EN 1: Engineering in the Kitchen

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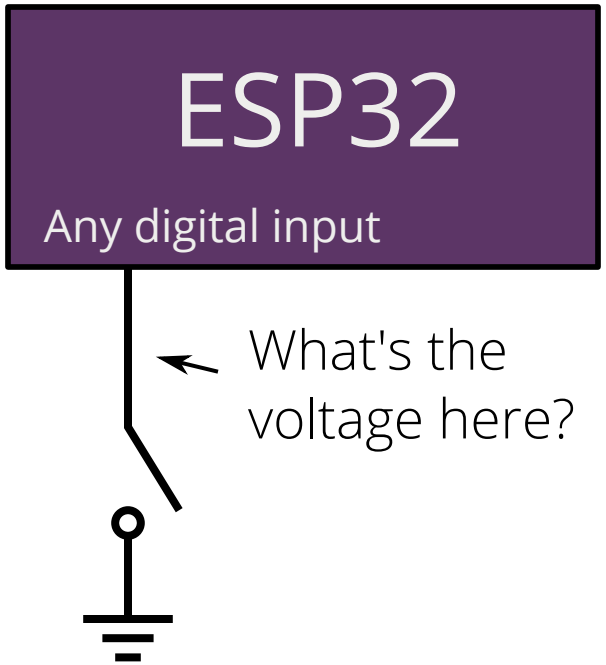
Tufts UNIVERSITY

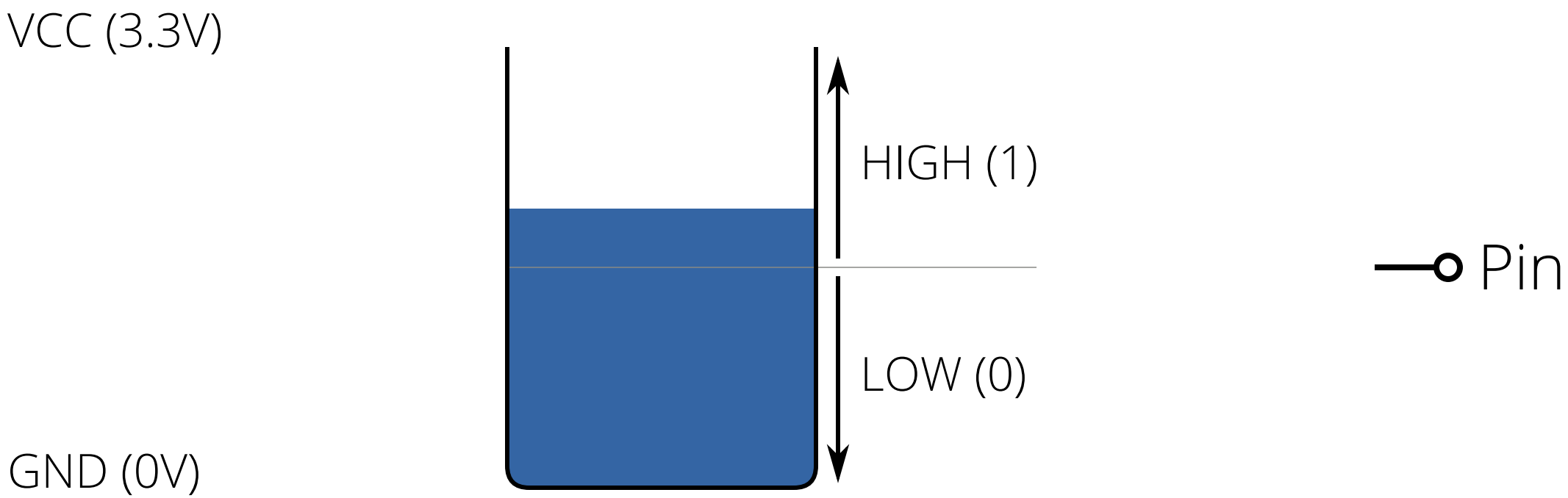
Wire up a switch



(Ground - "GND" pin in ESP32)

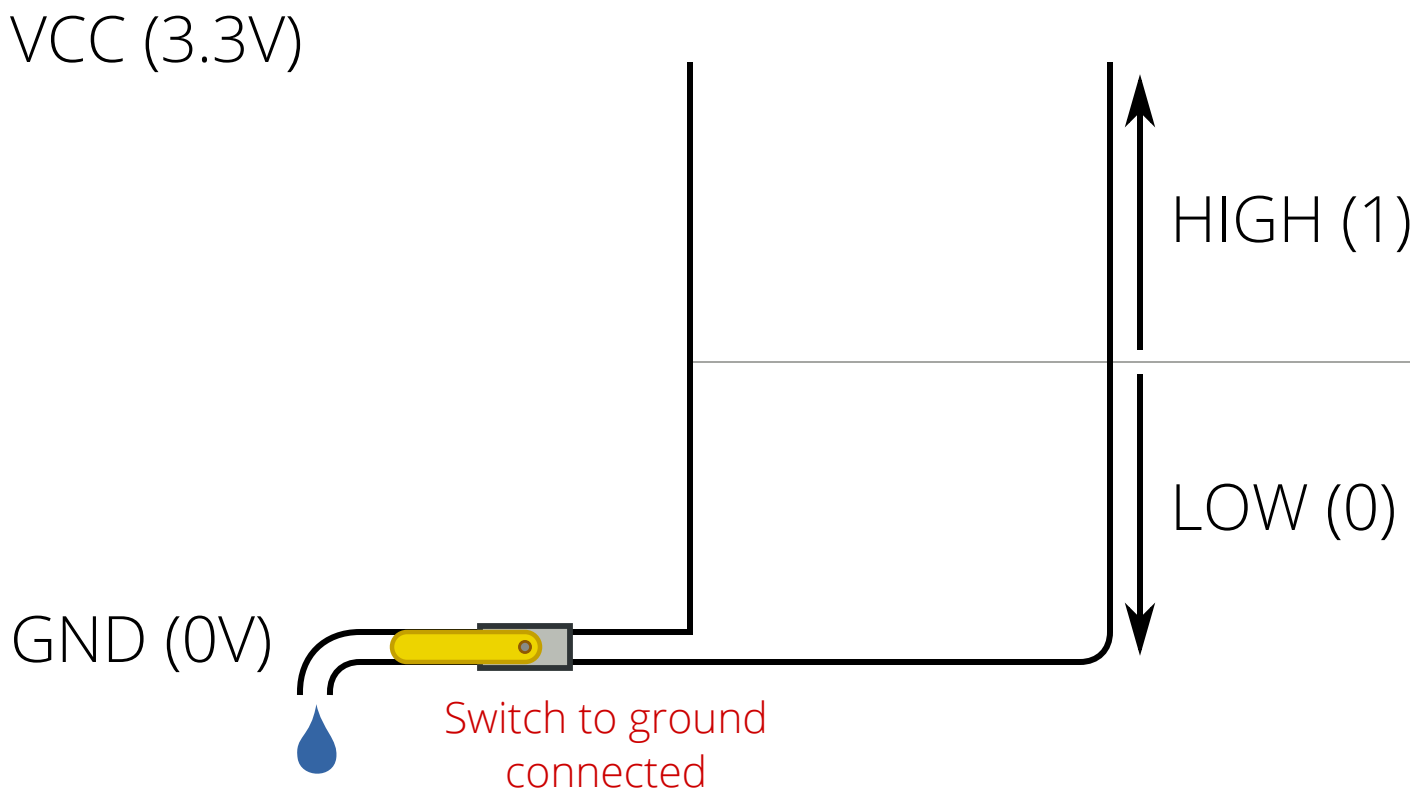
An analogy for an input pin

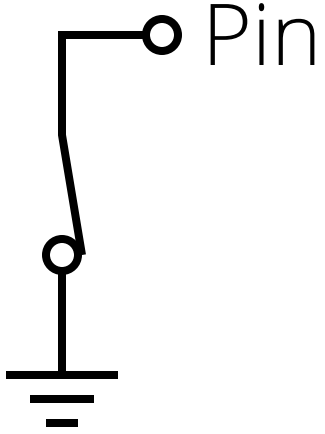
An input pin just reads whether the voltage (level) is above a threshold.



An analogy for an input pin

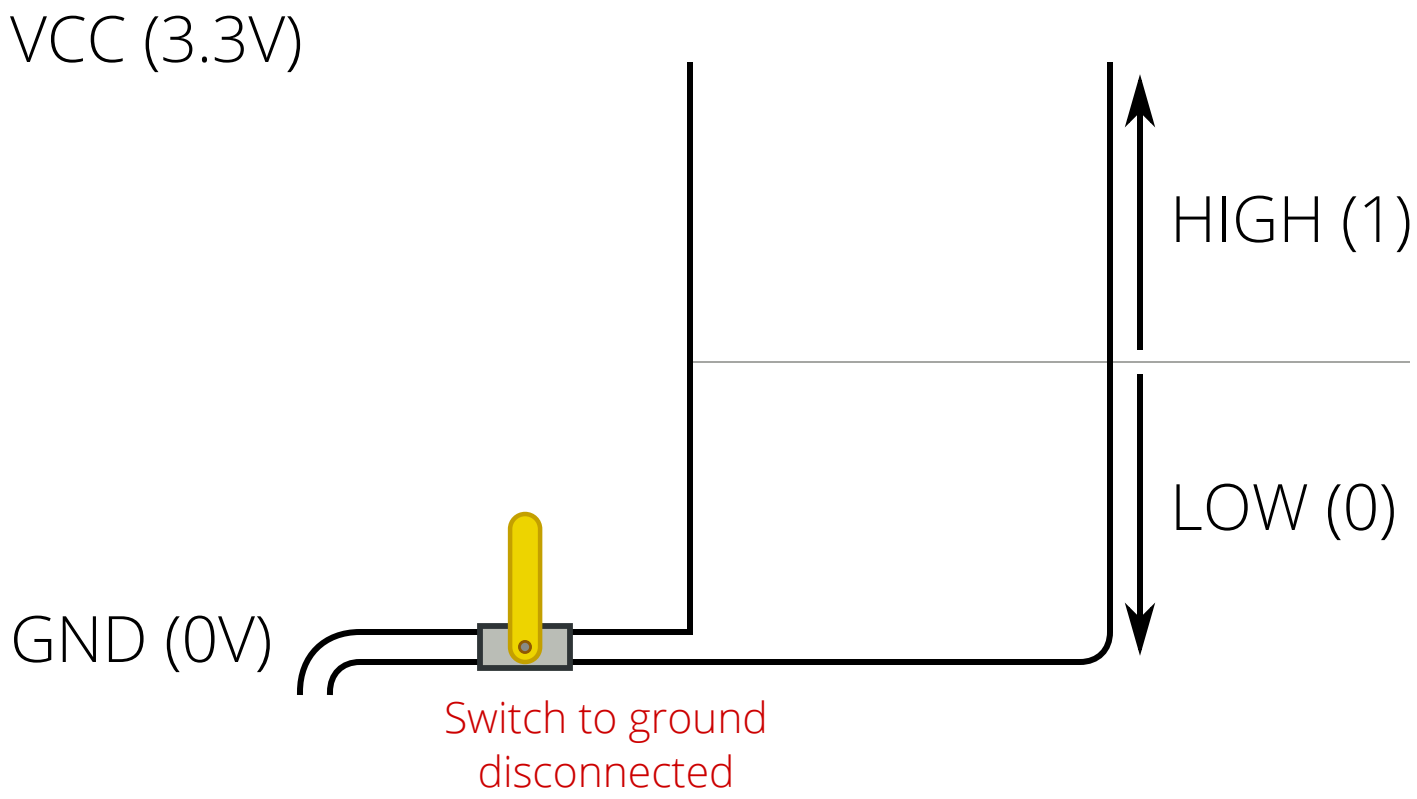
By reading the level, we can tell if the switch is making a connection to ground

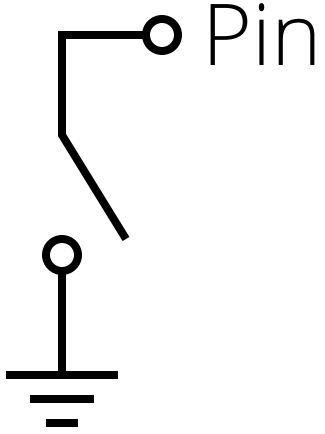




An analogy for an input pin

Except that when the switch is disconnected, we have no control over the level! We're at the mercy of the environment.





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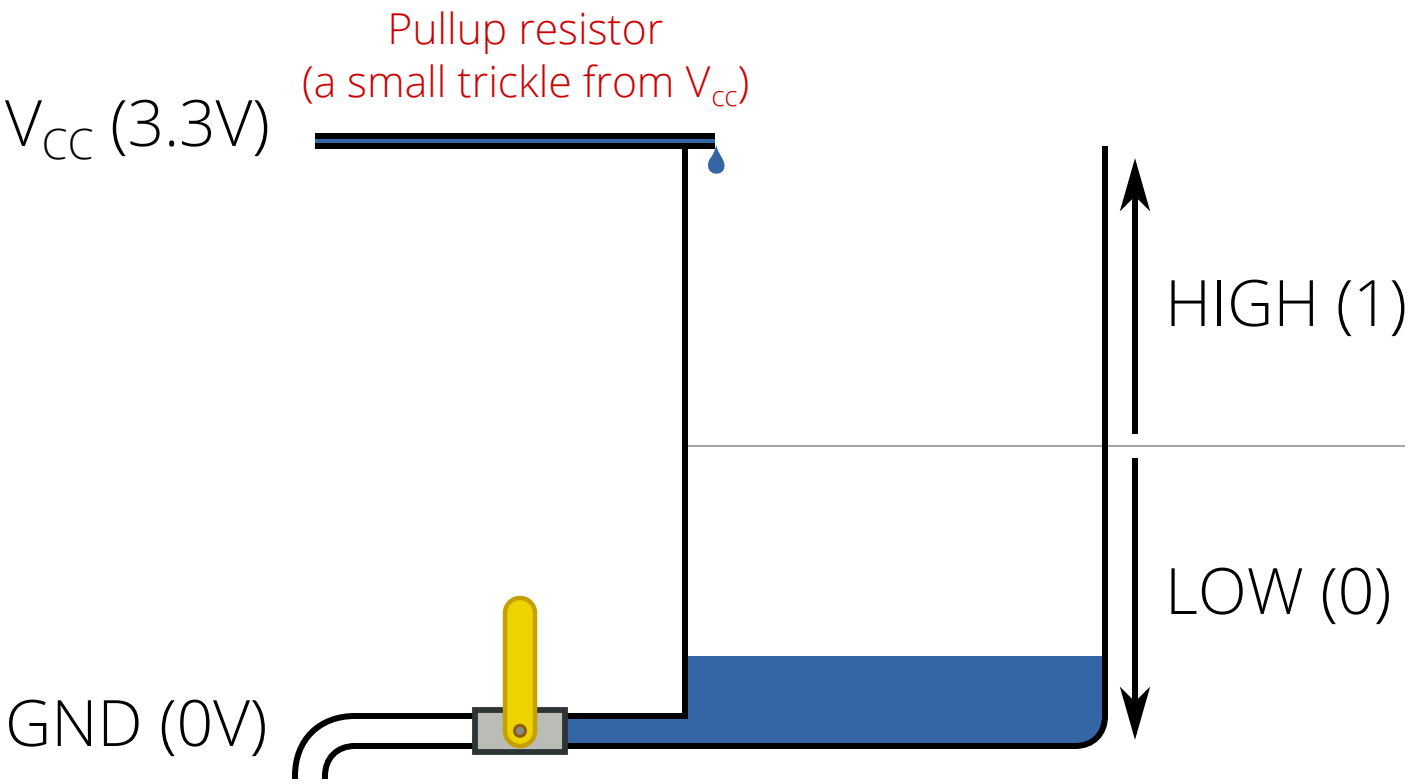
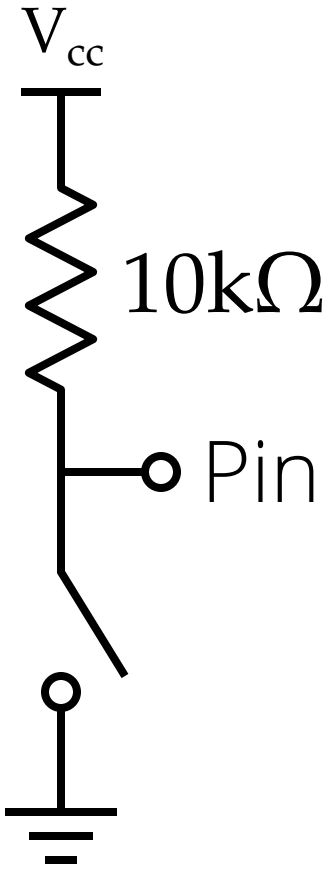
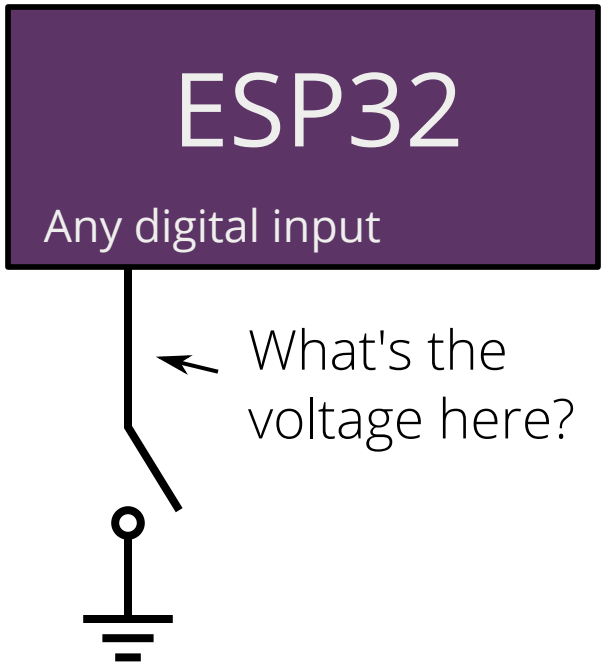


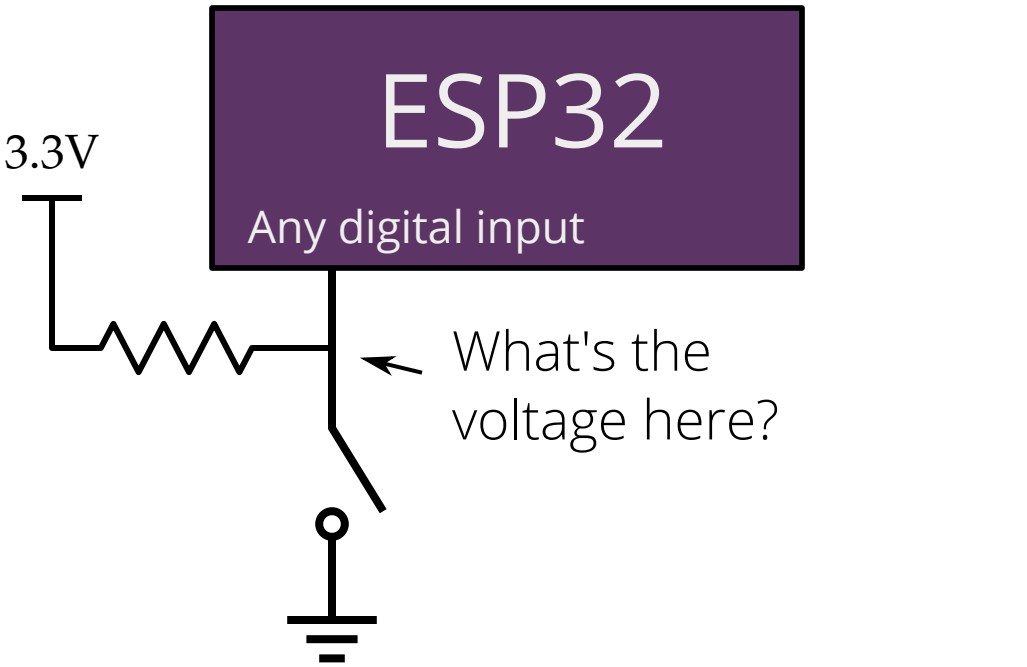


Wire up a switch



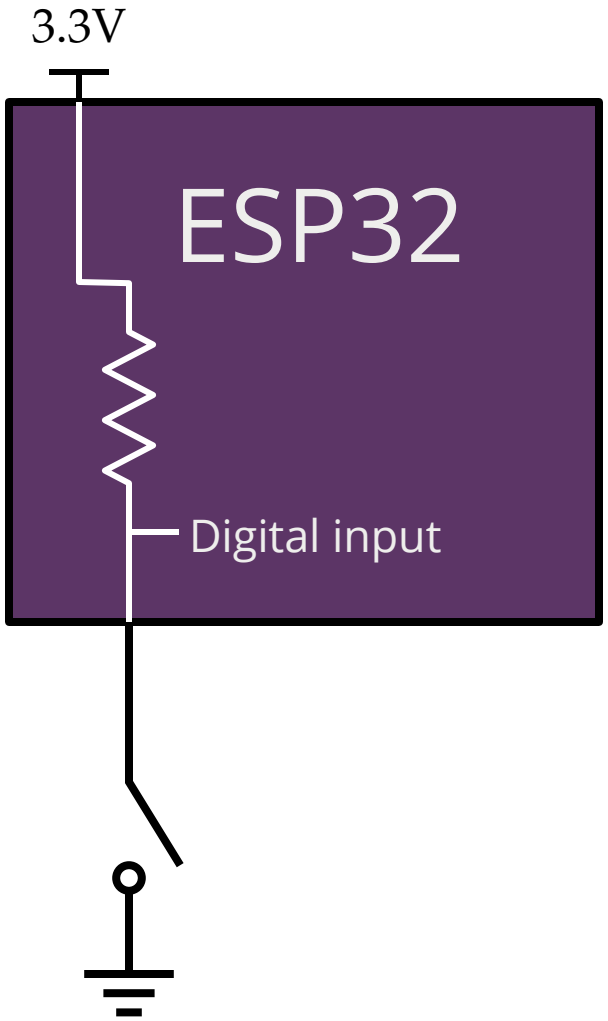
(Ground - "GND" pin in ESP32)

Wire up a switch



(Ground - "GND" pin in ESP32)

Internal pullups



(Ground - "GND" pin in ESP32)

Reading a switch

```
from machine import Pin # import necessary library
                        , make it an input
switch = Pin(12, Pin.IN, Pin.PULL_UP)
               ' pin to use       ' enable the pullup
print(switch.value())
```

Challenge: What happens if you leave out the `Pin.PULL_UP` part?

Challenge: Figure out how you can read the state of the switch if it is connected to 3.3V instead of GND.

A "normal" program:

Executes in sequence,
top to bottom.

Do thing 1.
If X, then
    Do thing 2.
Repeat 10 times:
    Do thing 3.
Do thing 4.

(all done!)

An embedded program:

Runs forever in a loop!

Repeat forever:
    Check some inputs
    if X, then
        Do thing 1
    Do thing 2
    if repetitions < 10:
        Do thing 4

(go back to top!)

An event loop in Python

```
from time import sleep
# Stuff that should happen once
from machine import Pin
switch = Pin(12, Pin.INPUT, Pin.PULL_UP)

while True:
    # Stuff that should happen repeatedly
    print(switch.value())
    sleep(1)
```

Constants in Python

We often have "special numbers" in our code

It helps to give them descriptive names instead of reusing the number everywhere.

```
PRESSED = 1

DELAY_TIME = 3000 # milliseconds

HELLO_MESSAGE = "Hello, microPython!"
```

`if` statements

```
if CONDITION:
  # Stuff to do if CONDITION is true
  # This is specified using indentation
else:
  # Stuff to do if CONDITION is false

# Stuff that is outside of the if-statement (un-indented)
```

CONDITION can be lots of things:

```
a == 3 # Check if a is equal to 3
x > y  # Check if x is greater than y
button.value() == 1
```

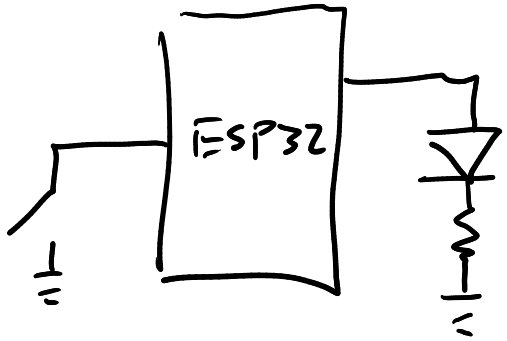
`if/elif` statements

"elif" is a contraction of "else if"

```
if FIRST_CONDITION:
  # Stuff to do if FIRST_CONDITION is true
elif SECOND_CONDITION:
  # Stuff to do if SECOND_CONDITION is true
else:
  # Stuff to do if neither condition is true
```

Write a program that turns on an LED when a switch is pressed.

(The ESP32 should read the switch and control the LED, don't just put the switch in series with the LED)



Challenge: Make the LED blink while the switch is pressed.

How do we *toggle* the LED when the switch is pressed?

```
last time = not pushed

while true:
    now = switch.value()
    if last time not pushed and now pushed:
        do stuff

    last time = now
```

How do we *toggle* the LED when the switch is pressed?

```
set LED state off
set switch state not pushed
while True:
    read the current state of the switch
    if the switch is pressed (and wasn't pressed last time):
        toggle the state of the LED
        set the LED to the new state
    save the current state as the last state
```

Challenge: Make the LED turn on for 2 seconds when the switch is pressed. It should go off after 2 seconds, even if the button is held down.

Challenge: The above, but you can't sleep() for more than 0.1 second.

OLED display

```
from s2pico_oled import OLED
from machine import Pin, I2C

i2c = I2C(0, sda=Pin(8), scl=Pin(9))
oled = OLED(i2c, Pin(18))
oled.test()
```

Draw some text at (0, 0):

```
oled.text("Yay MicroPython!", 0, 0, 1)
oled.show()
```

Course website has link for more functions!