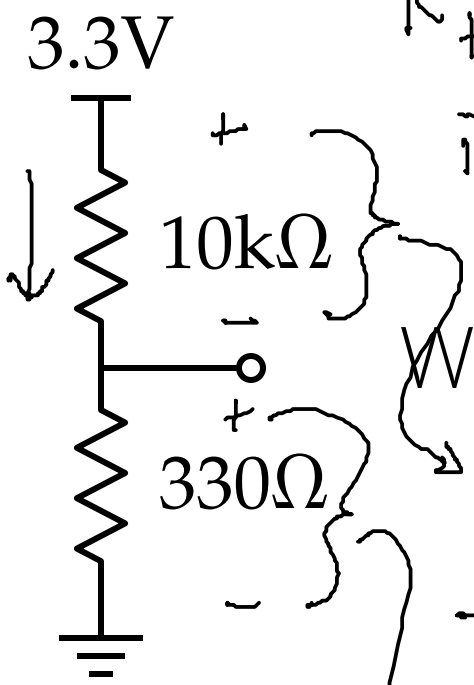
Warmup



$R_{total} = 10k\Omega + 330\Omega$

$i = \frac{3.3V}{R_{total}} = 0.319\ mA$

What is the voltage here?

$10k\Omega \cdot 0.319\ mA = 3.19V$

$3.3V - 3.19V = 0.11V$

$330\Omega \cdot 0.319\ mA = 0.11V$

EN 1-24: Engineering in the Kitchen

Steven Bell
12 October 2021

Tufts UNIVERSITY

ES 2 exemption exam

Contact Ethan Danahy with questions

https://sites.tufts.edu/soefirstyear/es2/es2spring2022/exemption-exam/

Roadmap

Basic circuits (ES 3 / EE 20)

Python, using a microcontroller (ES 2, EE 14)

We are here!

Measuring stuff with sensors (ME 30/31)

Making outputs do stuff (ME 30/31)

Controlling outputs precisely (EE 105, ME 80)

Networking, IoT and security (COMP 112, COMP 116, and more)

Measuring voltages

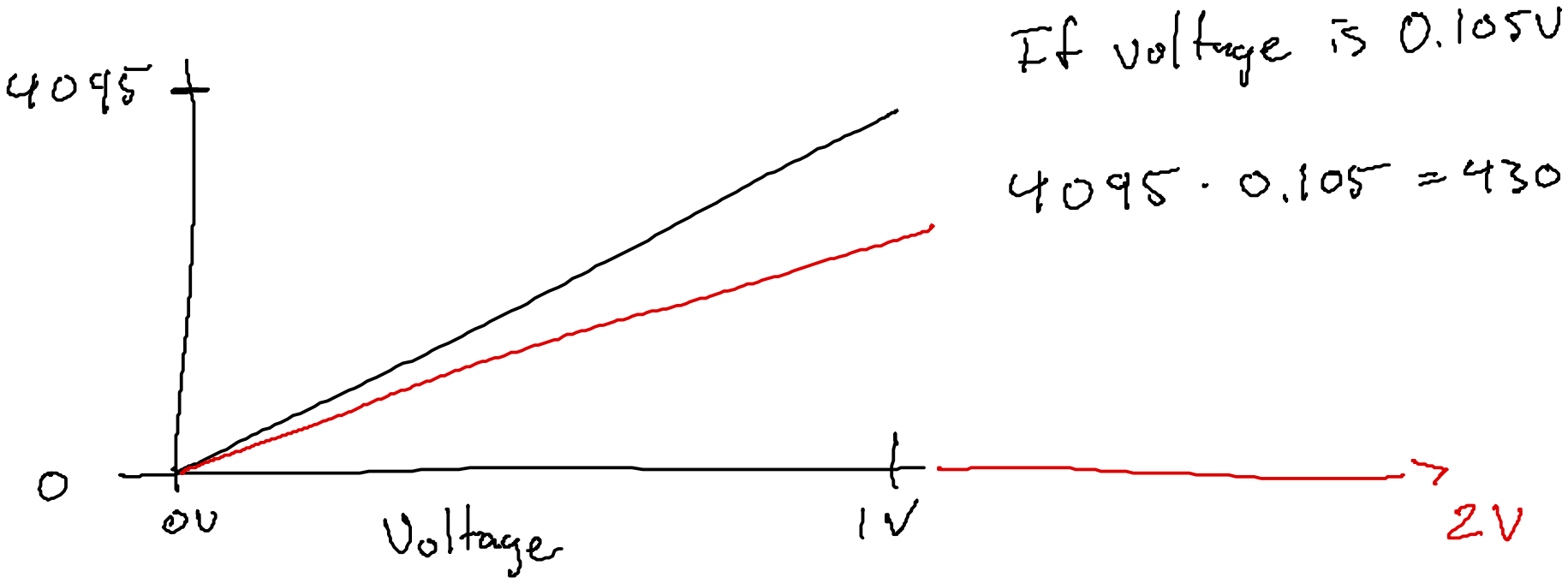
The ESP32 can read analog voltages on pins 32-39

```
from machine import ADC, Pin

adc = ADC(Pin(35))

print(adc.read())
```

Ok, but what does that number mean?

ADC has a voltage range of 1.0V (by default)

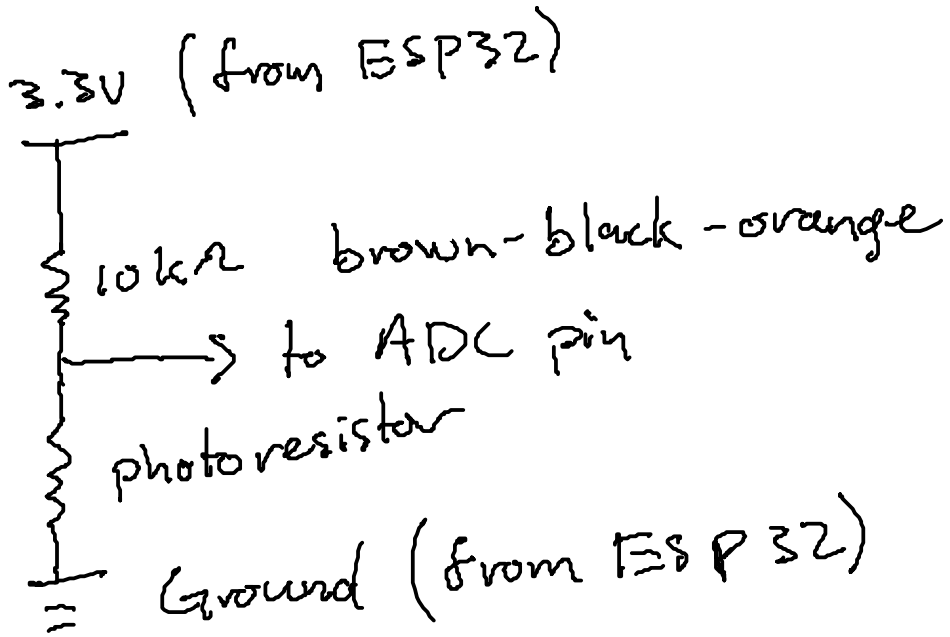
Readings are 12 bits (0-4095)



Changing the scales

```
adc.atten(ADC.ATTN_2_5DB) # ~ 1.34V
adc.atten(ADC.ATTN_6DB) # ~2.00V
adc.atten(ADC.ATTN_11DB) # ~3.6V (careful!)
```

Using this to measure stuff



What is a microwaveable food item I should bring?

Respond at PollEv.com/stevenbell

For next time

Bring your microwave control panel to class!

Put your instruction sheet in OneDrive