CEC Continuing Education Center

DesignNews

DC Motor Controls with the RP2040 Pico

DAY 3: RP2040 Pico and MicroPython Basics Part 2: Thonny Python

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Webinar Logistics

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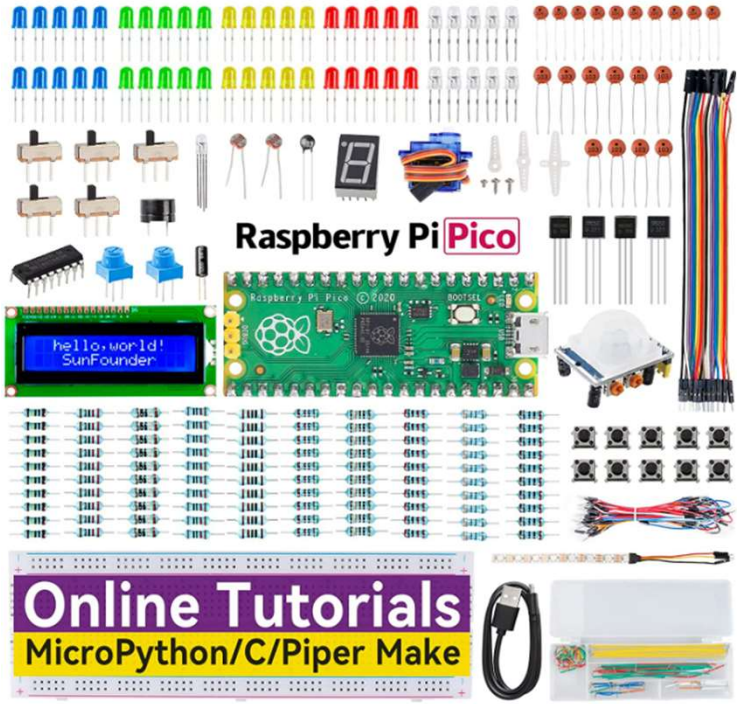
- Participate in ‘Attendee Chat’ by maximizing the chat widget in your dock.

Dr. Don Wilcher

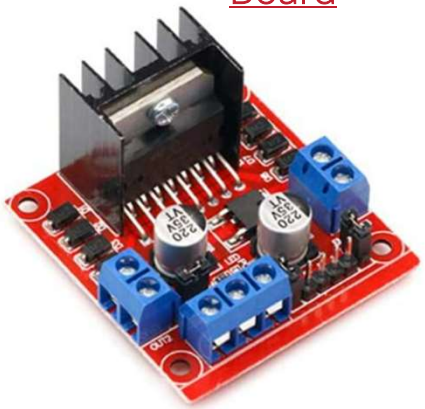
Visit ‘Lecturer Profile’ in your console for more details.

Course Kit and Materials

SunFounder Raspberry Pi Pico Starter Kit



L298N Motor Drive Controller Board



1 Channel Relay Module

ULN2003 4-Phase Stepper Motor with 5V Drive Board

1-5V – 6VDC Motor

Agenda:

- Thonny Python
- Accessing and Installing Thonny
- MicroPython Controls Lab Activities
- Lab: Servo Motor Controller

Raspberry Pi RP2040 :

"Raspberry Pi RP2040 SoC, a surprisingly powerful yet radically low-cost microcontroller packing dual Arm Cortex-M0+ processors, the most energy-efficient Arm processor available" (Adams, 2021).

Thonny Python

Thonny Python:

- was built from Python 3.7
  a) developed to make complex tasks simple
  b) influenced by Julia (Julia: is fast, dynamic, easy to use, and is an open-source programming language)
- Is one simple installation
- user interface removed all features(no distractions to use it)

Thonny Python. . .

Thonny Python:

- Easily view variables with the *View Variable* feature
- Simple Debugger allows single-step into programs without the use of breakpoints
- Highlights syntax

Question 1

Thonny was influenced by _____

a) Guido van Rossum
b) Python 3.7
c) Julia
d) none of the above

Thonny Python. . .

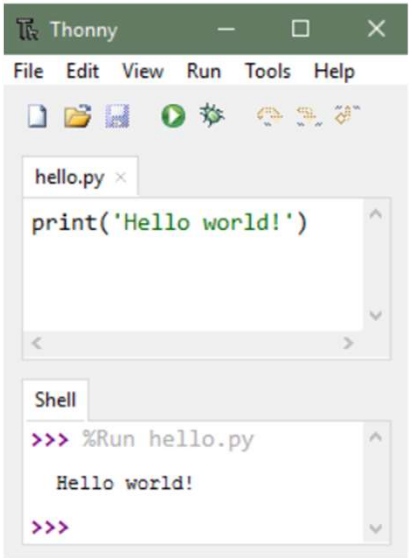
Highlights syntax errors

```
first_name = "Albus"
last_name = "Dumbledore

result = math.pi * (34 + 12
```

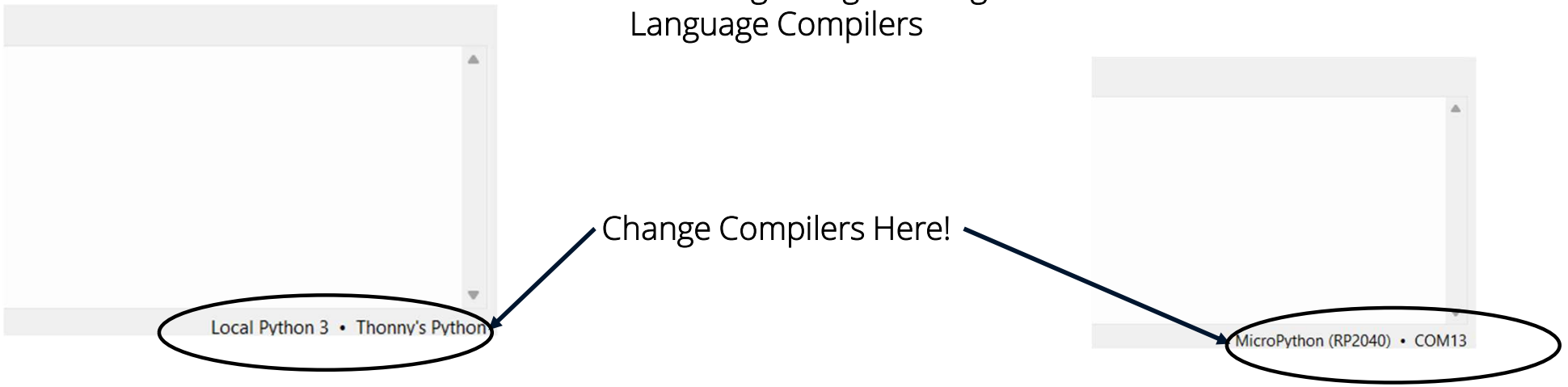
Missing Quotation and parentheses

Easy To Use



Thonny Python. . .

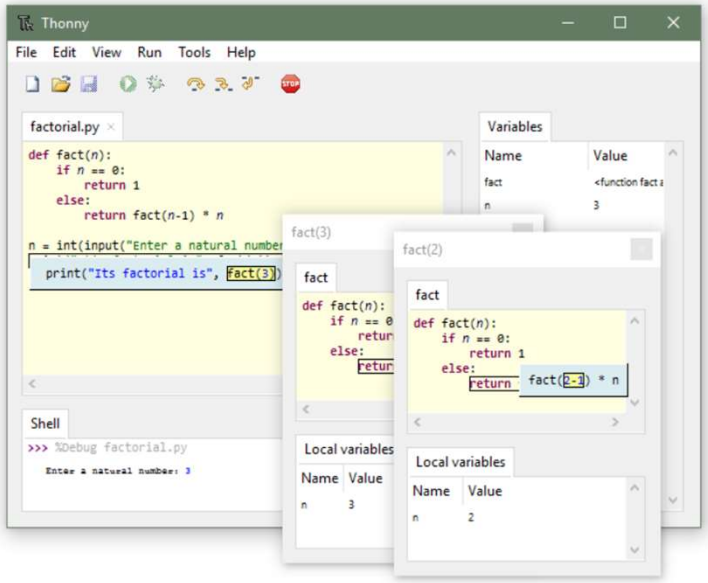
How to Change Programming Language Compilers



Accessing and Installing Thonny

Thonny
Python IDE for beginners

Download version 4.0.0 for Windows • Mac • Linux



https://thonny.org/

Accessing and Installing Thonny . . .

Instructions & downloads

- Installation instructions
  - for Windows
  - for Mac
  - for Linux
  - `pip install thonny`
- FAQ
- Wiki

Latest stable releases are linked in the download box at the top of this page.
Older releases and prereleases can be found at
https://github.com/thonny/thonny/releases

https://thonny.org/

Accessing and Installing Thonny . . .

Thonny IDE

Accessing and Installing Thonny . . .

MicroPython Code

loop_code.py

```
1 print("Loop starting!")
2 for i in range(10):
3     print("Loop number",i)
4 print("Loop finished!")
```

Output

Shell

```
Loop starting!
Loop number 0
Loop number 1
Loop number 2
Loop number 3
Loop number 4
Loop number 5
Loop number 6
Loop number 7
Loop number 8
Loop number 9
Loo finished!

>>>
```

Question 2

In reviewing slide 15, the for-loop initialization is identified by

a) range
b) 10
c) i
d) none of the above

MicroPython Control Lab Activities

MicroPython Code

```
1  value = input ("Enter Value")
2  if value == "20":
3      print(value)
4  else:
5      print("Incorrect Value")
6
```

Output

```
Shell
>>> %Run -c $EDITOR_CONTENT

 Enter Value20
 20

>>>
```

MicroPython Control Lab Activities . . .

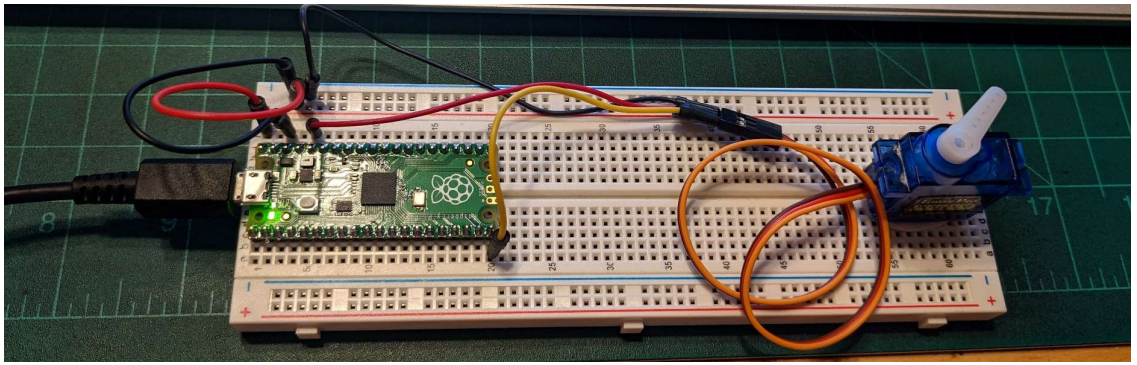
MicroPython Code

```
1  import machine
2
3  led = machine.Pin(25,machine.Pin.OUT)
4
5  bit = input ("Enter Control Bit")
6  if bit == "1":
7      print(bit)
8      led(1)
9      print("LED is ON")
10
11 else:
12     print(bit)
13     led(0)
14     print("LED is OFF")
```

Output

```
Shell
>>> %Run -c $EDITOR_CONTENT
  Enter Control Bit1
  1
  LED is ON

>>>
```



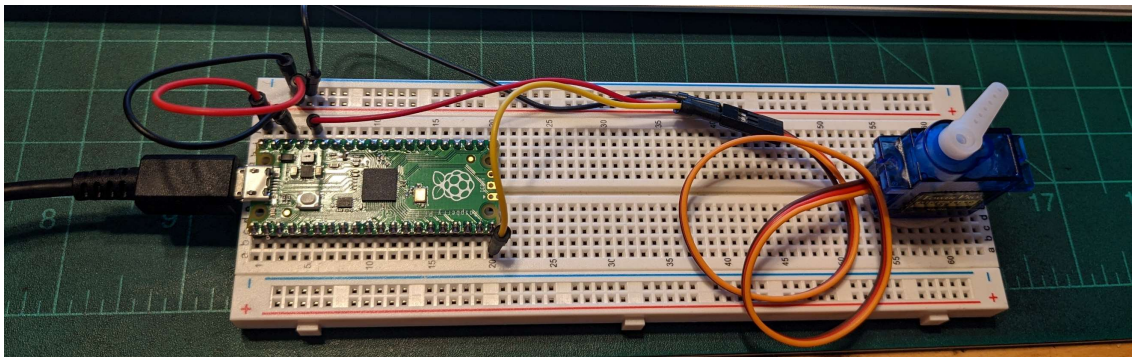
MicroPython Control Lab Activities . . .

MicroPython Code

```
1  import machine
2
3  led = machine.Pin(25,machine.Pin.OUT)
4
5  bit = input ("Enter Control Bit")
6  if bit == "1":
7      print(bit)
8      led(1)
9      print("LED is ON")
10
11 else:
12     print(bit)
13     led(0)
14     print("LED is OFF")
```

Output

```
Shell
>>> %Run -c $EDITOR_CONTENT
  Enter Control Bit0
  0
  LED is OFF
>>>
```

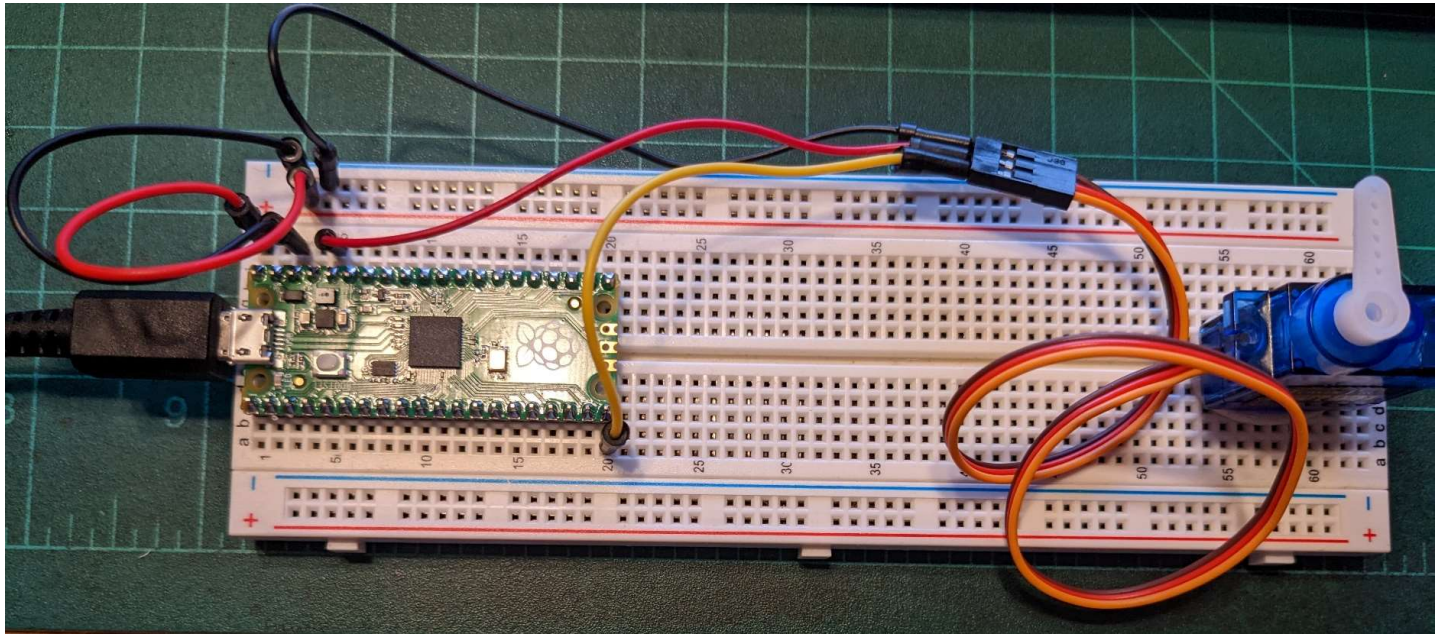


Question 3

In reviewing slide 19, identify the GPIO pin.

a) led
b) bit
c) 25
d) led(1)

Lab: Servo Motor Controller



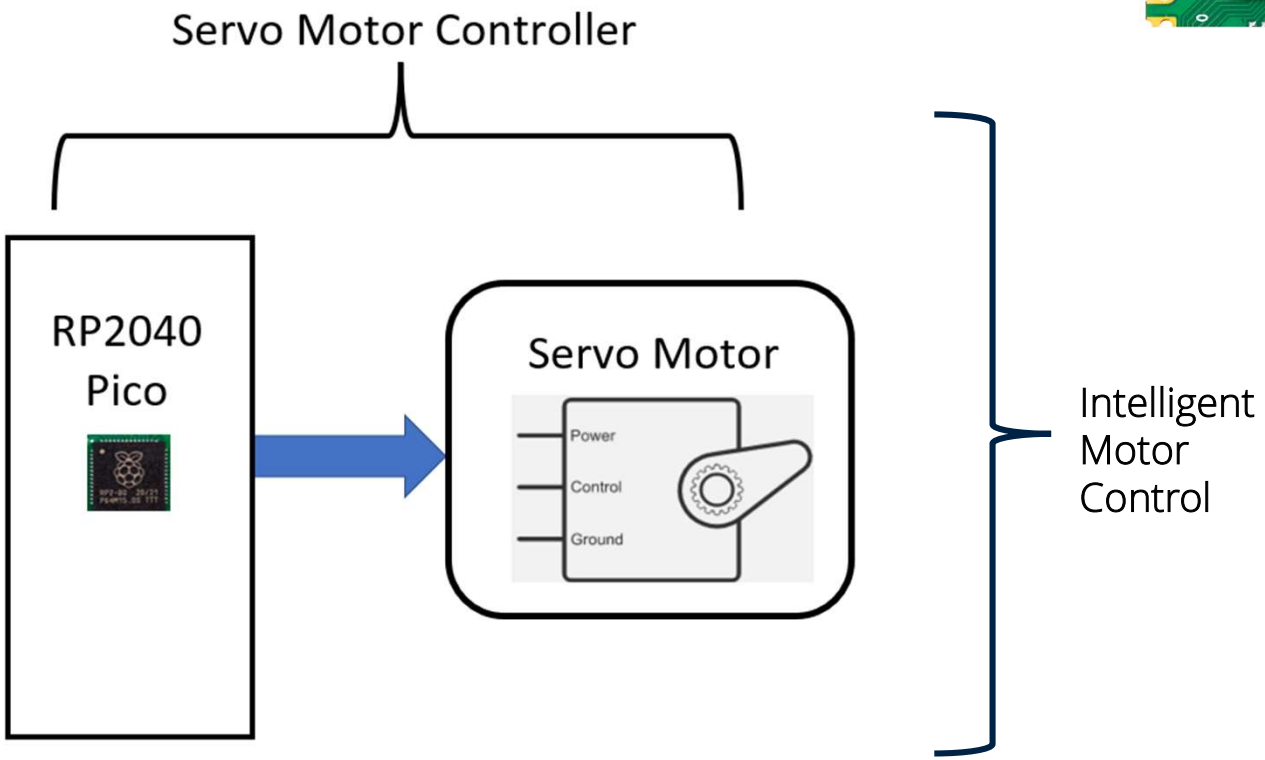
Lab: Servo Motor Controller. . .

Big IDEAS (Learning Objectives):

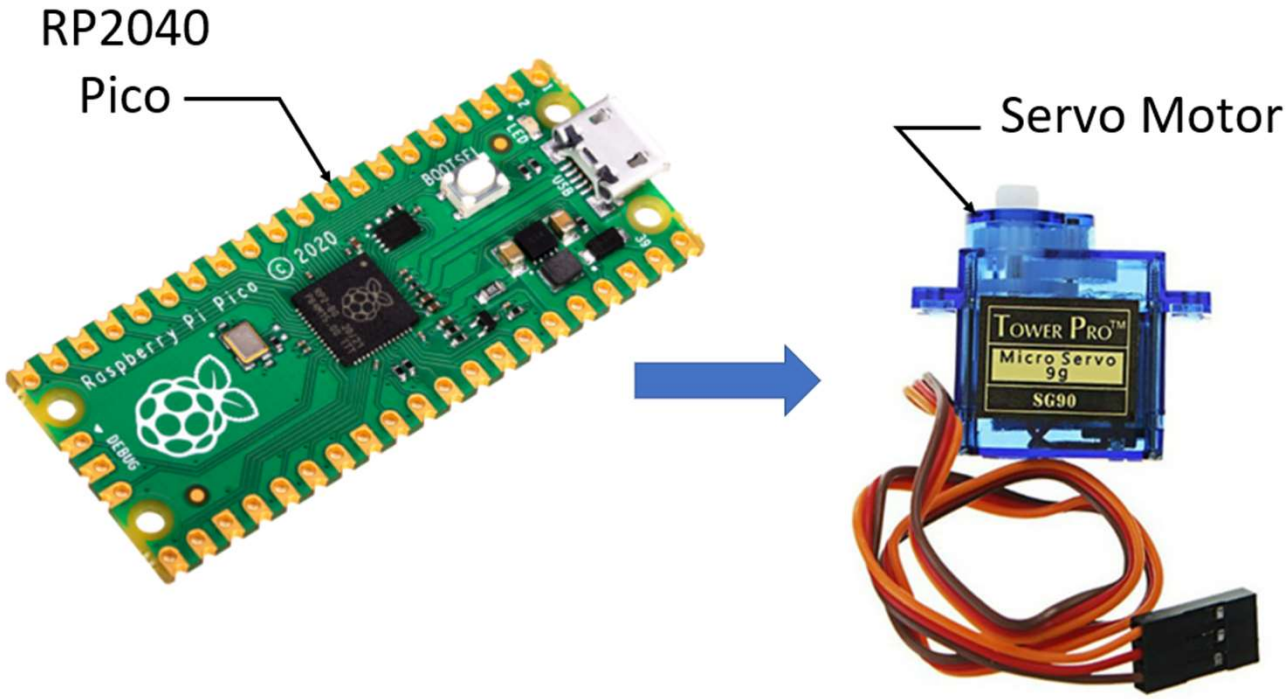
1. The participant will be able to wire a servo motor to an RP2040 microcontroller.
2. The participant will be able to create a servo motor controller code using MicroPython.
3. The participant will be able to test a servo motor controller using MicroPython.

Lab: Servo Motor Controller. . .

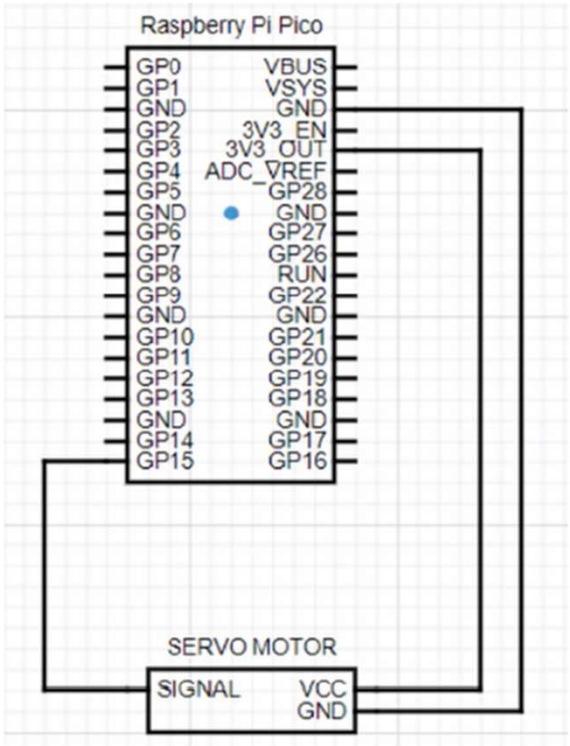
The RP2040 microcontroller easily controls a Servo motor by providing the appropriate timed control pulse signals, power, and ground voltage rails!



Lab: Servo Motor Controller. . .



Lab: Servo Motor Controller. . .



Servo Motor Controller Circuit Schematic Diagram

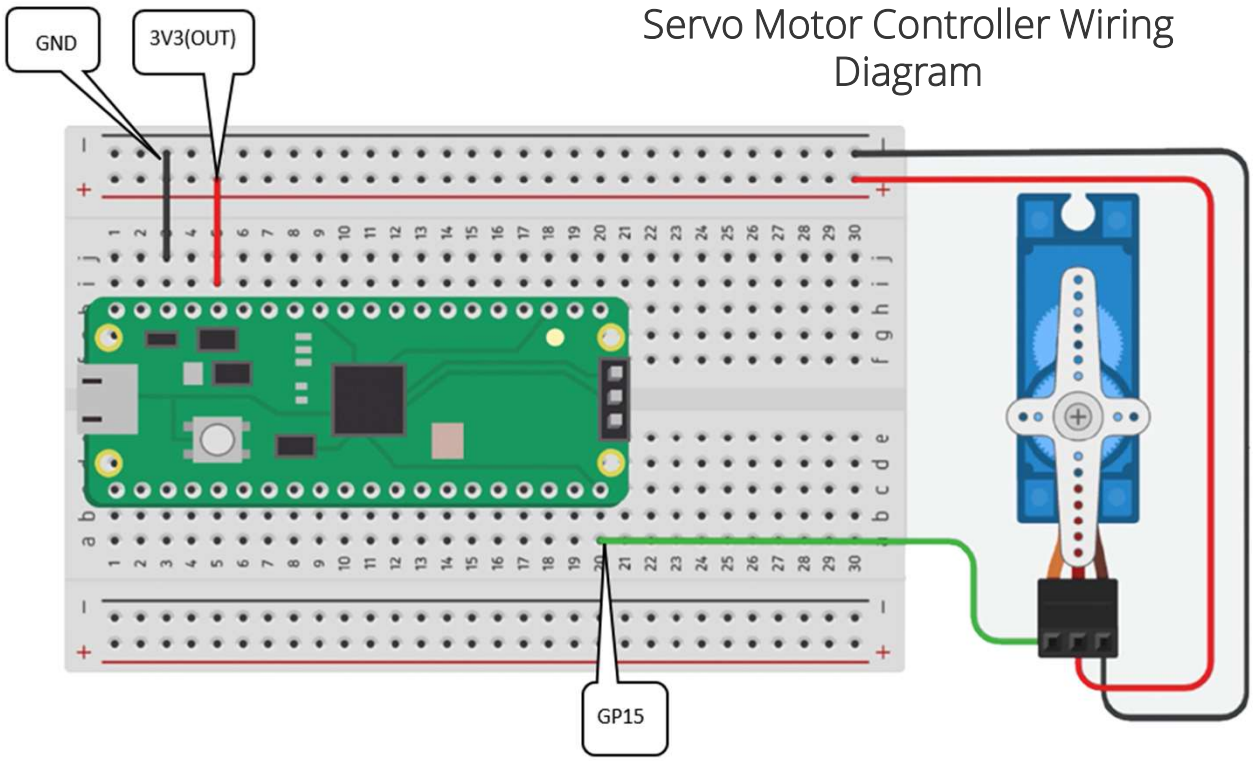
Question 4

Which GPIO pin on slide 25 provides the control signal for the servo motor?

a) GND
b) GP0
c) GP14
d) GP15

Lab: Servo Motor Controller. . .

Servo Motor Controller Wiring Diagram



Lab: Servo Motor Controller. . .

To run the MicroPython Code, click the Run button

File Edit View Run Tools Help

servo_motor.py

```
1  from machine import Pin, PWM
2  import utime
3
4  MID = 1500000
5  MIN = 1000000
6  MAX = 2000000
7
8  led = Pin(25,Pin.OUT)
9  pwm = PWM(Pin(15))
10
11 pwm.freq(50)
12 pwm.duty_ns(MID)
13
14 while True:
15     led.value(1)
16     pwm.duty_ns(MIN)
17     utime.sleep(1)
18     pwm.duty_ns(MID)
19     utime.sleep(1)
20     pwm.duty_ns(MAX)
21     led.value(0)
22     utime.sleep(1)
```

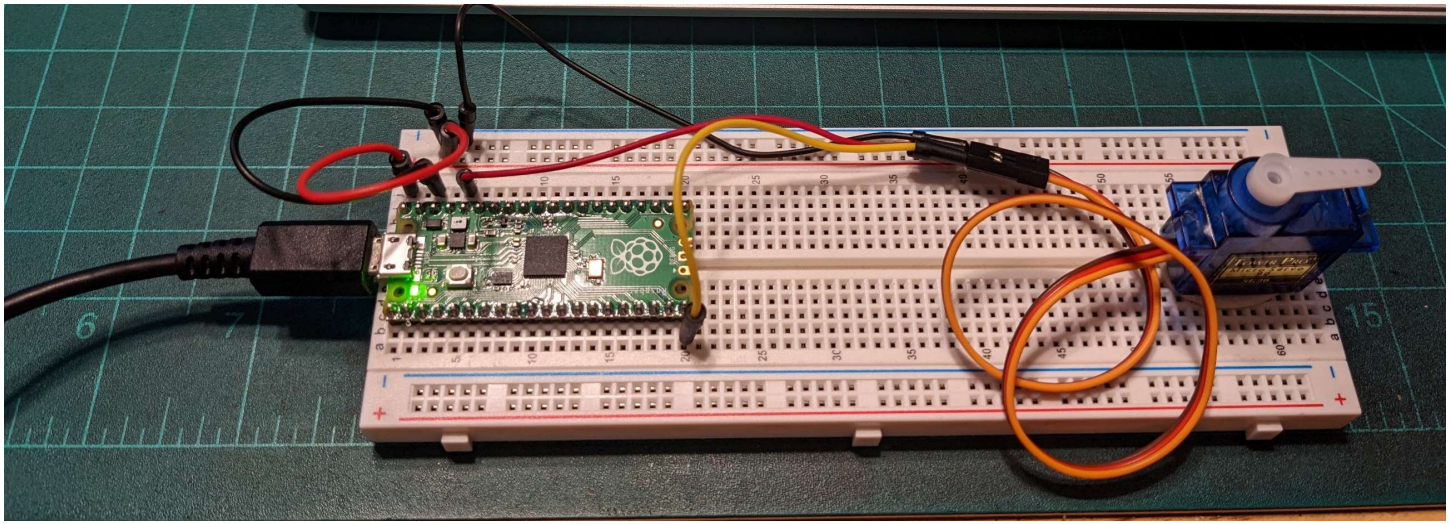
Shell

```
MicroPython v1.19.1 on 2022-06-18; Raspberry Pi Pico with RP2040
Type "help()" for more information.
>>>
```

Thonny IDE

Lab: Servo Motor Controller. . .

RP2040 Servo Motor Controller in Operation



Watch Video Clip → https://youtu.be/lvQzayXIIfw

Question 5

Which GPIO pin number is assigned to perform the pwm function on slide 28?

a) 25
b) 15
c) 50
d) none of the above

Thank you for attending

Please consider the resources below:

Adams, J. (2021, February 1). *Raspberry pi rp2040: Our microcontroller for the masses*. https://www.arm.com/blogs/blueprint/raspberry-pi-rp2040

RP2040 Datasheet. (2022). RP2040 datasheet: A microcontroller by raspberry pi. https://datasheets.raspberrypi.com/rp2040/rp2040-datasheet.pdf

Raspberry Pi Pico Resources: Raspberry Pi Documentation - Raspberry Pi Pico and Pico W

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