Tampines Regional Library
LearnX Community
Pi Python Introductory Course
Course Material
By
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PLEASE DO NOT WRITE ANYTHING ON THE PAGES
OF THIS BOOKLET. THANK YOU.

Programme

Python Lesson – Session # 1

LIBRARIES

- machine
- time
- tm1637
- picozero

VARIABLES

LOOPS

- while True:

PYTHON RULE

- Indentation
- Character casing

Python Lesson – Session # 2

FUNCTIONS

CONDITIONAL STATEMENTS

- **if else**

LOOPS

- while True:
- for loop

MESSAGING

- how humans and machine communicate with each other

Python Lesson – Session # 3

DEBUGGING – KNOWING THE TYPES OF ERRORS

TEST

- programming the lights and siren of a patrol car

Python Lesson – Session # 4

CONTINUING PYTHON LEARNING ON YOUR OWN

Free Basic Python Course

INSTALLING THONNY

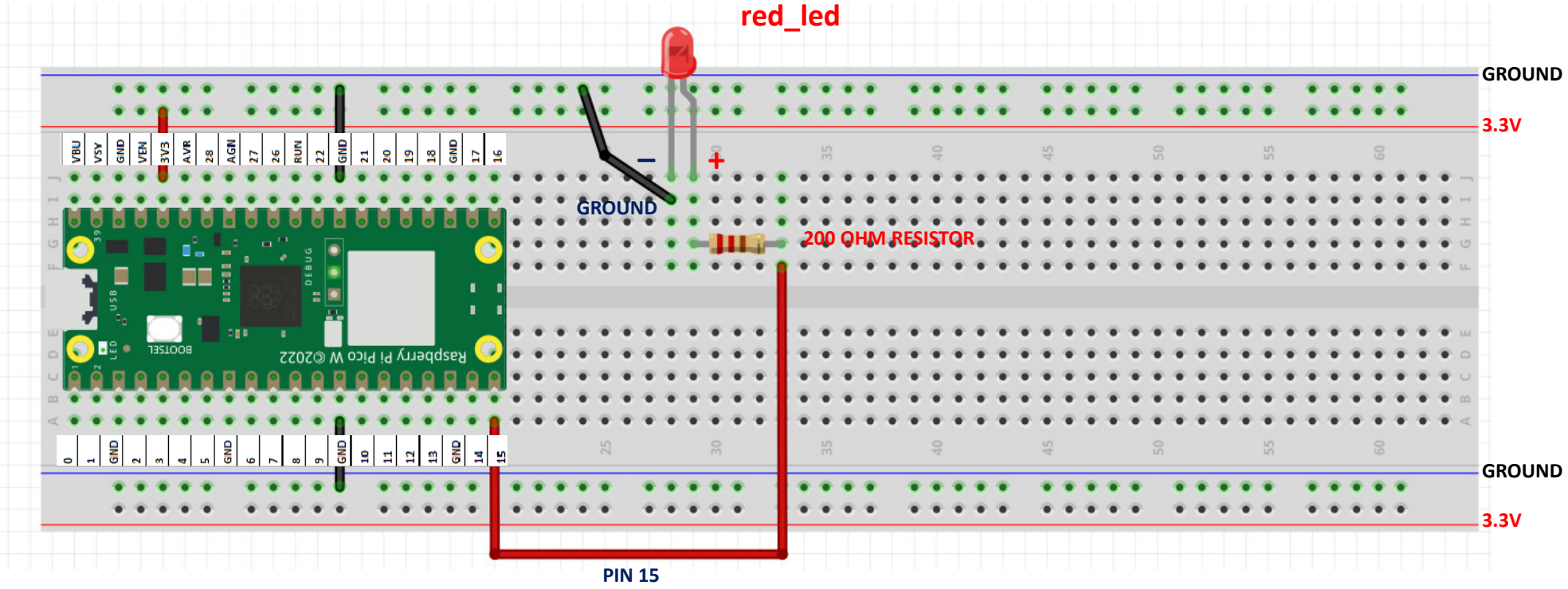
INTRODUCTION TO CHATGPT

USING CHATGPT AS MY PYTHON TUTOR

GENERATING A PYTHON PROGRAM USING CHATGPT

EXERCISE #1 Wiring a Light Emitting Diode (LED)

Please wire up the following circuit



TESTING OUR CIRCUIT USING THONNY SHELL

Ex 1a. Turning our Red LED on

Library

```
>>> from picozero import LED
>>> red_led = LED(15)
```

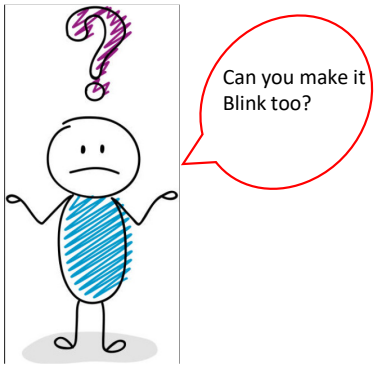
Variable

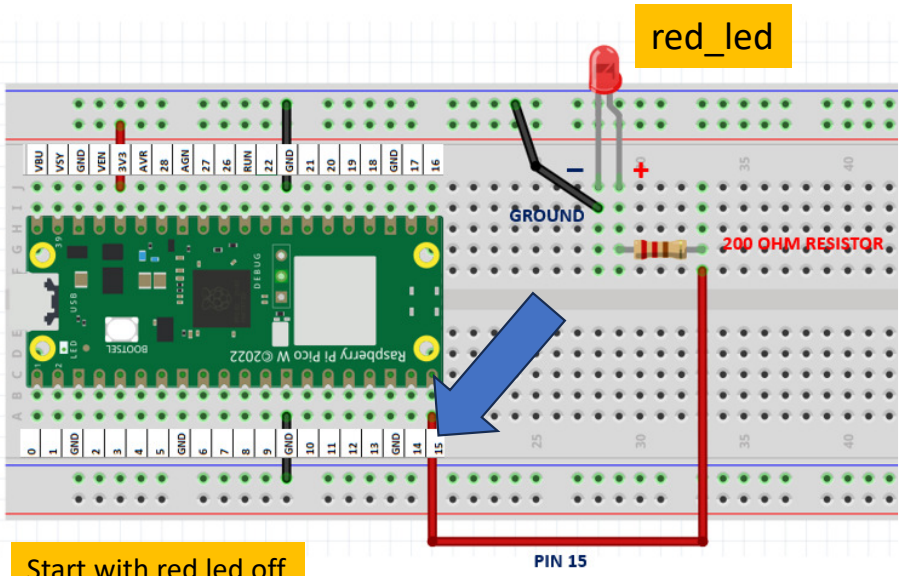
```
>>> red_led.on()
```

Ex 1b. Turning it off

```
>>> red_led.off()
```

Ex 1c. Blinking the red LED





Start with red led off
Wait 1 second
Turn red led on
Wait 1 second
Turn red led off
Wait 1 second
Turn red led on
Wait 1 second
Turn red led off

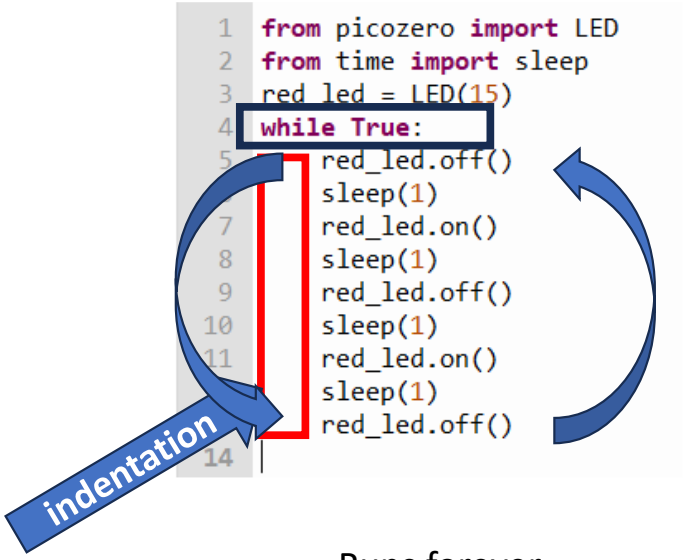
Running a set of codes forever

ex1c.py

```
1  from picozero import LED
2  from time import sleep
3  red_led = LED(15)
4
5  red_led.off()
6  sleep(1)
7  red_led.on()
8  sleep(1)
9  red_led.off()
10 sleep(1)
11 red_led.on()
12 sleep(1)
13 red_led.off()
```

Runs once

Convert

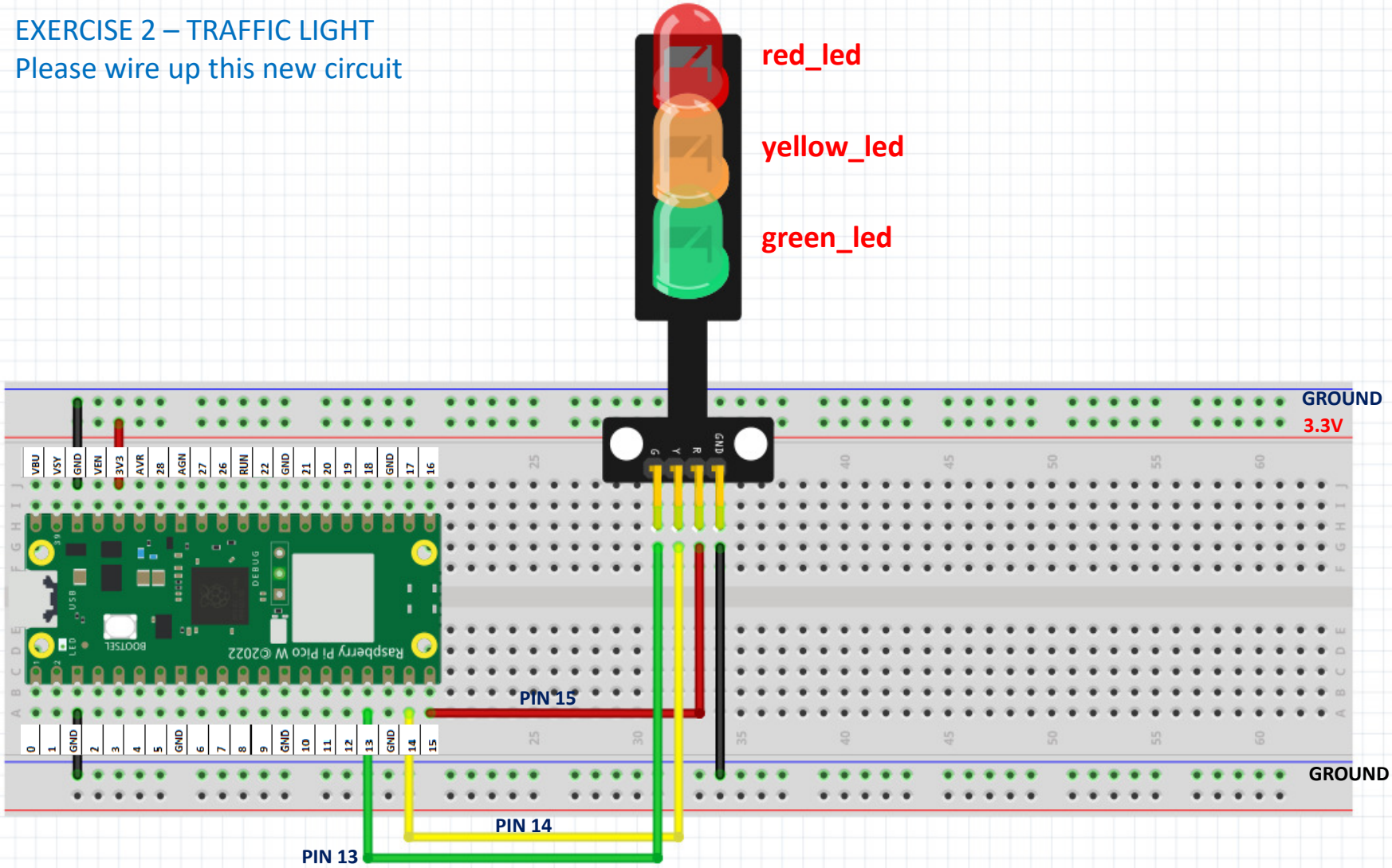


Runs forever

Save it as ex1d.py
Run this program

EXERCISE 2 – TRAFFIC LIGHT

Please wire up this new circuit

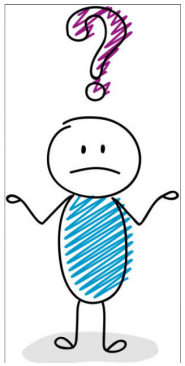


EXERCISE 2 – CONTROLLING MULTIPLE LEDs

Ex 2a. Test the Circuit. Turn each of the LEDs ON and OFF

```
>>> from picozero import LED
>>> red_led= LED(15)
>>> yellow_led = LED(14)
>>> green_led=LED(13)
```

Ex 2b. Turning the circuit into a Traffic Light System



How?

How does a traffic light work?

Green Light On
Give cars 10 seconds to cross
Green Light Off
Yellow Light On
Give 5 seconds warning
Yellow Light Off
Red Light On
Wait 10 seconds
Red Light Off

Algorithm

Code

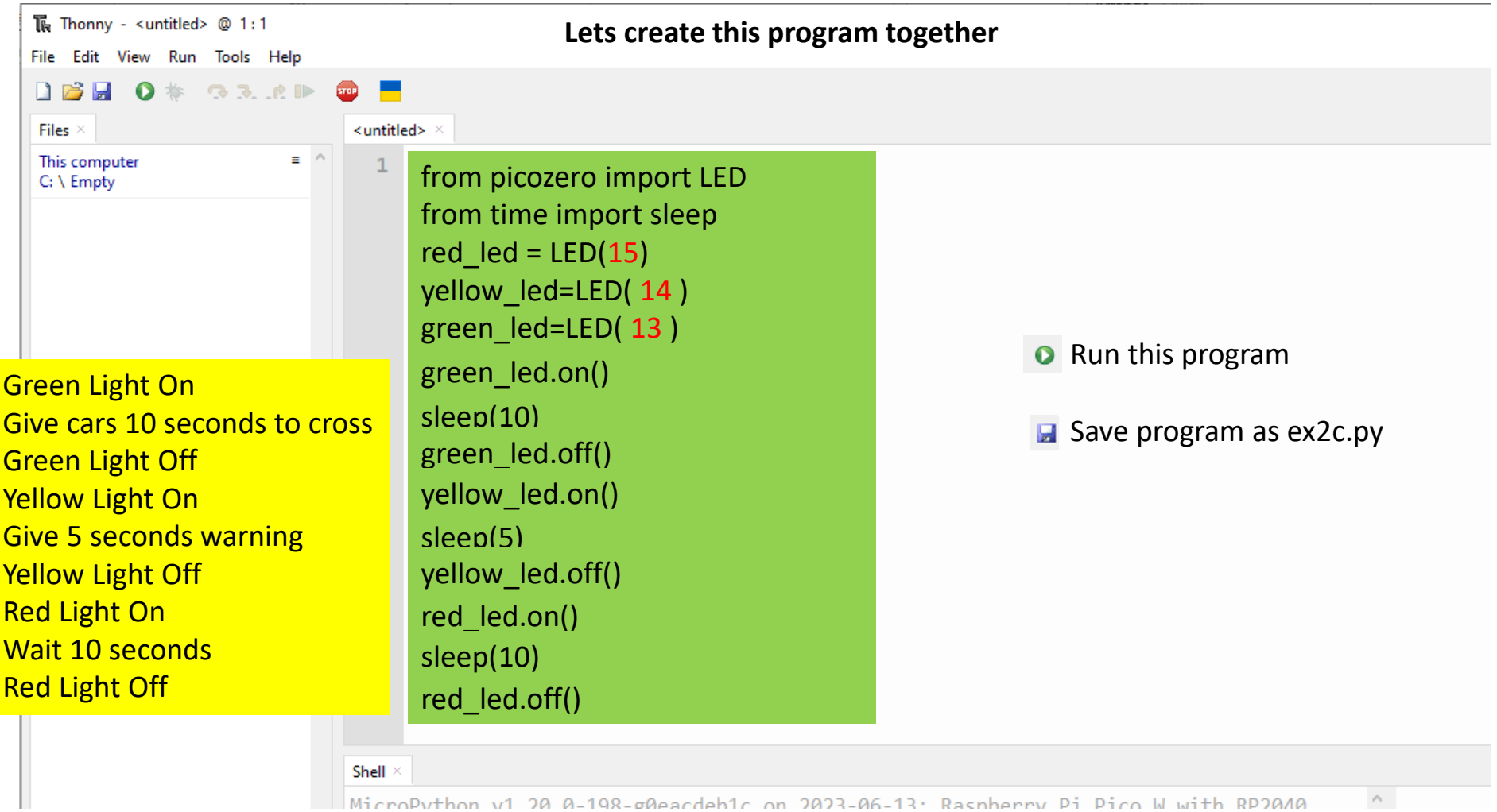
```
1  from picozero import LED
2  from time import sleep
3  red_led = LED(15)
4
5  red_led.off()
6  sleep(1)
7  red_led.on()
8  sleep(1)
9  red_led.off()
10 sleep(1)
   red_led.on()
   sleep(1)
   red_led.off()
```

hint

```
green_led.on()
sleep(10)
green_led.off()
yellow_led.on()
sleep(5)
yellow_led.off()
red_led.on()
sleep(10)
red_led.off()
```

Code this in the editor
Run and save it as ex2b.py

Lets create this program together



Green Light On
Give cars 10 seconds to cross
Green Light Off
Yellow Light On
Give 5 seconds warning
Yellow Light Off
Red Light On
Wait 10 seconds
Red Light Off

Run this program

Save program as ex2c.py

ex2c.py

```
1  from picozero import LED
2  from time import sleep
3  red_led = LED(15)
4  yellow_led=LED(14)
5  green_led=LED(13)
6
7  green_led.on()
8  sleep(10)
9  green_led.off()
10 yellow_led.on()
11 sleep(5)
12 yellow_led.off()
13 red_led.on()
14 sleep(10)
15 red_led.off()
```

Runs once

convert

Runs forever

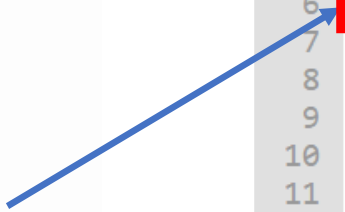
```
1  from picozero import LED
2  from time import sleep
3  red_led = LED(15)
4  yellow_led=LED(14)
5  green_led=LED(13)
6  while True:
7      green_led.on()
8      sleep(10)
9      green_led.off()
10     yellow_led.on()
11     sleep(5)
12     yellow_led.off()
13     red_led.on()
14     sleep(10)
15     red_led.off()
16
```

Run the Program
Save it as ex2d.py

FUNCTION – A SET OF CODES WITH A NAME

ex2d.py

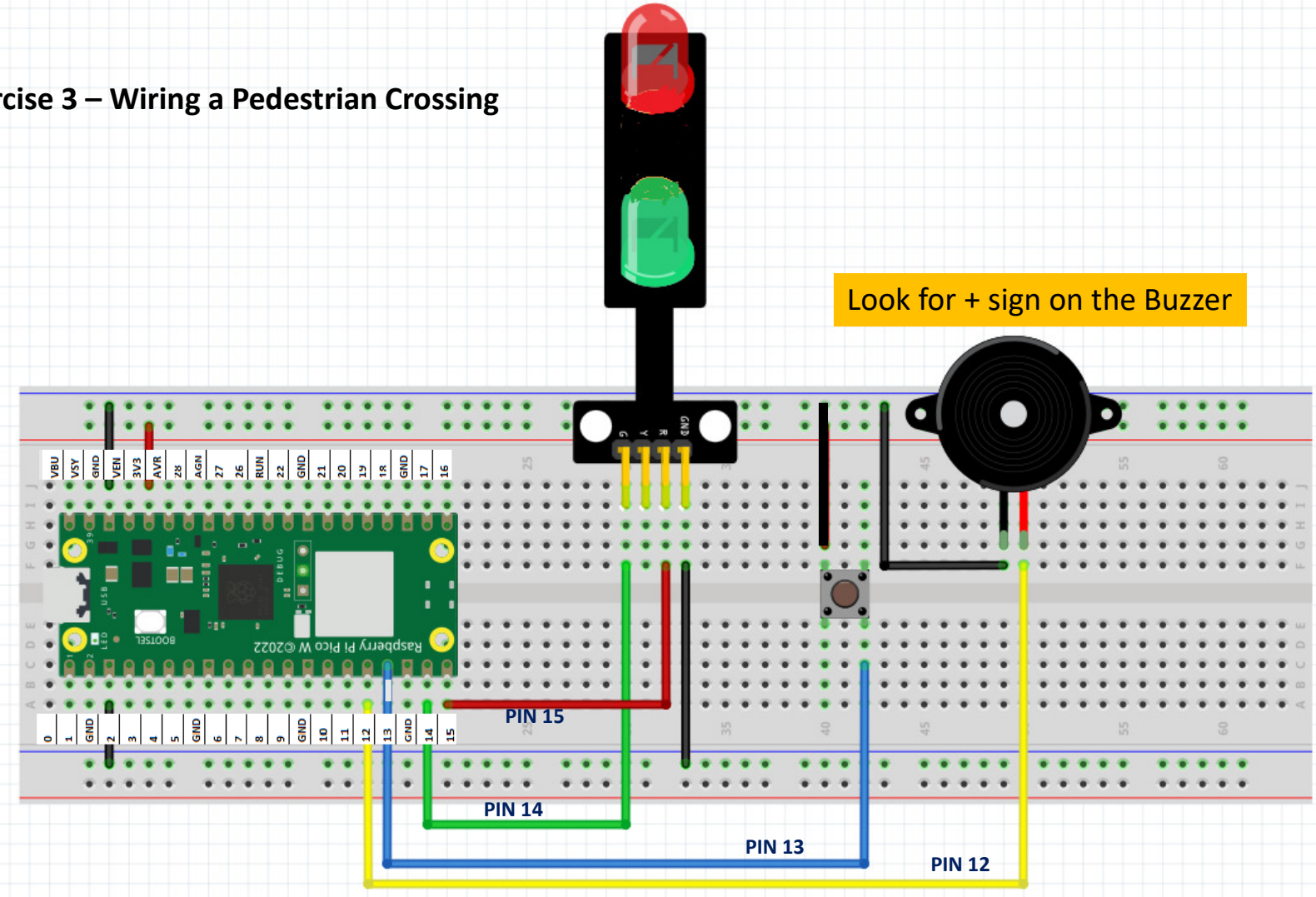
```
1  from picozero import LED
2  from time import sleep
3  red_led = LED(15)
4  yellow_led=LED(14)
5  green_led=LED(13)
6  while True:
7      green_led.on()
8      sleep(10)
9      green_led.off()
10     yellow_led.on()
11     sleep(5)
12     yellow_led.off()
13     red_led.on()
14     sleep(10)
15     red_led.off()
16
```



```
1  from picozero import LED
2  from time import sleep
3  red_led = LED(15)
4  yellow_led=LED(14)
5  green_led=LED(13)
6  def trafficlight():
7      green_led.on()
8      sleep(10)
9      green_led.off()
10     yellow_led.on()
11     sleep(5)
12     yellow_led.off()
13     red_led.on()
14     sleep(10)
15     red_led.off()
16
17 while True:
18     trafficlight()
19
```

Run the Program
Save it as ex2e.py

Exercise 3 – Wiring a Pedestrian Crossing



TESTING OUR CIRCUIT USING THONNY SHELL

Ex 3a. Turning our Buzzer on

```
>>> from picozero import Buzzer
>>> buzzer= Buzzer(12)
>>> buzzer.on()
```

Ex 3b. Turning it off

```
>>> buzzer.off()
```

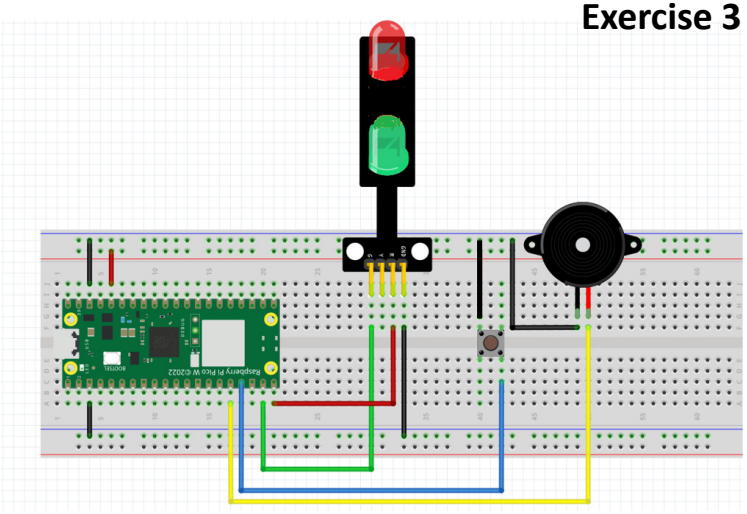
Ex 3b. Setting up multiple sensors : our circuit has Buzzer, Button, LED

```
>>> from picozero import Buzzer, Button, LED
>>> buzzer= Buzzer(12)
>>> button=Button(13)
>>> red_led=LED(15)
>>> button.when_pressed = red_led.on
>>> button.when_released = red_led.off
>>> button.when_pressed = buzzer.on
>>> button.when_released = buzzer.off
```

Let's say we want the LED
To light up when we press the button
And off when we release the button

Let's say we want the BUZZER
To buzz when we press the button
And off when we release the button

Exercise 3 – Turning the circuit into a pedestrian crossing with code



HOW DOES A PEDESTRAIN CROSSING WORK?

RED LED IS ON / GREEN LED IS OFF
WAIT FOR 10 SECONDS
RED LED GOES OFF
GREEN LED GOES ON
GIVE 10 SECONDS FOR PEOPLE TO CROSS
GREEN LED GOES OFF
RED LED TURNS ON

convert

TO CODE

```
from picozero import  LED, Buzzer, Button
from time import sleep
red_led = LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
red_led.on()
green_led.off()
sleep(10)
red_led.off()
green_led.on()
sleep(10)
green_led.off()
red_led.on()
```

RUN and
Save this program as ex3c.py

Exercise 3 – Turning the circuit into a pedestrian crossing with code

```
from picozero import  LED, Buzzer, Button
from time import sleep
red_led = LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
red_led.on()
green_led.off()
sleep(10)
red_led.off()
green_led.on()
sleep(10)
green_led.off()
red_led.on()
```

RUN ONCE

convert

```
while True:
    red_led.on()
    green_led.off()
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    green_led.off()
    red_led.on()
```

RUN FOREVER

RUN AND SAVE PROGRAM AS ex3d.py

ex3d.py

```
from picozero import LED, Buzzer, Button
from time import sleep
red_led = LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)

red_led.on()
green_led.off()

while True:
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    green_led.off()
    red_led.on()
```

How to convert this into a functon

Give a name for your function. Let's call it greenman()

```
from picozero import LED, Buzzer, Button
from time import sleep
red_led = LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
red_led.on()
green_led.off()
def greenman():
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    green_led.off()
    red_led.on()
while True:
    greenman()
```

Run program
Save it as ex3e.py

ex3e.py

```
from picozero import LED, Buzzer, Button
from time import sleep
red_led = LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
red_led.on()
green_led.off()
def greenman():
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    green_led.off()
    red_led.on()
while True:
    greenman()
```

BEFORE THE GREEN LIGHT GOES OFF, WE WANT TO ALERT THE PEDESTRIAN BY FLASHING THE GREEN LED AND BUZZER

How?
WHERE in the program
to add this function?

```
def countdown():
    for x in range(1,11,1):
        green_led.on()
        buzzer.on()
        sleep(0.5)
        green_led.off()
        buzzer.off()
        sleep(0.5)
```

10 X

ex3e.py

```
from picozero import LED, Buzzer, Button
from time import sleep
red_led=LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
red_led.on()
green_led.off()



def greenman():
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    countdown()
    green_led.off()
    red_led.on()


while True:
    greenman()
```

```
def countdown():
    for x in range(1,11,1):
        green_led.on()
        buzzer.on()
        sleep(0.5)
        green_led.off()
        buzzer.off()
        sleep(0.5)
```

Run program
Save it as ex3f.py

ex3f.py

```
[ ex3f.py ]
1  from picozero import Buzzer, Button, LED
2  from time import sleep
3
4  red_led=LED(15)
5  green_led=LED(14)
6  button=Button(13)
7  buzzer= Buzzer(12)
8
9  red_led.on()
10 green_led.off()
11
12 def countdown():
13     for x in range(1,11,1):
14         green_led.on()
15         buzzer.on()
16         sleep(.5)
17         green_led.off()
18         buzzer.off()
19         sleep(.5)
20
21 def greenman():
22     sleep(10)
23     red_led.off()
24     green_led.on()
25     sleep(10)
26     countdown()
27     green_led.off()
28     red_led.on()
25
26 button.when_pressed = greenman
32
```

This program works fine.
But in the real world, it's not practical.
Why?

If no one wants to cross, the program will still continue to work

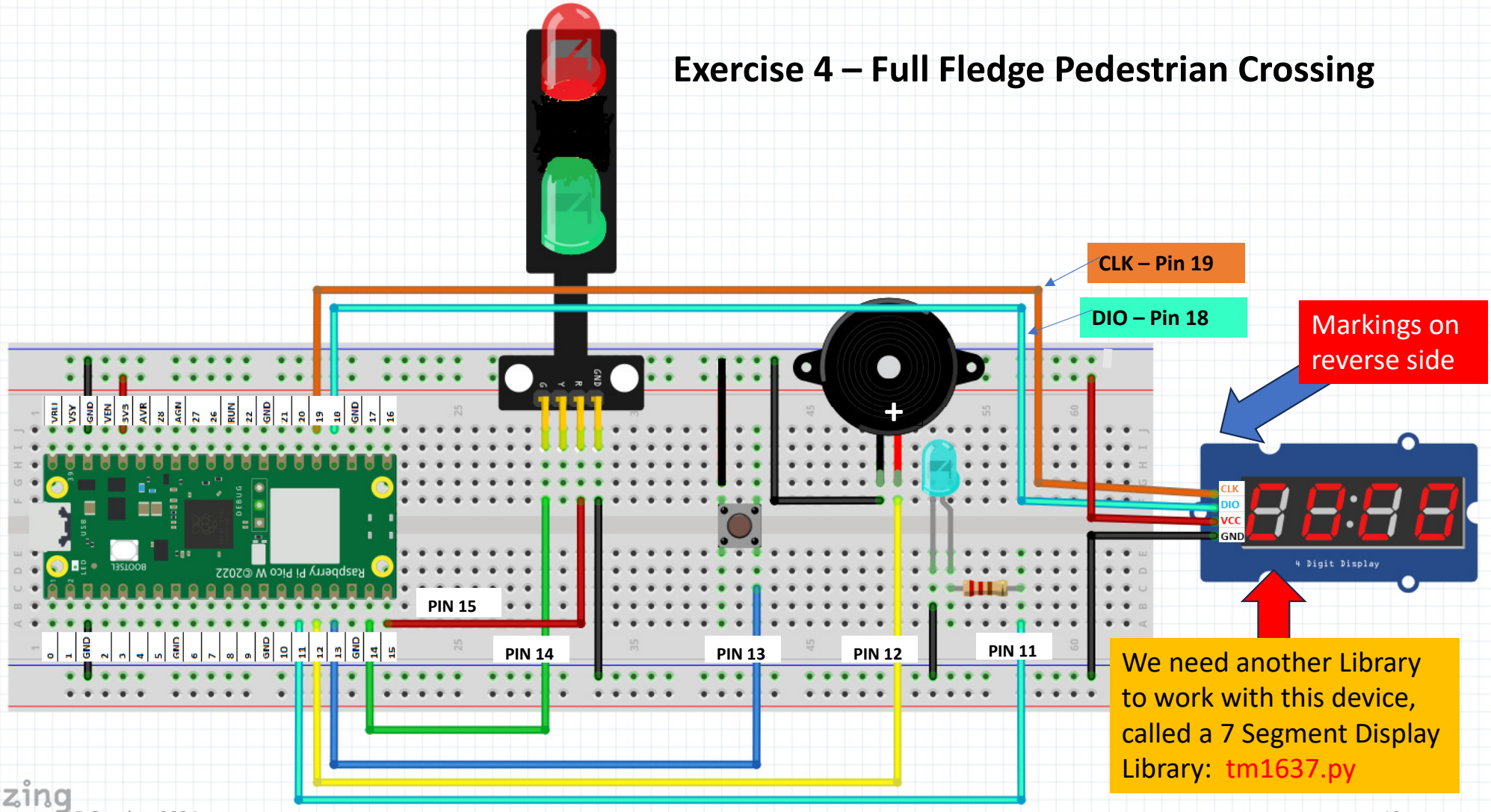
We want this program to run only
when someone presses the button. How can we make use of the button

```
26 while True:
27     greenman()
```

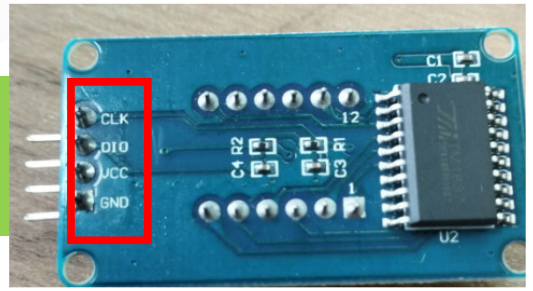
```
25
26 button.when_pressed = greenman
```

Make this change
Run program
Save it as ex3g.py

Exercise 4 – Full Fledge Pedestrian Crossing



EXERCISE 4a – THE 7 SEGMENT DISPLAY




```
>>> from machine import Pin
>>> import tm1637
>>> tm = tm1637.TM1637(clk=Pin(19), dio=Pin(18))
```

```
>>> tm.show("help")
```

```
>>> tm.number(1234)
```

```
>>> tm.temperature(24)
```

```
>>> tm.show(" " * 4)
```

In python " " * 4 means 4 SPACES
This will clear the display.
Make sure there is a SPACE in between the quotation marks

Exercise 4a. Display the following
PICO
95
70 Degrees Celcius
Clear the display

COUNT DOWN DISPLAY

```
from machine import Pin
from time import sleep
import tm1637
tm = tm1637.TM1637(clk=Pin(19), dio=Pin(18))

for x in range(10,-1,-1):
    tm.number(x)
    sleep(1)
```

Run program
Save as ex4b.py

Try Counting from 0 to 10.
Refer to ex3f.py if you are not sure how to count upwards

Modify ex3g.py to add Count down to countdown()

Besides the green man flashing and the buzzer beeping
the counter will show how much time left for crossing
countdown()

```
from picozero import LED, Buzzer, Button
from machine import Pin
import tm1637
from time import sleep
red_led=LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
tm = tm1637.TM1637(clk=Pin(19), dio=Pin(18))
red_led.on()
green_led.off()
def countdown():
    for x in range(10,-1,-1):
        tm.number(x)
        green_led.on()
        buzzer.on()
        sleep(0.5)
        green_led.off()
        buzzer.off()
        sleep(0.5)
def greenman():
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    countdown()
    green_led.off()
    red_led.on()

button.when_pressed =    greenman
```

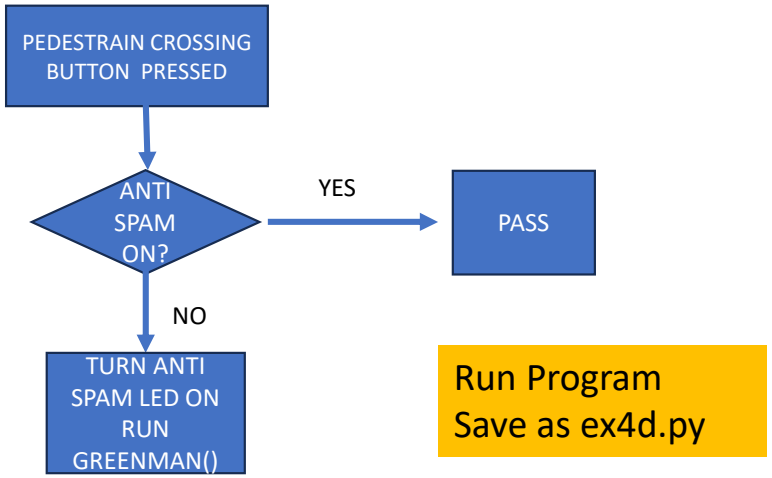
Run this amended program
Save as ex4c.py

MODIFY ex4c.py to add antispam control

```
from picozero import LED, Buzzer, Button
from machine import Pin
import tm1637
from time import sleep
red_led=LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
tm=tm1637.TM1637(clk=Pin(19),dio=Pin(18))
antispam_led=LED(11)
antispam_led.off()
red_led.on()
green_led.off()
def countdown():
    for x in range(10,-1,-1):
        tm.number(x)
        green_led.on()
        buzzer.on()
        sleep(0.5)
        green_led.off()
        buzzer.off()
        sleep(0.5)
def check():
    if antispam_led.on():
        pass
    else:
        antispam_led.on()
        greenman()
```

```
def greenman():
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)
    countdown()
    green_led.off()
    red_led.on()
    antispam_led.off()

button.when_pressed = check
```



Run Program
Save as ex4d.py

Patrol Car Ex – Putting knowledge gained to use

Use your blue , red LED and a Buzzer to make a noisy flashing lights on a patrol car

Choose any pin you wish

Wire up the circuit and write the python code to make it work

HINT

Material

1 x Red LED

1 x Blue LED

1 x Buzzer

Python Code

machine and time library

while True:

Red LED on and off

Blue LED on and off

Sleep in between on and off

Use this example

```
from picozero import LED, Buzzer, Button
from time import sleep
red_led=LED(15)
green_led=LED(14)
buzzer=Buzzer(12)
button=Button(13)
red_led.on()
green_led.off()

def greenman():
    sleep(10)
    red_led.off()
    green_led.on()
    sleep(10)

    green_led.off()
    red_led.on()

while True:
    greenman()
```

Save your program
As **patrolcar.py**
And RUN

Python Lesson – Session # 4

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