PYTHON BASICS
& ROBOT ASSEMBLY

Day 1: Code & Build

Tuesday, February 3, 2026

Today's Schedule

SESSION 1: 9:00 - 10:50 AM

9:00 - 9:20 • Setup & Hello World

Install Thonny, first program

9:20 - 10:00 • Python Fundamentals

Variables, data types, operations

10:00 - 10:50 • Control Flow

If statements, loops, functions + practice

☕ **BREAK: 10:50 - 11:10 AM**

SESSION 2: 11:10 AM - 1:00 PM

What is Python?

Python is a programming language – a way to give instructions to computers.

Easy to Learn

Reads like English!

Powerful

Used by Netflix, Google, NASA

Versatile

Games, websites, robots, AI

In-Demand

Top programming language

Access Course Materials on GitHub

All code files and presentations are available online:

1 **Open Your Browser**

Chrome, Safari, Firefox, Edge - any browser works

2 **Go to GitHub Repository**

Type this URL (case-sensitive!):

```
github.com/Wisdomerh/IBM-REDHAT-TY-2026
```

3 **Bookmark This Page!**

You'll use it throughout the week

💡 **Ask your instructor if you can't find the link!**

What's in the Repository?

Everything you need for this week:

Debug_Challenges

3 broken code files + solutions

challenge1_BROKEN.py, challenge1_SOLUTION.py, etc.

Behavior_Challenges

5 robot behavior programs

square_pattern.py, figure8.py, spin.py, etc.

Main_Code

Full robot control program

main_cleaned.py (obstacle avoidance + WiFi)

Presentations

All PowerPoint slides

Tuesday.pptx, Thursday.pptx, etc.

To Download: Click green **Code** button → Download ZIP → Extract files

Setting Up Thonny

If you haven't installed Thonny yet:

1. Open your web browser
2. Go to **thonny.org**
3. Download for your OS (Windows/Mac/Linux)
4. Install and open Thonny

What is Thonny?

An IDE (Integrated Development Environment) – like Microsoft Word, but for writing code!

🙋 Need Help? Raise your hand – we'll come to you!

Your First Program: Hello World!

Let's write our first line of Python code!

```
print("Hello, World!")
```

Follow Along:

1. Type the code above into Thonny
2. Press the green ▶ Play button (or F5)
3. Watch your computer say hello! 👋

🎉 **Congratulations! You're officially a programmer!** 🎉

Variables: Storing Information

Think of a variable as a labeled box where you store information:

```
# Storing text (strings)
name = "Alice"
school = "Your School Name"

# Storing numbers
age = 15
height = 172.5

# Using variables
print("My name is " + name)
```

Data Types

String (str)

Text

```
Examples: "Hello", "Python"
```

Integer (int)

Whole numbers

```
Examples: 42, 2026
```

Float

Decimals

```
Examples: 3.14, 98.6
```

Boolean

True/False

```
Examples: True, False
```

Python as a Calculator

Try these operations:

```
+   Addition       10 + 5   →   15
-   Subtraction     10 - 5   →   5
*   Multiplication     10 * 5   →   50
/   Division       10 / 5   →   2.0
**   Power       10 ** 2   →   100
%   Remainder       10 % 3   →   1
```

💡 **Try It: age * 365 (your age in days!)**

Making Decisions: If Statements

Programs make decisions based on conditions:

```
age = 16

if age >= 17:
    print("You can drive!")
elif age >= 16:
    print("You can get a permit!")
else:
    print("Soon!")
```

⚠️ **Indentation (spaces) matters in Python!**

Loops: Repeating Actions

For Loop (count specific times):

```
for i in range(5):
    print("Hello", i)
```

While Loop (repeat while condition is true):

```
count = 3
while count > 0:
    print(count)
    count = count - 1
```

Functions: Reusable Code

Write once, use many times!

```
def greet(name):
    print("Hello, " + name)

# Use the function
greet("Alice")
greet("Bob")
```

- Write once, use many times
- Keep code organized
- Easy to debug

Practice Time!

Until 10:50 - try these:

1. Make a countdown from 10 to 1
2. Check if a number is even or odd (use %)
3. Create a function that converts Celsius to Fahrenheit

Break Time!

20 minutes - back at 11:10!

Get ready for ROBOT ASSEMBLY! 🤖

ROBOT ASSEMBLY TIME!

Let's connect the wheels and sensor!

Your Robot Parts

Simple setup - just a few parts to connect:

- Raspberry Pi Pico (the brain)
- 4 wheels (2 front, 2 rear)
- 2 motor drivers (front & rear)
- 1 ultrasonic sensor
- Wires to connect everything

📦 **Keep all parts organized!**

Connecting Your Robot

This is what we'll be doing:

1. Connect FRONT DRIVER to Pico (4 wires)
2. Connect REAR DRIVER to Pico (4 wires)
3. Connect ULTRASONIC SENSOR to Pico (3 Wires)
4. Connect BATTERY PACK to power
5. Test the connections

We'll do each step together!

⚡ Safety First!

Important Rules:

⚡ Turn OFF power before connecting wires

📌 Each wire goes to a specific pin on the Pico

📌 We'll show you exactly where each wire goes

📌 Double-check before turning power on

📌 Make sure not to pull on the wires too hard!!!!

🙋 **ALWAYS ask if you're unsure!**

Raspberry Pi Pico Wiring Diagram

⚠️ **IMPORTANT: Power (5V) and Ground already connected to Pico**

REAR DRIVER

- Yellow wire → **GP 2**
- Blue wire → **GP 3**
- Black wire → **GP 5**
- Red wire → **GP 6**

FRONT DRIVER

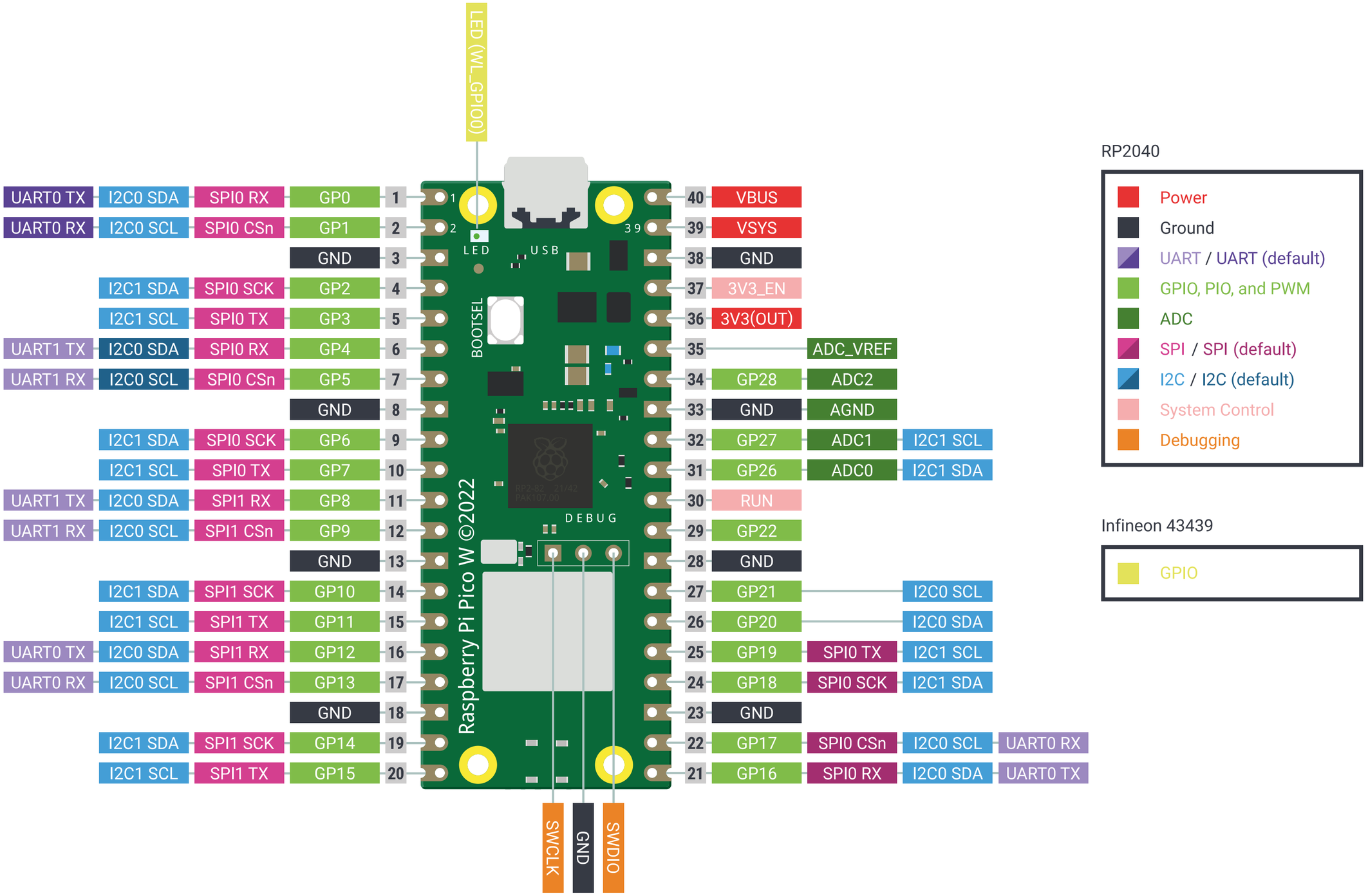
- Yellow wire → **GP 8** *(next to GP 9)*
- Blue wire → **GP 9**
- Black wire → **GP 11**
- Red wire → **GP 12**

ULTRASONIC SENSOR

- Black wire (Trig) → **GP 14**
- Blue wire (Echo) → **GP 15**
- **Yellow wire** → Any **GROUND** pin (GND)

Key Reminders:

- GP 8 label may be hidden under black frame - it's **next to GP 9**
- GP 15 is **on the mounting hole**
- Ask for help before connecting if unsure! 🙋


LED (WL_GPIO0)
UART0 TX I2C0 SDA SPI0 RX GP0 1
UART0 RX I2C0 SCL SPI0 CSn GP1 2
GND 3
I2C1 SDA SPI0 SCK GP2 4
I2C1 SCL SPI0 TX GP3 5
UART1 TX I2C0 SDA SPI0 RX GP4 6
UART1 RX I2C0 SCL SPI0 CSn GP5 7
GND 8
I2C1 SDA SPI0 SCK GP6 9
I2C1 SCL SPI0 TX GP7 10
UART1 TX I2C0 SDA SPI1 RX GP8 11
UART1 RX I2C0 SCL SPI1 CSn GP9 12
GND 13
I2C1 SDA SPI1 SCK GP10 14
I2C1 SCL SPI1 TX GP11 15
UART0 TX I2C0 SDA SPI1 RX GP12 16
UART0 RX I2C0 SCL SPI1 CSn GP13 17
GND 18
I2C1 SDA SPI1 SCK GP14 19
I2C1 SCL SPI1 TX GP15 20
40 VBUS
39 VSYS
38 GND
37 3V3_EN
36 3V3(OUT)
35 ADC_VREF
34 GP28 ADC2
33 GND AGND
32 GP27 ADC1 I2C1 SCL
31 GP26 ADC0 I2C1 SDA
30 RUN
29 GP22
28 GND
27 GP21 I2C0 SCL
26 GP20 I2C0 SDA
25 GP19 SPI0 TX I2C1 SCL
24 GP18 SPI0 SCK I2C1 SDA
23 GND
22 GP17 SPI0 CSn I2C0 SCL UART0 RX
21 GP16 SPI0 RX I2C0 SDA UART0 TX
LED
USB
BOOTSEL
DEBUG
Raspberry Pi Pico W ©2022
SWCLK
GND
SWDIO
RP2040
Power
Ground
UART / UART (default)
GPIO, PIO, and PWM
ADC
SPI / SPI (default)
I2C / I2C (default)
System Control
Debugging
Infineon 43439
GPIO

</> Testing Your Robot - First Wheel

Here's code to test ONE wheel. Use what you learned to test the others!

```
from machine import Pin
import time

# Rear left wheel (GP2 and GP3)
rear_left_forward = Pin(2, Pin.OUT)
rear_left_backward = Pin(3, Pin.OUT)

# Test: Spin wheel forward for 2 seconds
rear_left_forward.value(1)
rear_left_backward.value(0)
time.sleep(2)

# Stop the wheel
rear_left_forward.value(0)
rear_left_backward.value(0)
```

💡 YOUR CHALLENGE: Test the other 3 wheels!

Hints:

- Rear right: GP 5 & GP 6 • Front left: GP 8 & GP 9 • Front right: GP 11 & GP 12

📏 Testing the Ultrasonic Sensor

This sensor measures distance - let's test it with your hand!

```
from machine import Pin, time_pulse_us
import time

# Ultrasonic sensor pins
trig = Pin(14, Pin.OUT)
echo = Pin(15, Pin.IN)

def get_distance():
    trig.value(0)
    time.sleep_us(2)
    trig.value(1)
    time.sleep_us(10)
    trig.value(0)

    pulse_time = time_pulse_us(echo, 1, 30000)
    distance = (pulse_time * 2) / 29.1  # in cm
    return distance

# Continuous testing loop
while True:
    dist = get_distance()
    print("Distance:", dist, "cm")
    time.sleep(0.5)
```

✋ TRY IT: Move your hand closer and further from the sensor!

What You'll See:

Numbers updating in real-time showing distance in centimeters

• Close hand: ~5-10 cm • Arm's length: ~50-70 cm • Far away: 100+ cm

Python Controls Your Robot

On Thursday, you'll see code like this:

```
# Set motor speed
speed = 50

# Check for obstacles
distance = sensor.read()
if distance < 20:
    turn_right()
else:
    move_forward()

# Make it drive in a square
for i in range(4):
    move_forward()
    turn_left()
```

What's Tomorrow?

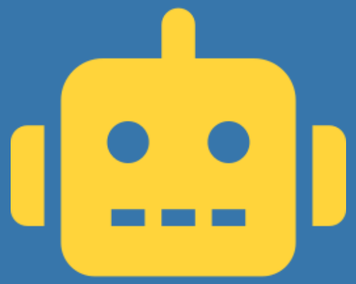
Wednesday: SETU Visit

- A Visit from an SETU student/lecturer
- Learn about computer science courses
- Ask questions about college life

Thursday: Advanced Python + Robot Programming

- Write Python to control your robot
- Fix Bugs
- Program obstacle avoidance
- Make it drive autonomously

Review Python basics tonight!



Amazing Work Today!

You're a Python programmer
AND a robot builder!

See you tomorrow! 👋