

# Arduino / Python

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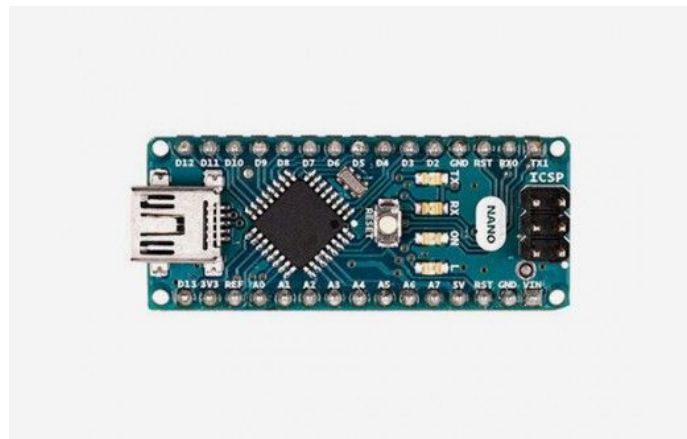
# Arduino

- 一家製作開源硬體和開源軟體的公司
- Arduino 允許任何人製造 Arduino 板和軟體分發

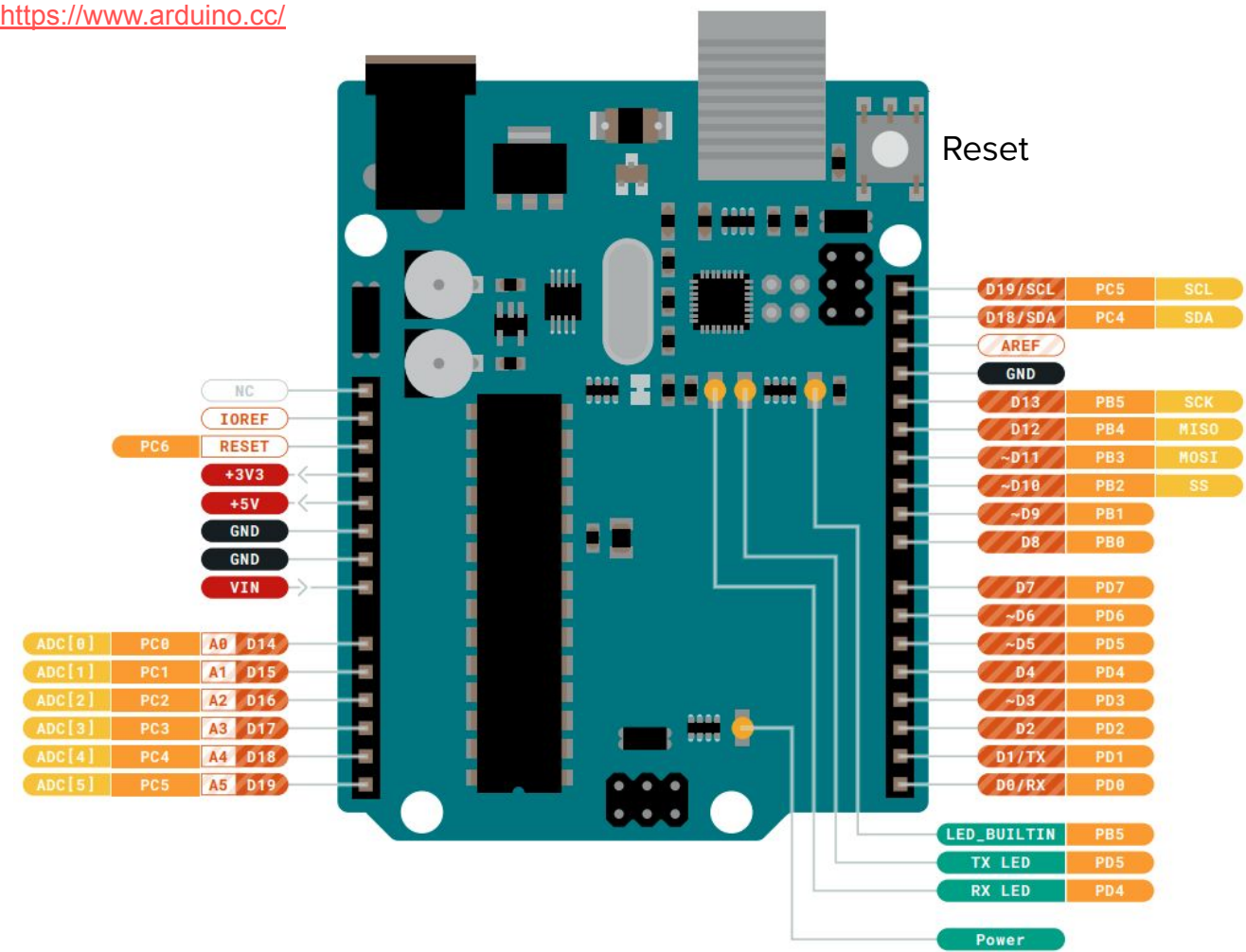
系列產品



Arduino UNO



Arduino NANO



Ground

Power

LED

Internal Pin

SWD Pin

Digital Pin

Analog Pin

Other Pin

Microcontroller's Port

Default

# Arduino 特色

- Inexpensive (便宜)
- Cross-platform (跨平台)
- Simple, clear programming environment (簡潔的開發環境)
- Open source and extensible software (開源且易於擴充的軟體)
- Open source and extensible hardware (開源且易於擴充的硬體)

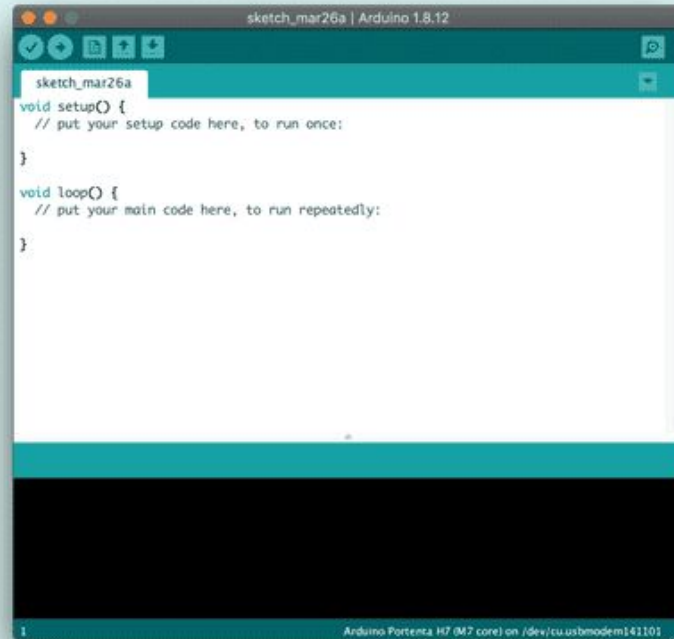
# Arduino 程式開發環境

- Code online on the Arduino Web Editor - 須安裝代理程式
- Code offline on the Arduino Desktop IDE
  - Windows / Mac OS X / Linux
  - Portable versions (Windows / Linux)
  - Chrome extension

<https://www.arduino.cc/en/software>

# Arduino Desktop IDE

<https://www.arduino.cc/en/software>



# Blink Example

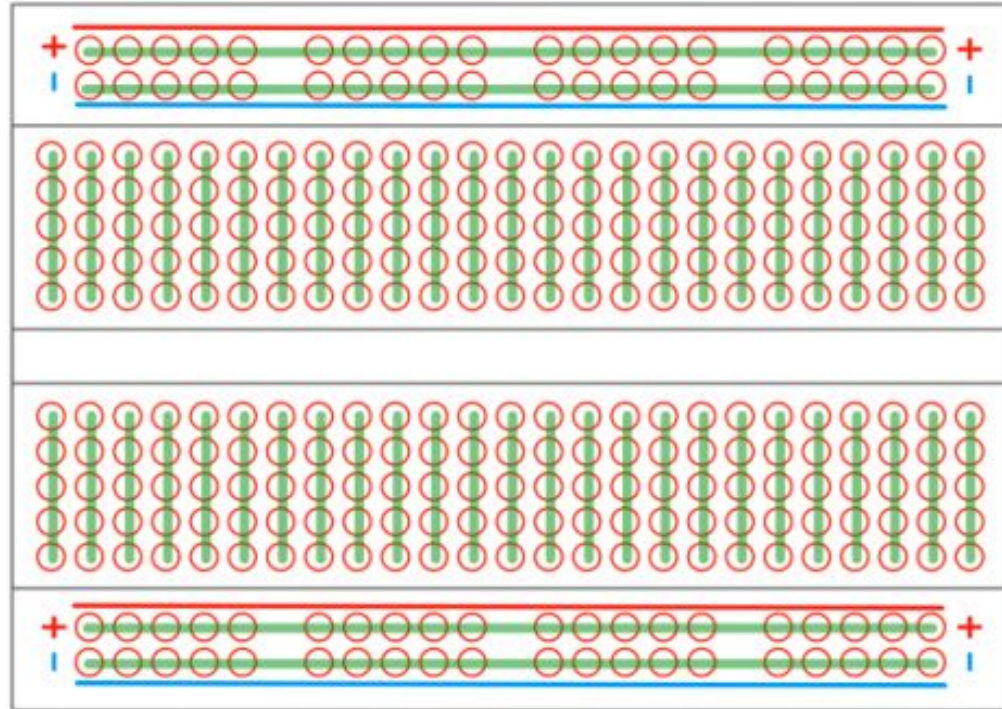
1. Launch Arduino IDE
2. TOOL → BOARD: Select Arduino/Genuino UNO
3. TOOL → PORT: COMX(ARDUINO/ GENUINO UNO)
4. FILE → EXAMPLES → BASICS → BLINK
5. VERIFY 
6. Upload 

# Code for Blink

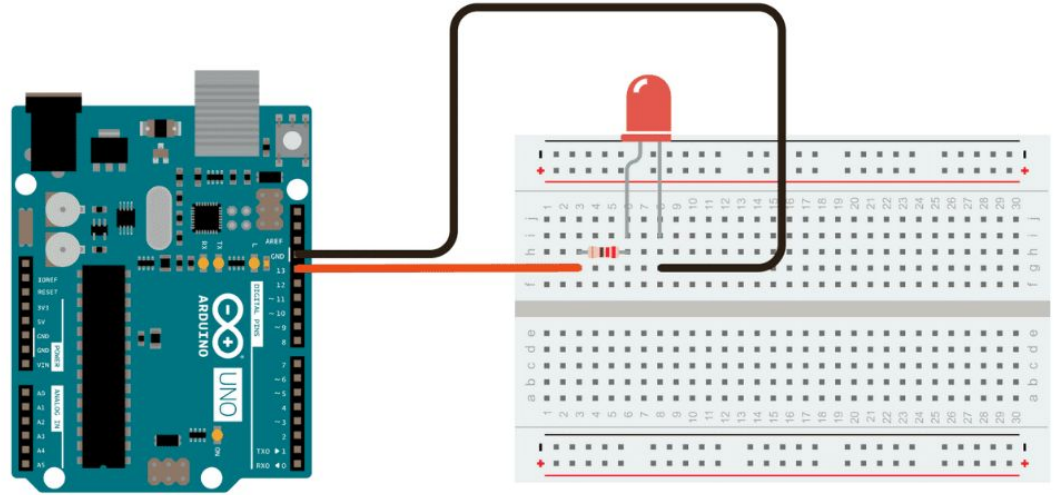
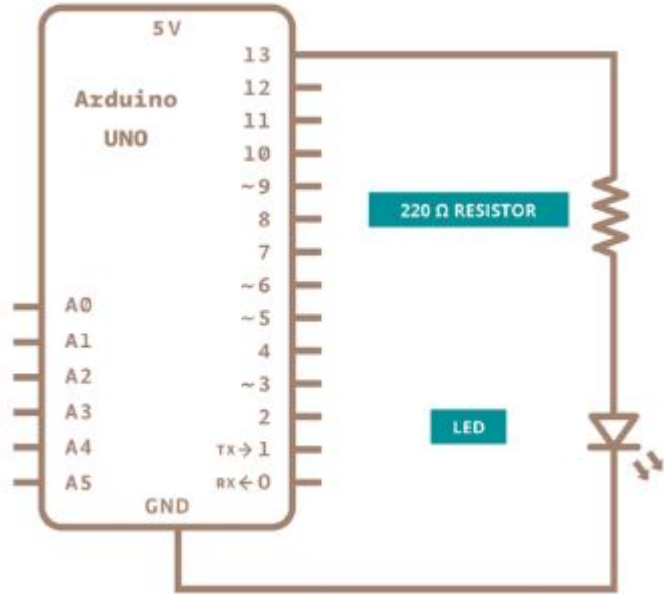
```
void setup() {  
    // initialize digital pin LED_BUILTIN as an output.  
    pinMode(LED_BUILTIN, OUTPUT); // LED_BUILTIN = D13 for UNO  
}  
  
// the loop function runs over and over again forever  
void loop() {  
    digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)  
    delay(1000); // wait for a second  
    digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW  
    delay(1000); // wait for a second  
}
```



# Bread Board



# Circuit Design



# Firmata / Python

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# Firmata (I)

微控制器通信協議

讓電腦或手持式裝置控制微控制器

Arduino 對於 Firmata 的整合度很高

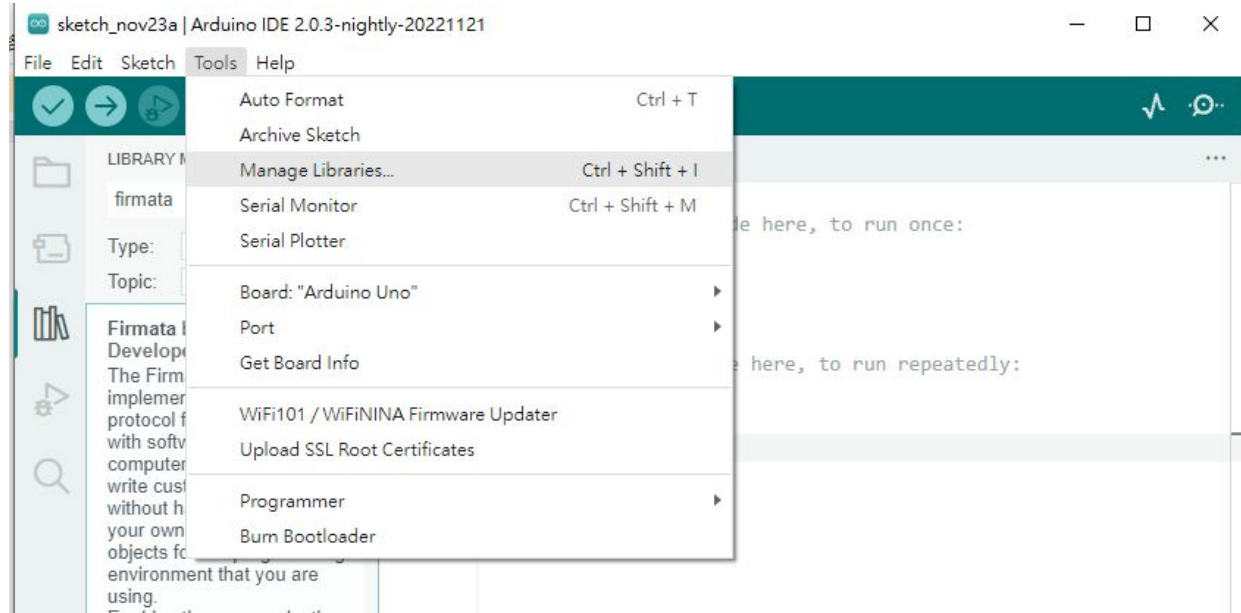
Arduino 的 IDE 內建多個 Firmata 應用

# Firmata (II)

- Python 控制 Arduino 有很多套件
  - <https://github.com/firmata/pyduino>
  - <https://github.com/lupeke/python-firmata>
  - <https://github.com/tino/pyFirmata>
  - <https://mryslab.github.io/telemetry>
  - ...
- pyduino / python-firmata developed early (a little old...)
- pyFirmata is easier / telemetry is advanced
- We will use pyFirmata in this lesson

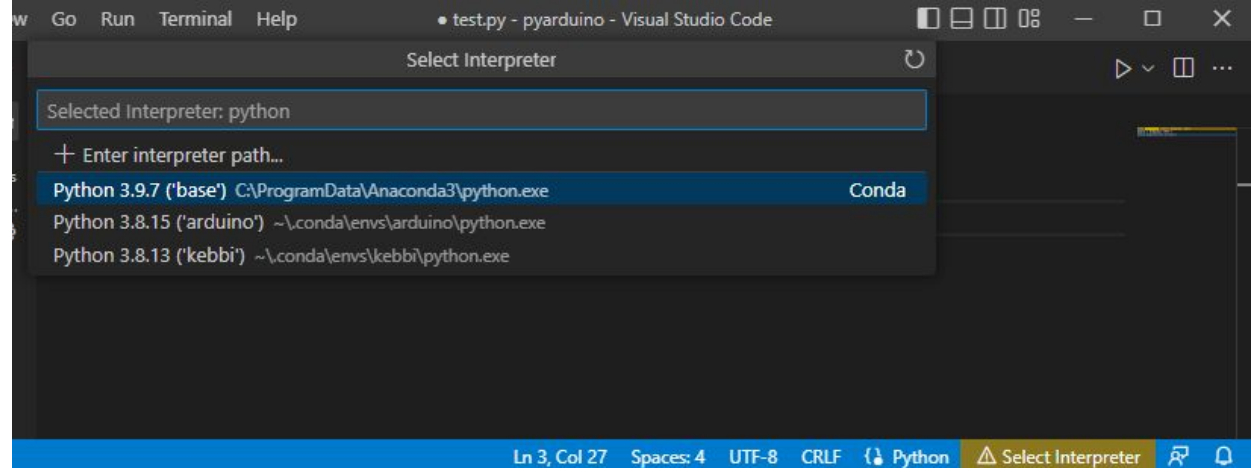
# Install Arduino Firmata

- Tools => Manage Libraries...
- Search firmata
- Install Firmata
- File => Examples => Firmata => StandardFirmata
- Verify and Upload



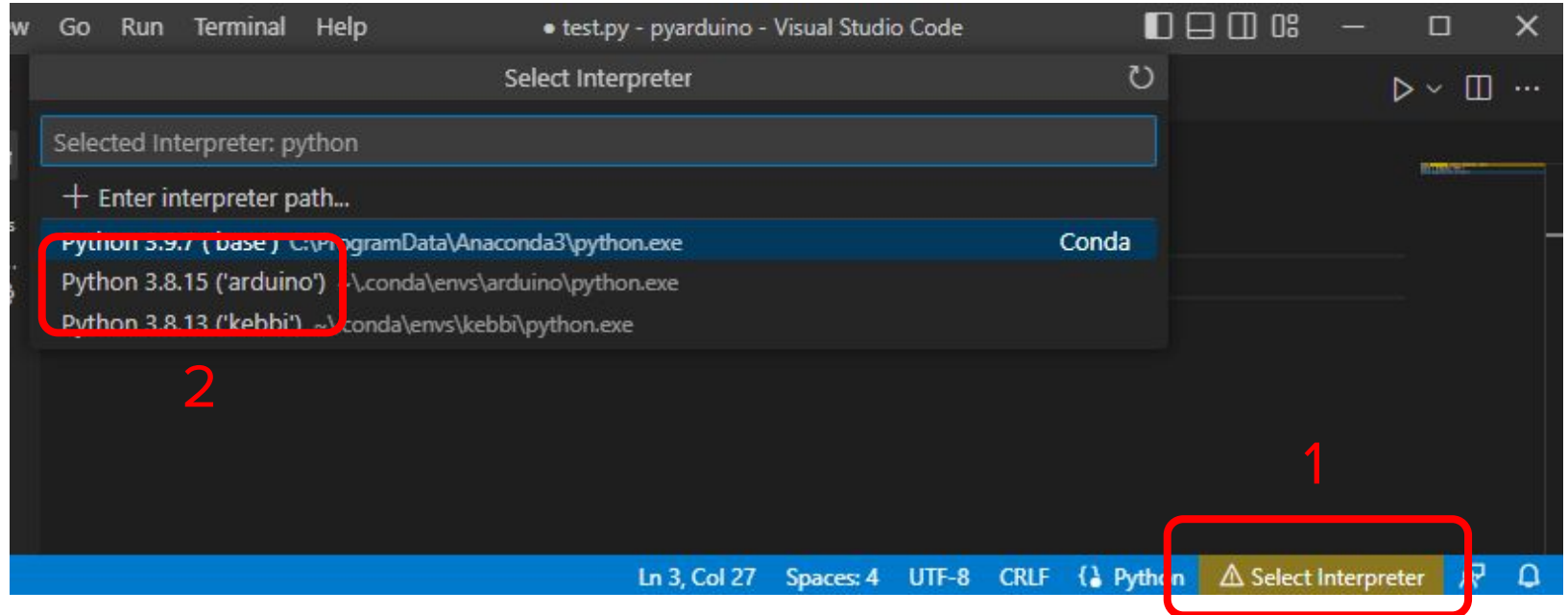
# Install Python Firmata

- Windows Start => Anaconda 3 => Anaconda Prompt
- `conda create -n arduino python=3.8`
- `conda activate arduino`
- `pip install pyfirmata`
- `mkdir arduino`
- `cd arduino`
- `code .`
- choose proper python version



# Choose proper python in VSC

- Select Interpreter
- arduino





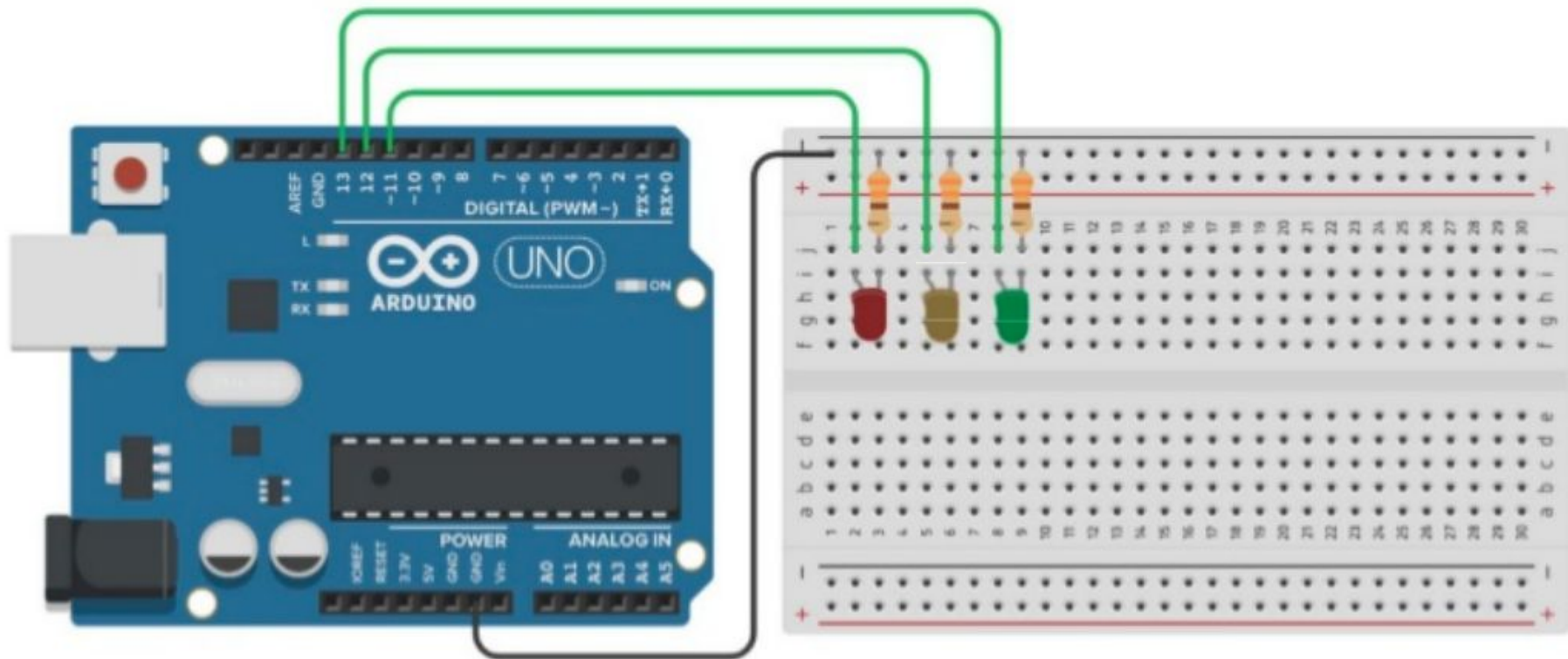
## Test code

```
from pyfirmata import Arduino  
board = Arduino('COM3')  
board.digital[13].write(1)
```

紅綠燈

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# 紅綠燈



# On and Off

```
from pyfirmata import Arduino
import time
```

```
board = Arduino('COM3')
```

```
RED = 11
```

```
YELLOW = 12
```

```
GREEN = 13
```

```
while True:
```

```
    board.digital[RED].write(1)      # turn on RED
    board.digital[YELLOW].write(1)   # turn on YELLOW
    board.digital[GREEN].write(1)    # turn on GREEN
    time.sleep(1);                   # wait for a second
    board.digital[RED].write(0)       # turn off RED
    board.digital[YELLOW].write(0)    # turn off YELLOW
    board.digital[GREEN].write(0)     # turn off GREEN
    time.sleep(1);                   # wait for a second
```

# On and Off

```
from pyfirmata import Arduino
import time

board = Arduino('COM3')

LEDS = [11, 12, 13]

while True:
    for led in LEDS:
        board.digital[led].write(1) # turn on LED
        time.sleep(1);                # wait for a second
    for led in LEDS:
        board.digital[led].write(0) # turn off LED
        time.sleep(1);                # wait for a second
```

# On and Off

```
from pyfirmata import Arduino
import time

board = Arduino('COM3')

LEDS = [11, 12, 13]

def switchLED(state):
    for led in LEDS:
        board.digital[led].write(state) # set LED state
        time.sleep(1)

while True:
    switchLED(1)
    switchLED(0)
```

# 練習 1

紅、黃、綠依次輪流亮起，一次一個，每次 1 sec。

- 紅燈亮:1 sec
- 黃燈亮:1 sec
- 綠燈亮:1 sec
- 紅燈亮:1 sec
- 黃燈亮:1 sec
- 綠燈亮:1 sec

## 練習 2

紅、黃、綠依次輪流亮起，一次加一個，三個全亮後熄滅重來，每次 1 sec。

- 紅燈亮:1 sec
- 紅黃燈亮:1 sec
- 紅黃綠燈亮:1 sec
- 全部熄滅:1 sec
- 紅燈亮:1 sec
- 紅黃燈亮:1 sec
- 紅黃綠燈亮:1 sec



## 練習 3

與練習2相同，紅、黃、綠依次輪流亮起。

第一輪每次亮 2 sec, 第二輪每次亮 1 sec, 第三輪每次亮 0.5 sec..., 六輪一循環。

- 紅燈亮: 2 sec
- 紅黃燈亮: 2 sec
- 紅黃綠燈亮: 2 sec
- 全部熄滅: 1 sec
- 紅燈亮: 1 sec
- 紅黃燈亮: 1 sec
- 紅黃綠燈亮: 1 sec
- ...

## 練習 4

- 紅燈亮: 5 sec
- 黃燈閃爍: 3 sec, 6 flashes
- 綠燈亮: 5 sec
- 黃燈閃爍: 3 sec, 6 flashes
- 紅燈亮: 5 sec
- ...

## 練習 5

自由創作：可使用更多 LED 燈，做出自己想要的效果。