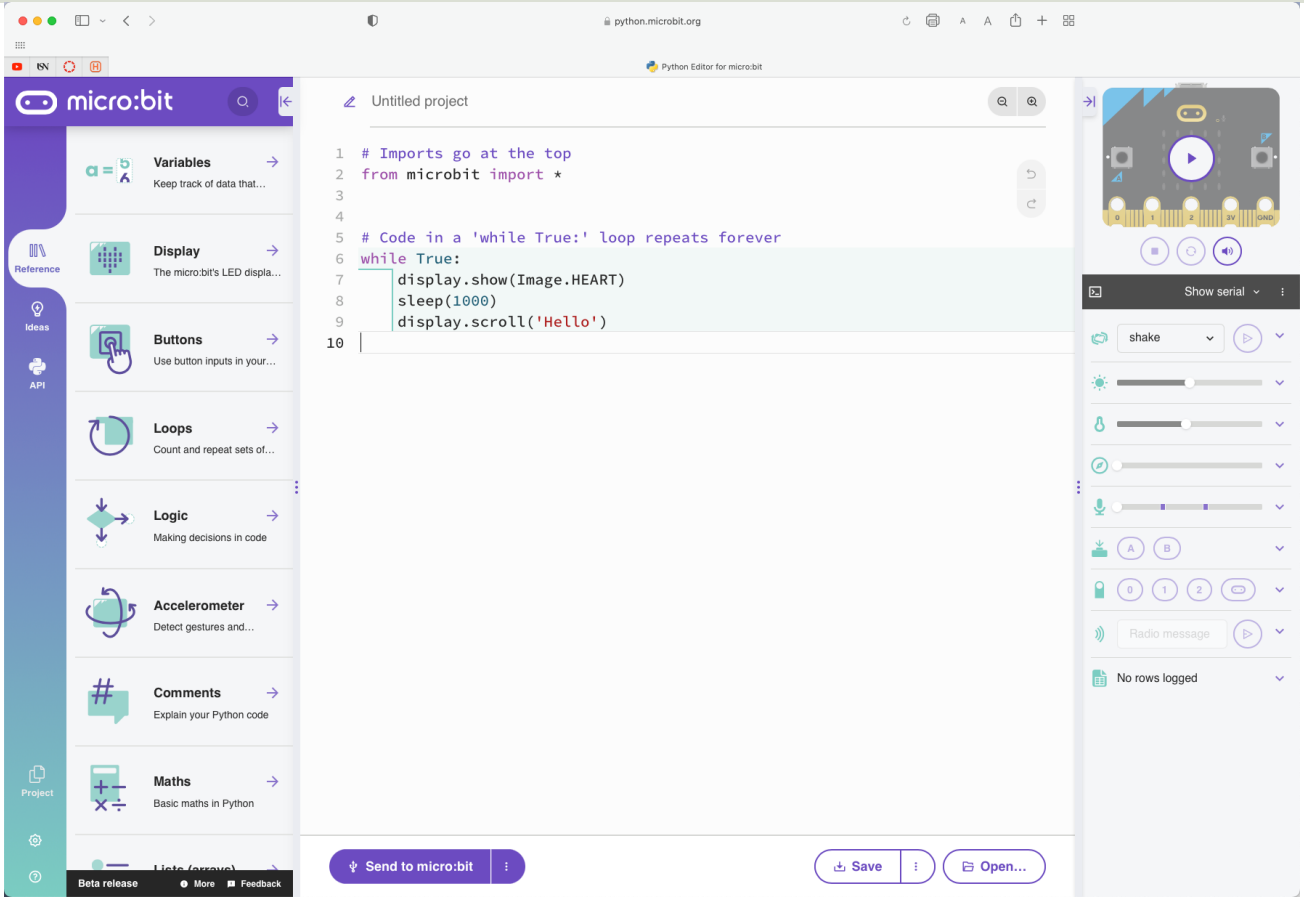
# Online Python Editor



# Mu Python Editor

Hans-Petter Halvorsen

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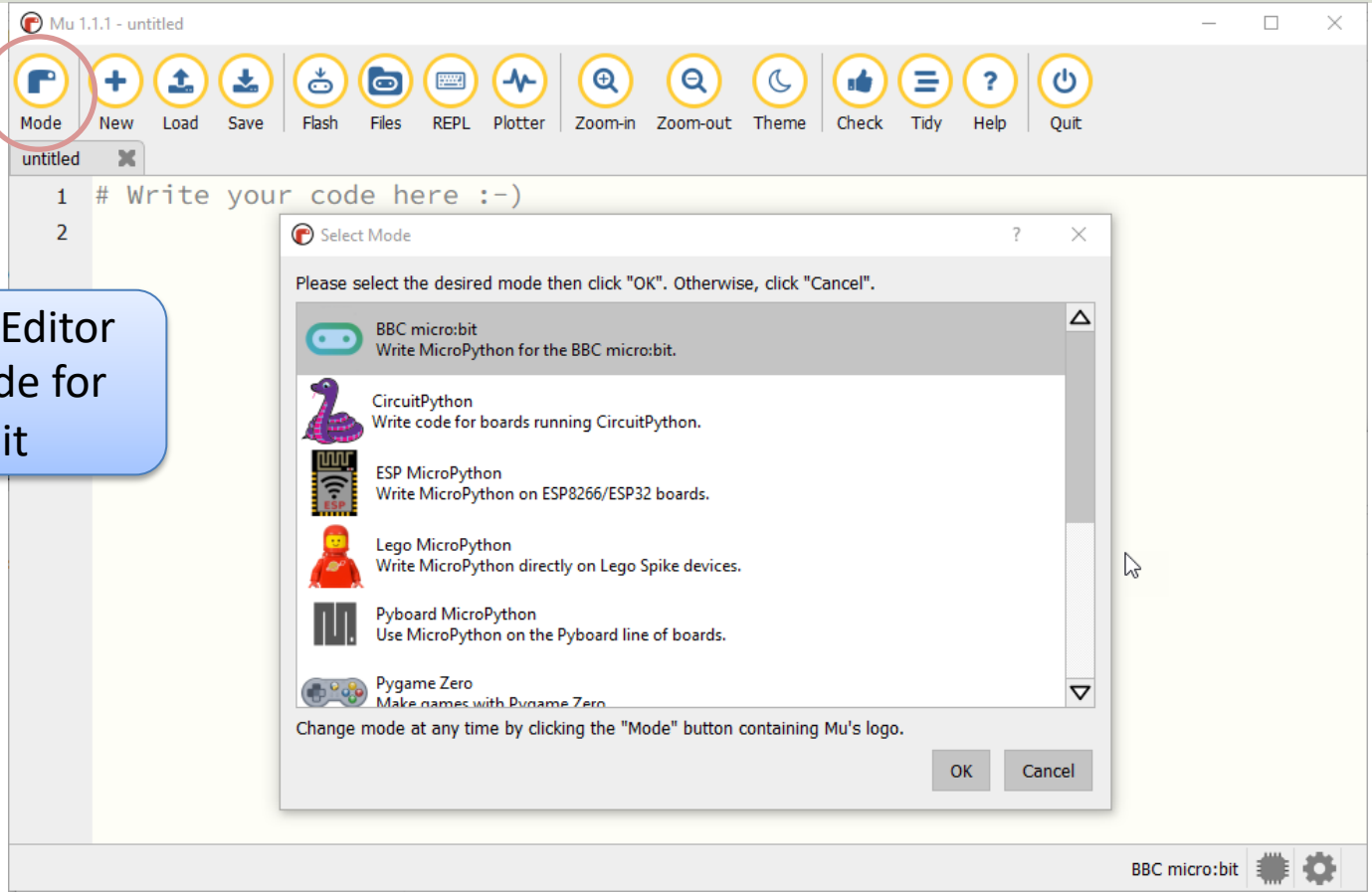
# Mu Python Editor

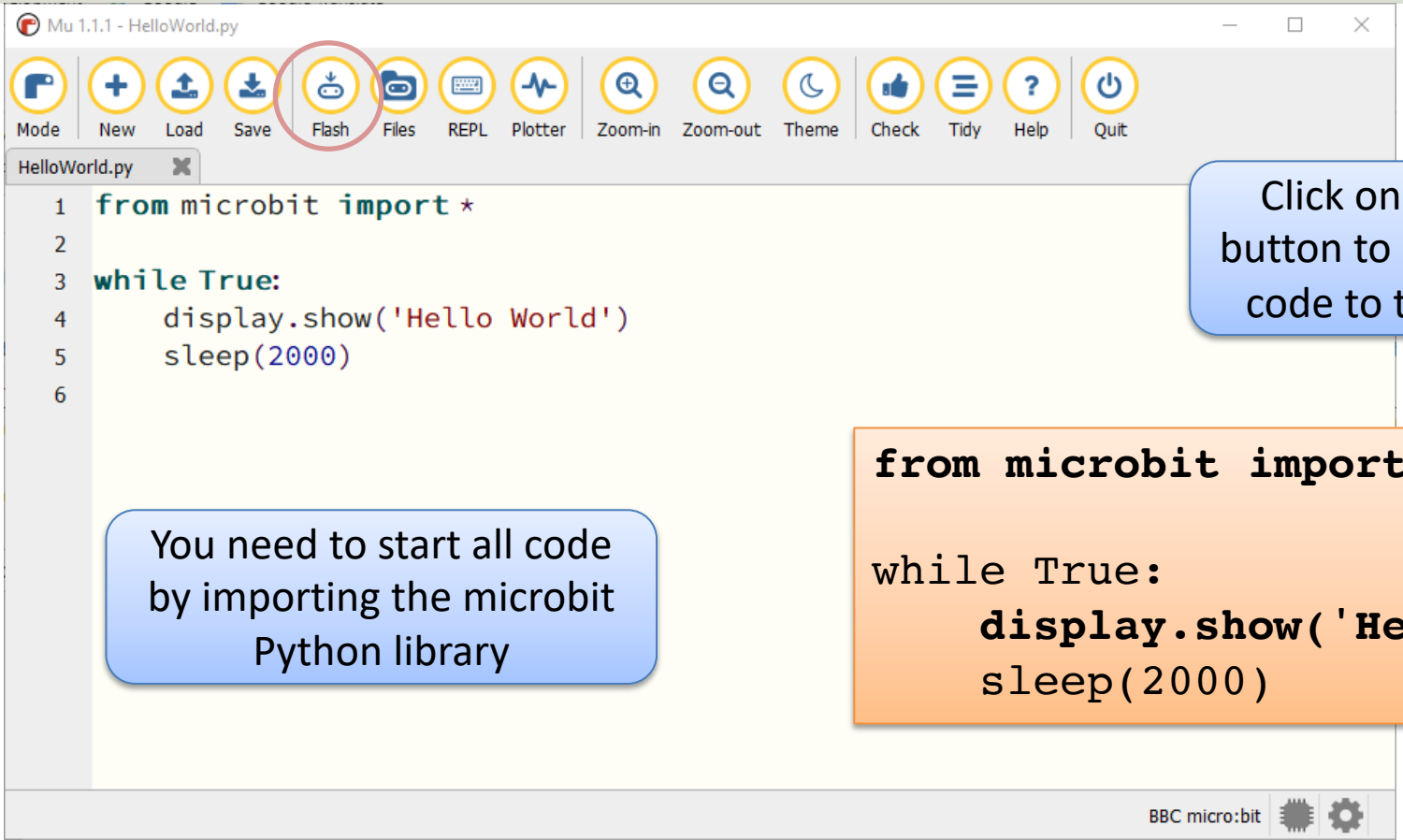
- Mu is a Python code editor for beginners
- It is tailor-made for micro:bit programming
- Mu has a “micro:bit mode” that makes it easy to work with micro:bit, download code to the micro:bit hardware, etc.
- Mu and micro:bit Tutorials: https://codewith.mu/en/tutorials/1.0/microbit

# Mu Python Editor

The Mu Python Editor has built-in Mode for the micro:bit



# Hello World



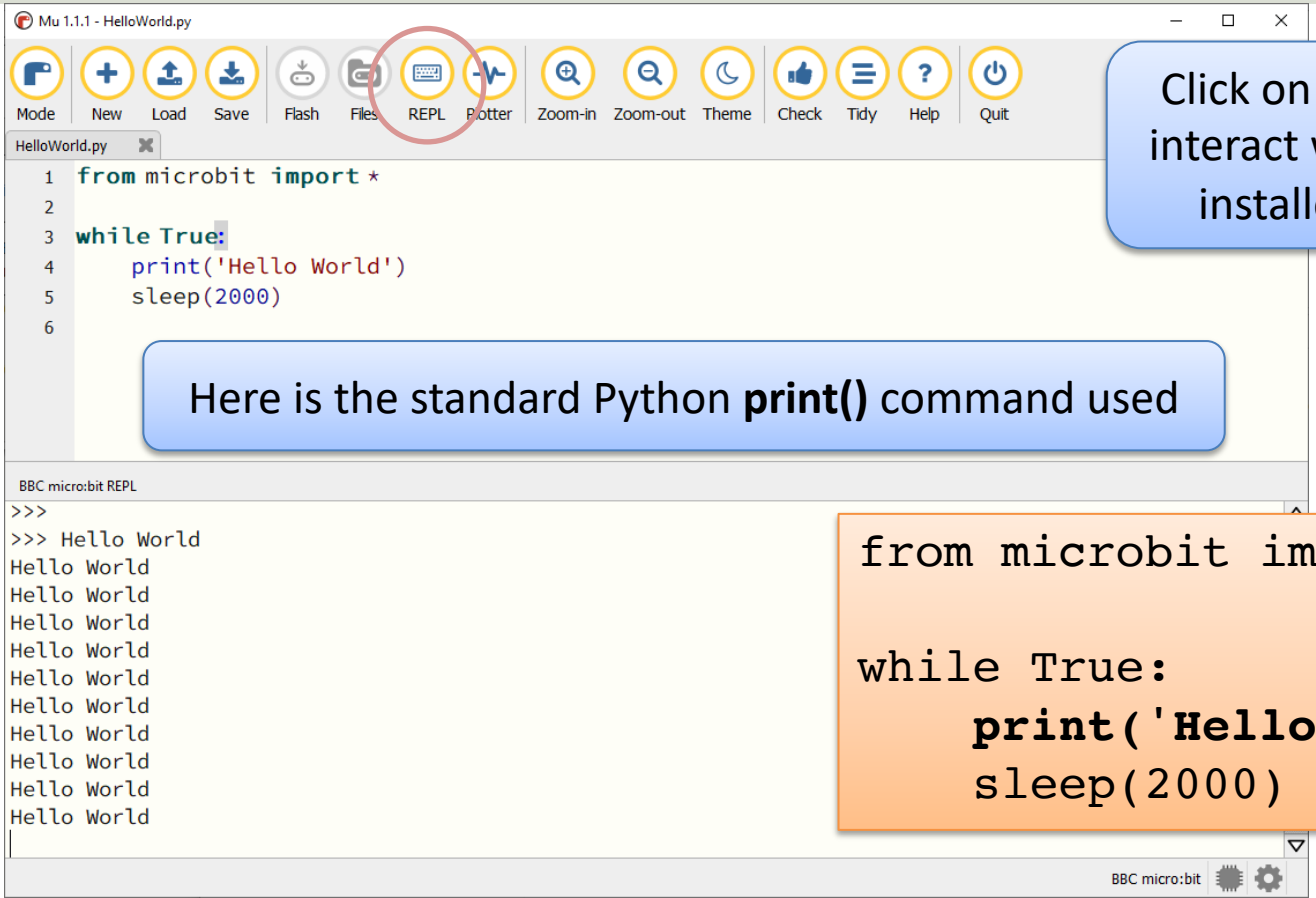

Click on the “Flash” button to download the code to the micro:bit

You need to start all code by importing the microbit Python library

```
from microbit import *

while True:
    display.show('Hello World')
    sleep(2000)
```

# REPL



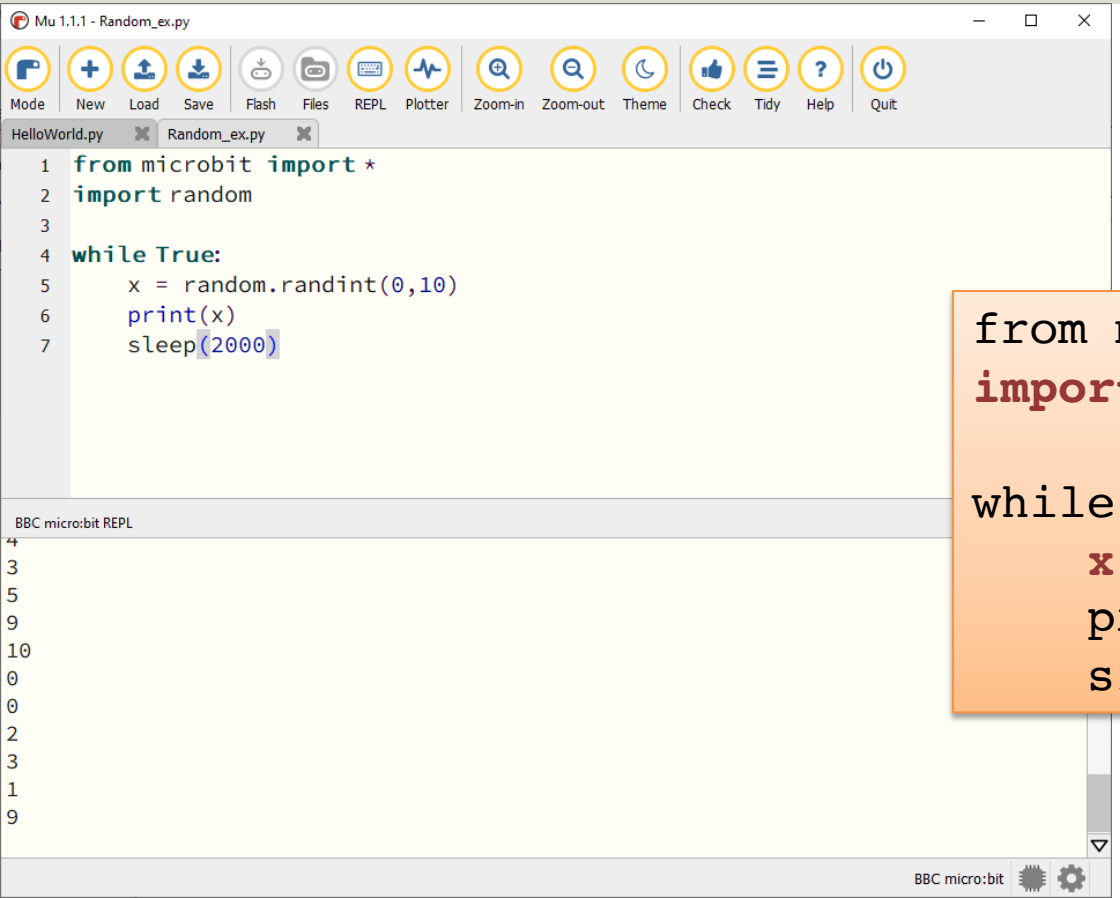

Click on the “REPL” button to interact with the MicroPython installed on the micro:bit

Here is the standard Python **print()** command used

```
from microbit import *

while True:
    print('Hello World')
    sleep(2000)
```

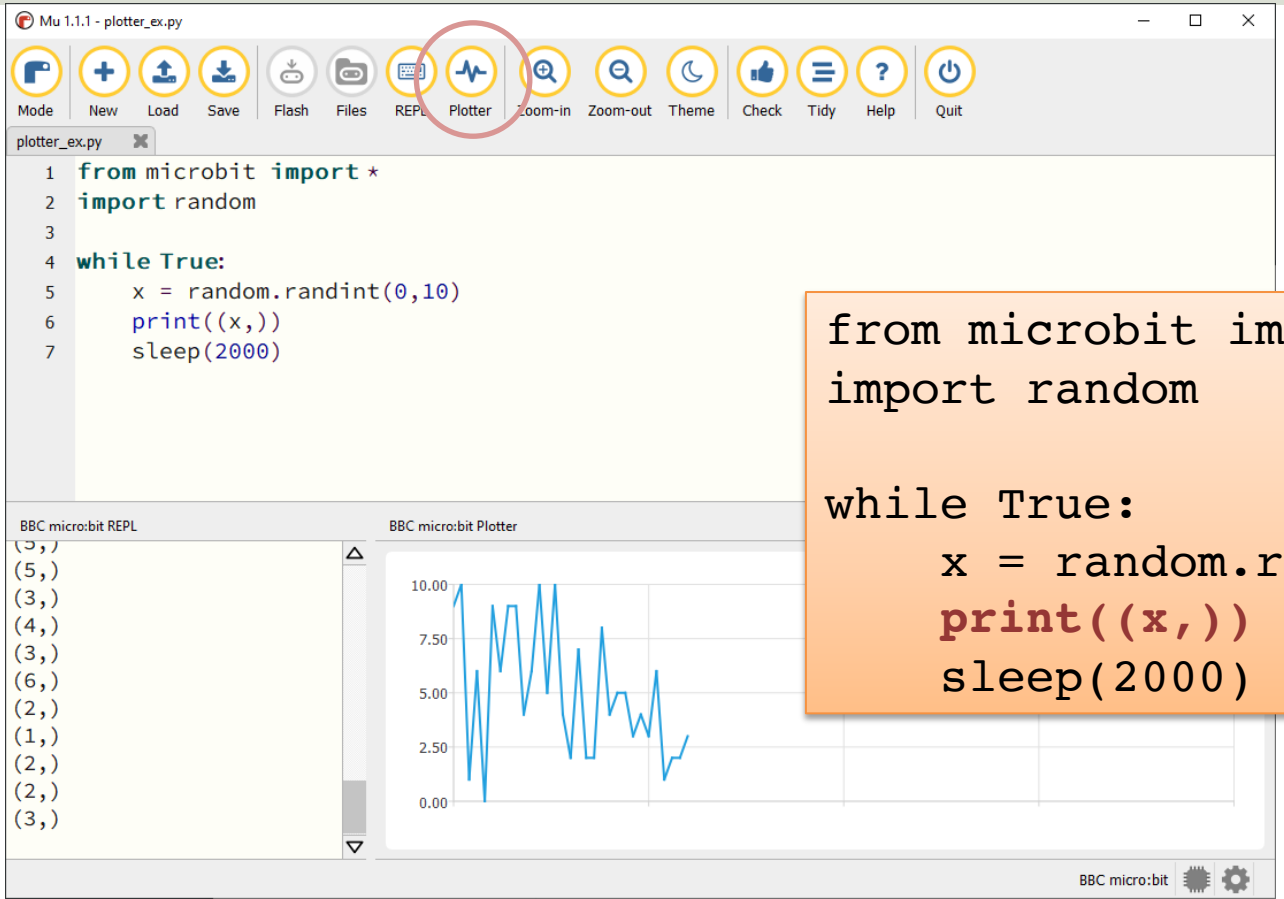
# REPL – Random Numbers




```
from microbit import *
import random

while True:
    x = random.randint(0,10)
    print(x)
    sleep(2000)
```

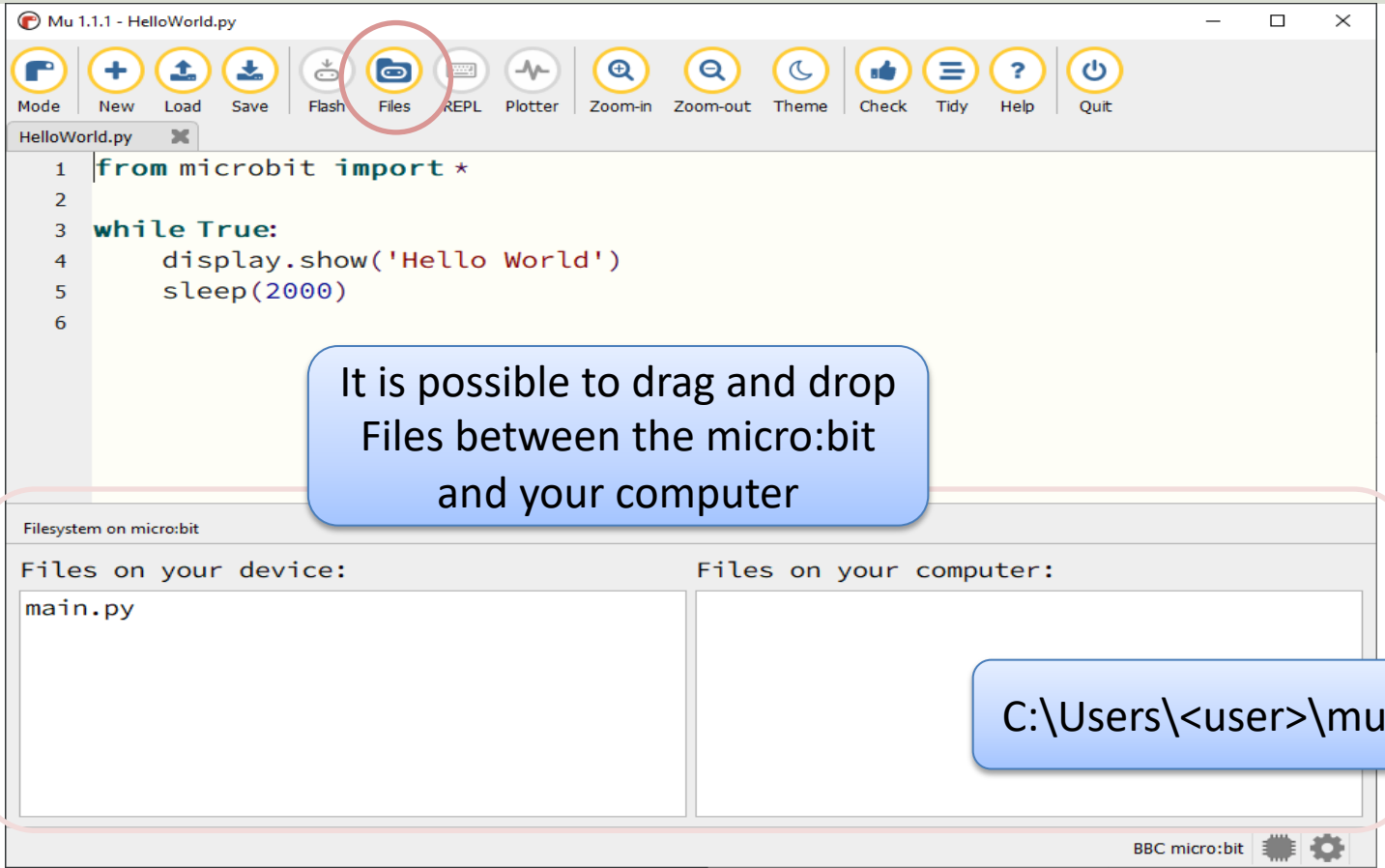
# Plotter




```
from microbit import *
import random

while True:
    x = random.randint(0,10)
    print((x,))
    sleep(2000)
```

# Files


Mu 1.1.1 - HelloWorld.py
Mode
New
Load
Save
Flash
Files
REPL
Plotter
Zoom-in
Zoom-out
Theme
Check
Tidy
Help
Quit
HelloWorld.py
1 from microbit import *
2
3 while True:
4 display.show('Hello World')
5 sleep(2000)
6
It is possible to drag and drop Files between the micro:bit and your computer
Filesystem on micro:bit
Files on your device:
main.py
Files on your computer:
C:\Users\<user>\mu_code
BBC micro:bit

https://www.halvorsen.blog

# micro:bit Interfaces

## with Python Examples

Hans-Petter Halvorsen

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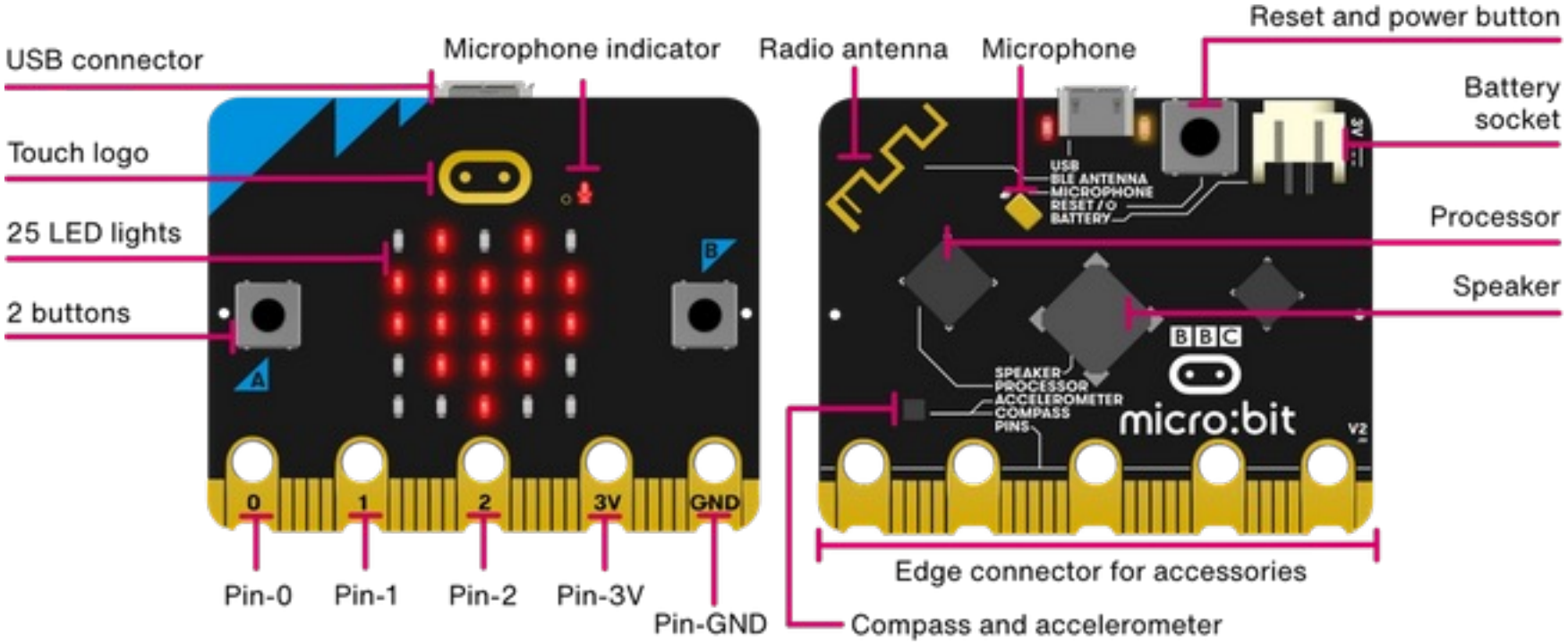
# micro:bit Interfaces

- **LED Matrix (5x5)**
- **Buttons (A and B)**
- **Temperature Sensor**
- Light Sensor
- Accelerometer
- Compass
- Touch (only available for new micro:bit)
- Microphone (only available for new micro:bit)
- I/O Pins: Analog/Digital Input/Output Pins

# New micro:bit (micro:bit v2)




https://youtu.be/pIUJ4kvJ_QU

https://microbit.org

# LED Matrix (5x5)

Hans-Petter Halvorsen

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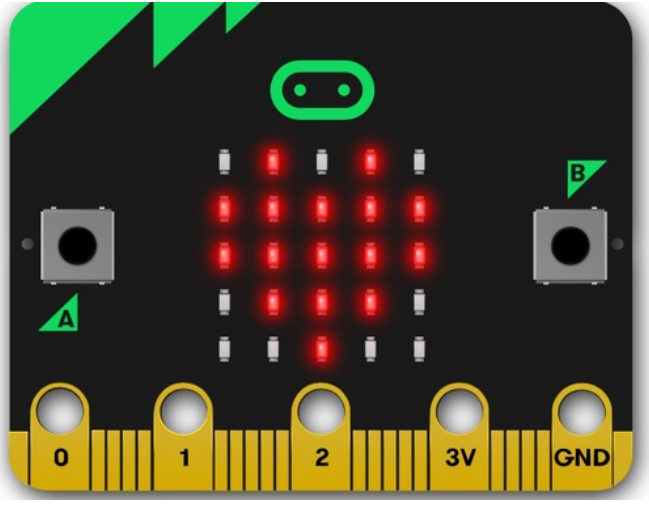
# LED Matrix (5x5)

- An LED, or light-emitting diode is an output device that gives off light.
- The Micro:bit has a display of 25 (5x5) LEDs for you to program.
- You can use the LED matrix to show images or show text or numbers



# LED Matrix - Text

```
from microbit import *

display.show("WELCOME")
```

This will show one letter at the time on the LED matrix

```
from microbit import *
while True:
display.show("WELCOME")
sleep(1000)
```

It will do it "Forever"

```
from microbit import *

display.scroll("WELCOME")
```

The word "WELCOME" will scroll over the LED matrix

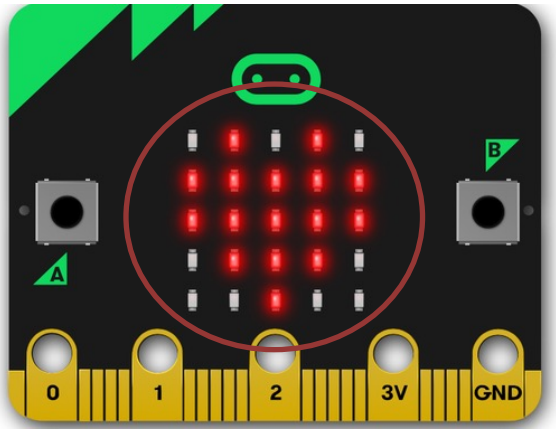
```
from microbit import *
while True:
display.scroll("WELCOME")
sleep(1000)
```

# LED Matrix - Images

The micro:bit has a set of other built-in images that you can use

```
from microbit import *

display.show(Image.HEART)
```




There are almost 100 built-in images that you can use. Just enter “Image.” and the Intellisense will list all available Images that you can use.

# Buttons (A and B)

Hans-Petter Halvorsen

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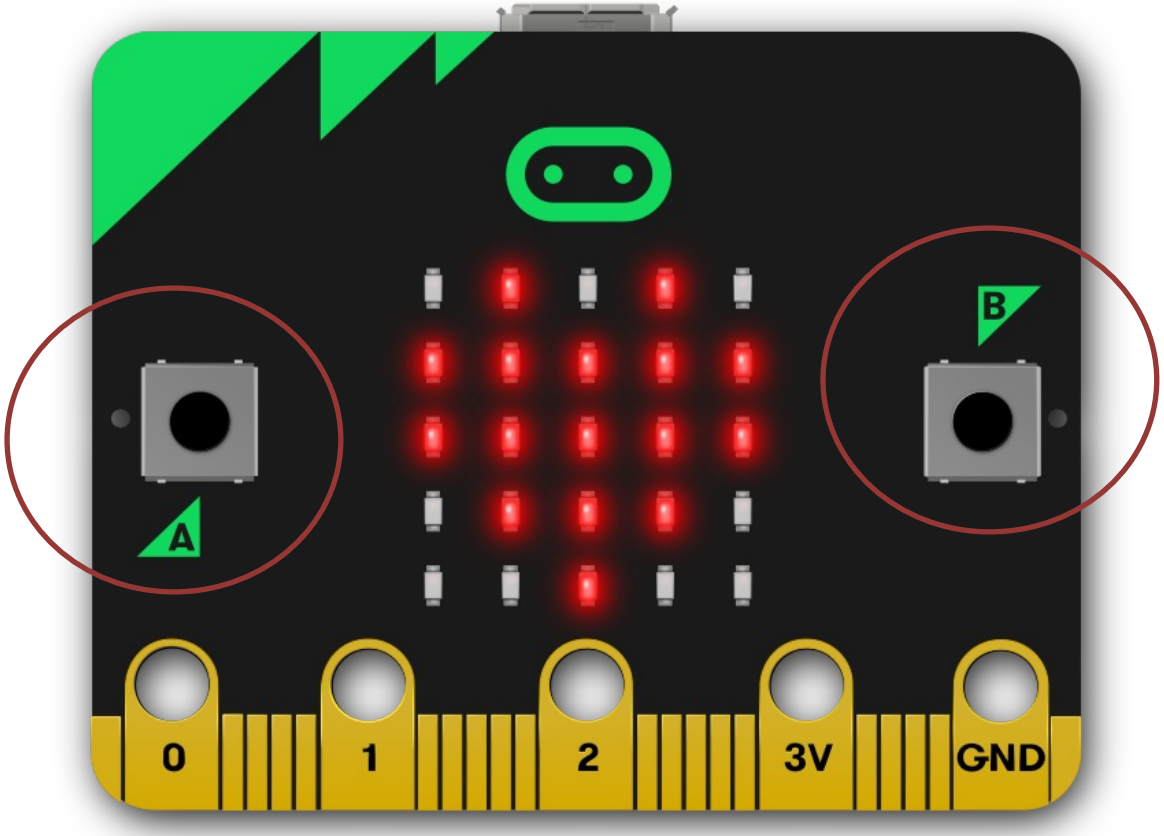
# Buttons (A and B)



# Buttons (A and B)

```
from microbit import *

while True:
    if button_a.was_pressed():
        display.scroll("A")
        print("A")
    elif button_b.was_pressed():
        display.scroll("B")
        print("B")
    else:
        display.scroll("?")
        print(”?")

    sleep(1000)
```

# Temperature Sensor

Hans-Petter Halvorsen

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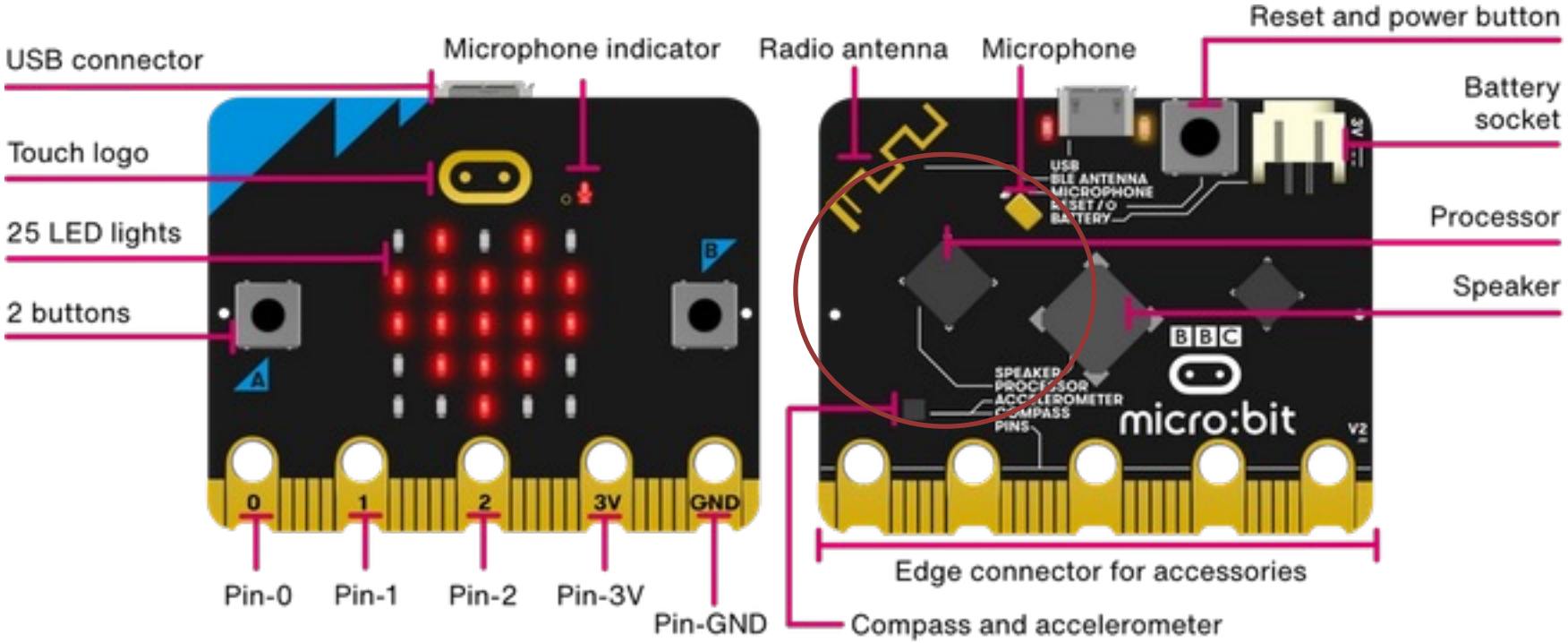
# Temperature Sensor

- Micro:bit has a built-in Temperature Sensor (that is located on the CPU)
- This sensor can give an approximation of the air temperature.
- Just use the built-in `temperature()` function in order to get the temperature value from the sensor

# Temperature Sensor



# Temperature Sensor

In order to read the temperature, you just use the built-in `temperature()` function:

```
from microbit import *

currentTemp = temperature()
```

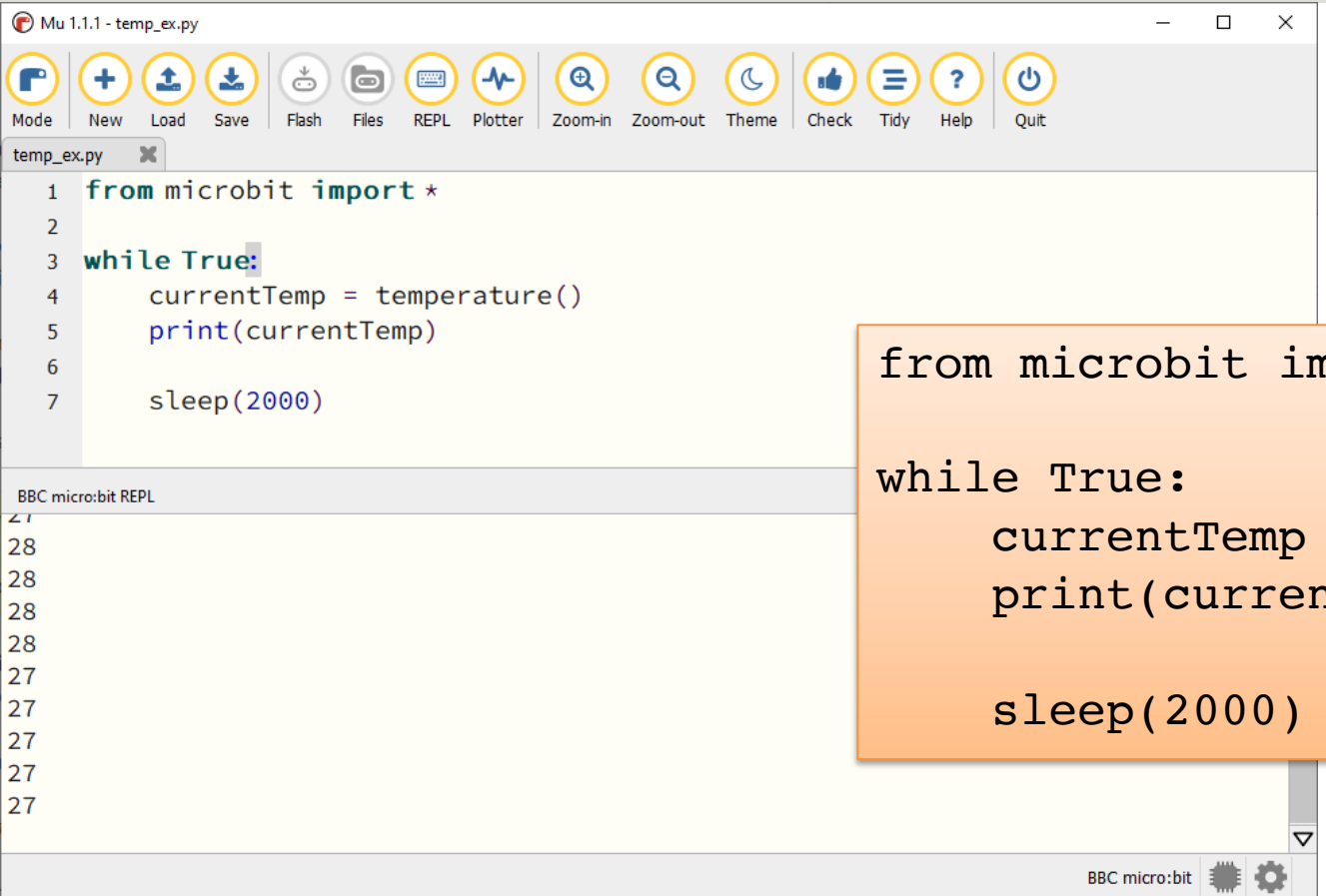
This examples displays the temperature on the LED matrix:

```
from microbit import *

while True:
    if button_a.was_pressed():
        display.scroll(temperature())
```

https://microbit.org/get-started/user-guide/features-in-depth/#temperature-sensor

# Temperature Sensor

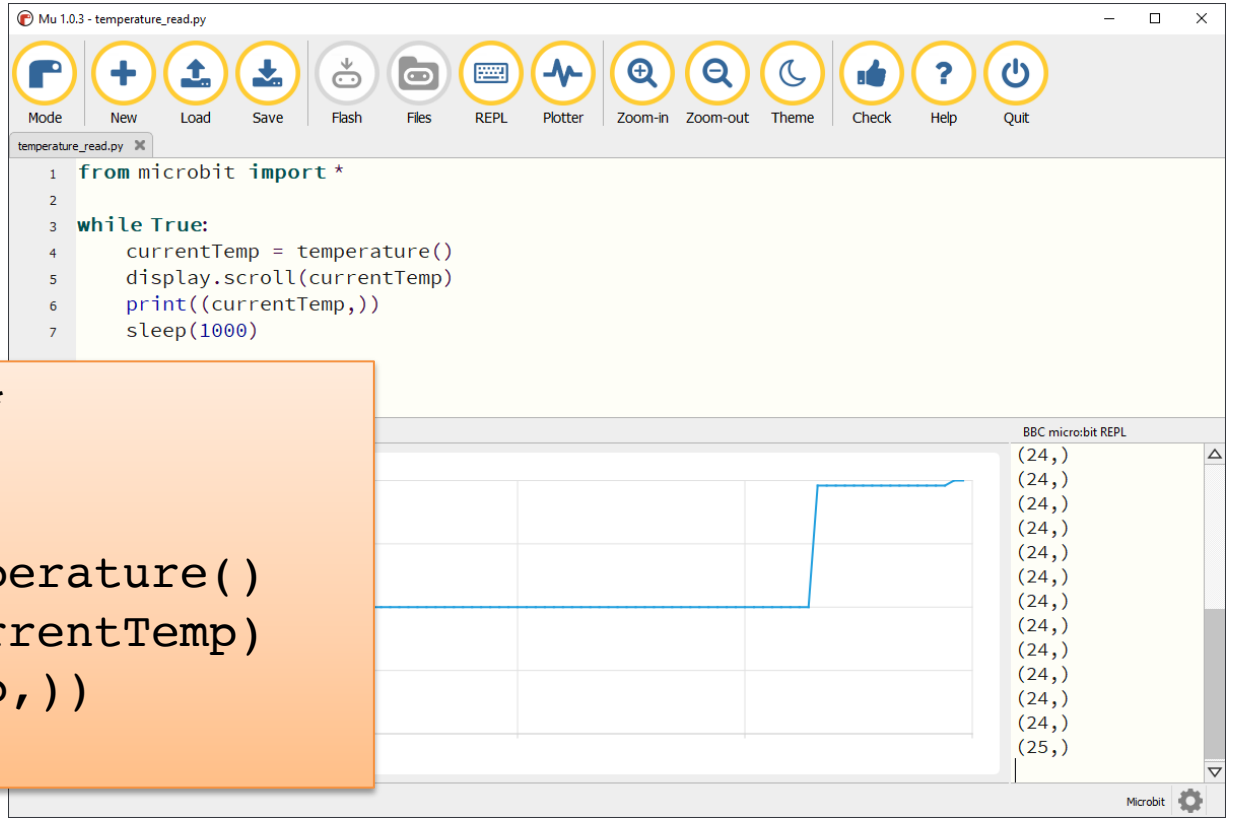



```
from microbit import *

while True:
    currentTemp = temperature()
    print(currentTemp)

    sleep(2000)
```

# Temperature Sensor




```
from microbit import *

while True:
    currentTemp = temperature()
    display.scroll(currentTemp)
    print((currentTemp,))
    sleep(1000)
```

# I/O Pins

Hans-Petter Halvorsen

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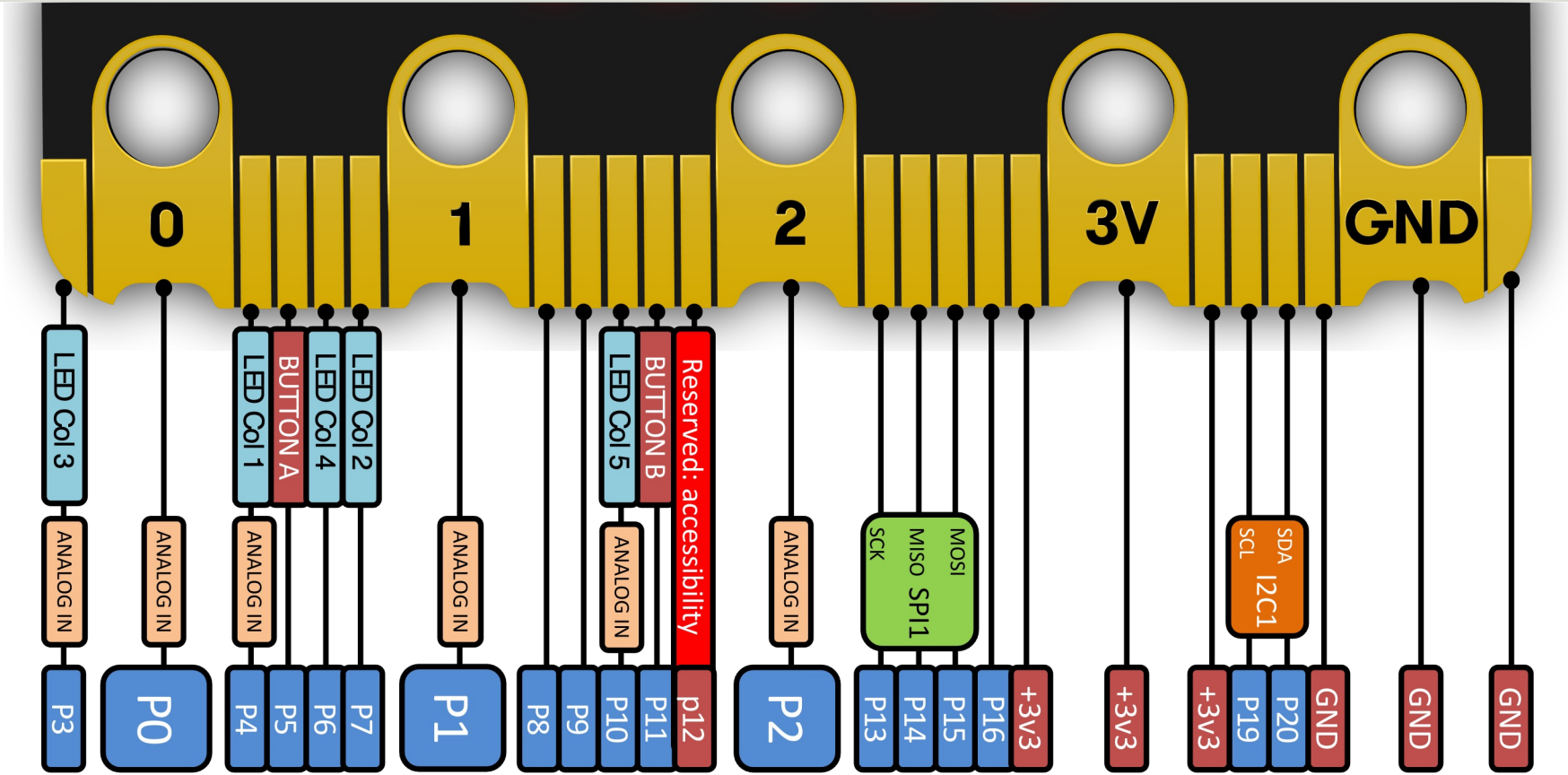
# micro:bit Interfaces

- **LED Matrix (5x5)**
- **Buttons (A and B)**
- **Temperature Sensor**
- Light Sensor
- Accelerometer
- Compass
- Touch (only available for new micro:bit)
- Microphone (only available for new micro:bit)
- I/O Pins: Analog/Digital Input/Output Pins

https://microbit.pinout.xyz/

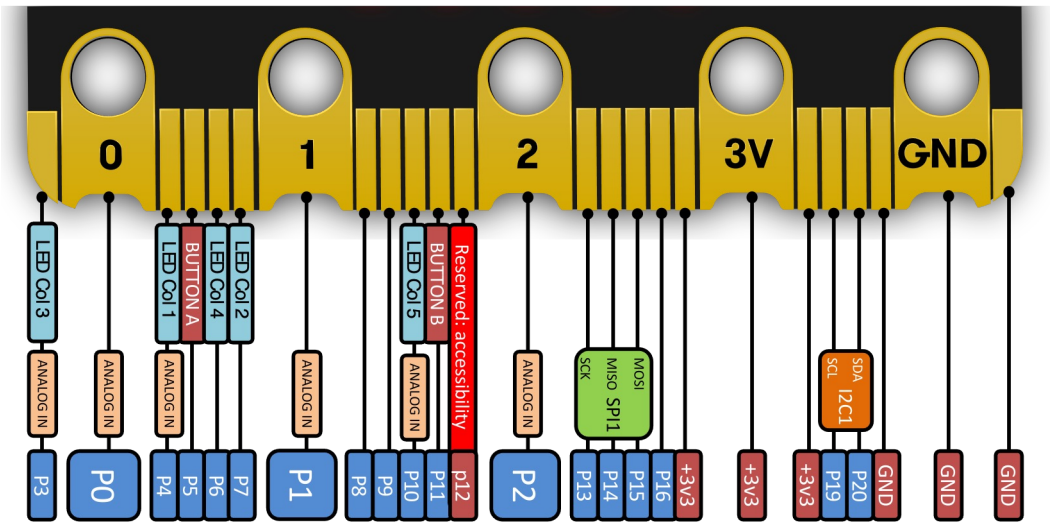
# I/O Pin Overview v.2



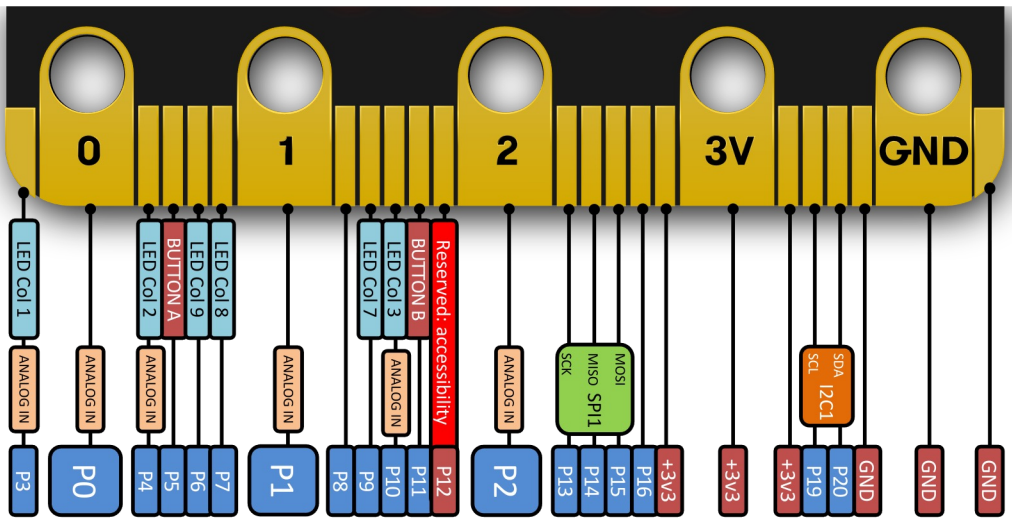
# I/O Pin Overview

https://microbit.pinout.xyz/

New micro:bit (micro:bit v2)

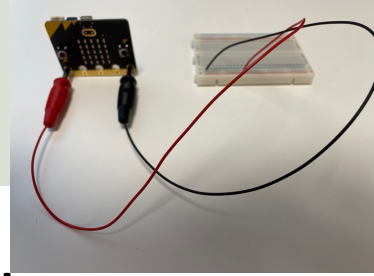



Original micro:bit

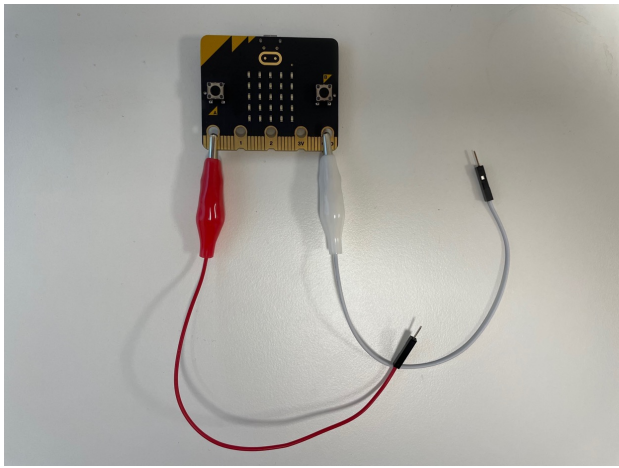



https://tech.microbit.org/hardware/edgeconnector/

# I/O Pins



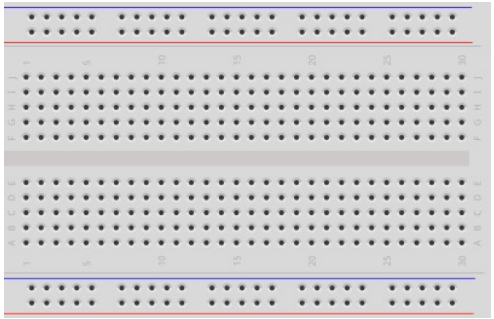
- We use the I/O pins to connect external components like LEDs, different types of Sensors, etc.
- You can use 4mm Banana plugs or alligator/crocodile clips
- Typically you also want to use a Breadboard



https://tech.microbit.org/hardware/edgeconnector/

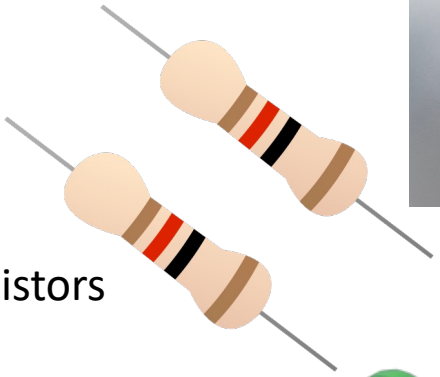
https://makecode.microbit.org/device/crocodile-clips

# Component Examples

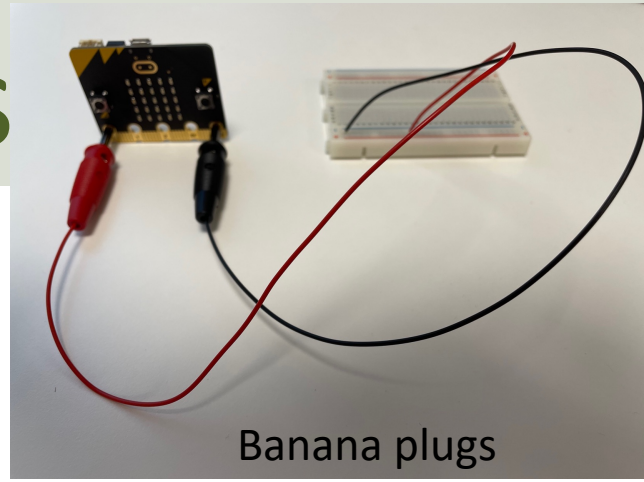


Breadboard

Temperature Sensor

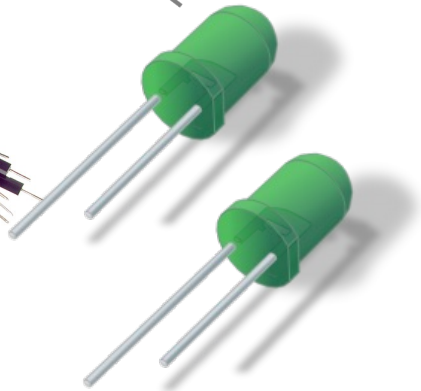


Resistors

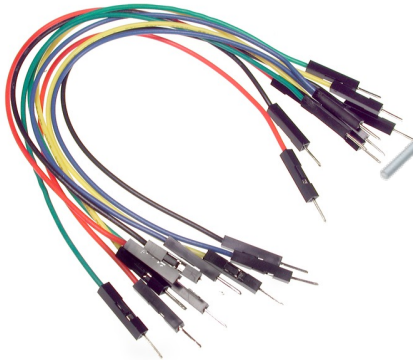


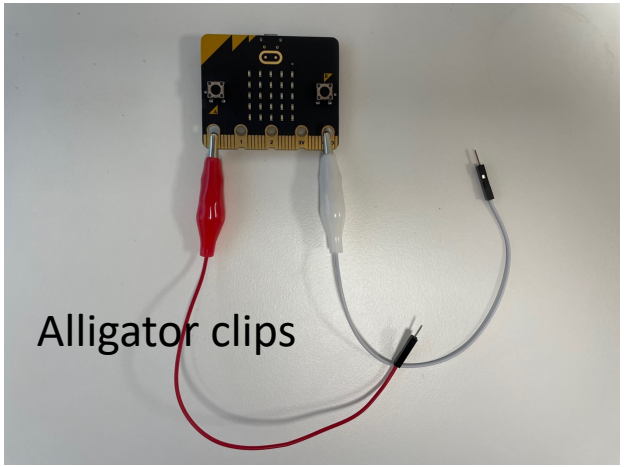
Banana plugs

LEDs



Wires





Alligator clips

Multimeter

# Types of I/O Pins

- Analog/Digital Input/Output Pins
- Pulse Width Modulation (PWM)
- SPI
- I2C
- UART (used for serial communication)

We will not use the I/O pins in this Tutorial, but I will give an overview and give examples in other micro:bit/Python Tutorials that goes in more depth regarding these I/O pins with lots of practical examples

# micro:bit Resources and References

- micro:bit Python User Guide
  https://microbit.org/get-started/user-guide/python/
- micro:bit MicroPython documentation
  https://microbit-micropython.readthedocs.io
- Learn micro:bit (Adafruit):
  https://learn.adafruit.com/bbc-micro-bit-lesson-number-0
- Online Python Editor: https://python.microbit.org
- Mu Python Editor: https://codewith.mu

# Hans-Petter Halvorsen

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