Lab 07: Counter & Decoder

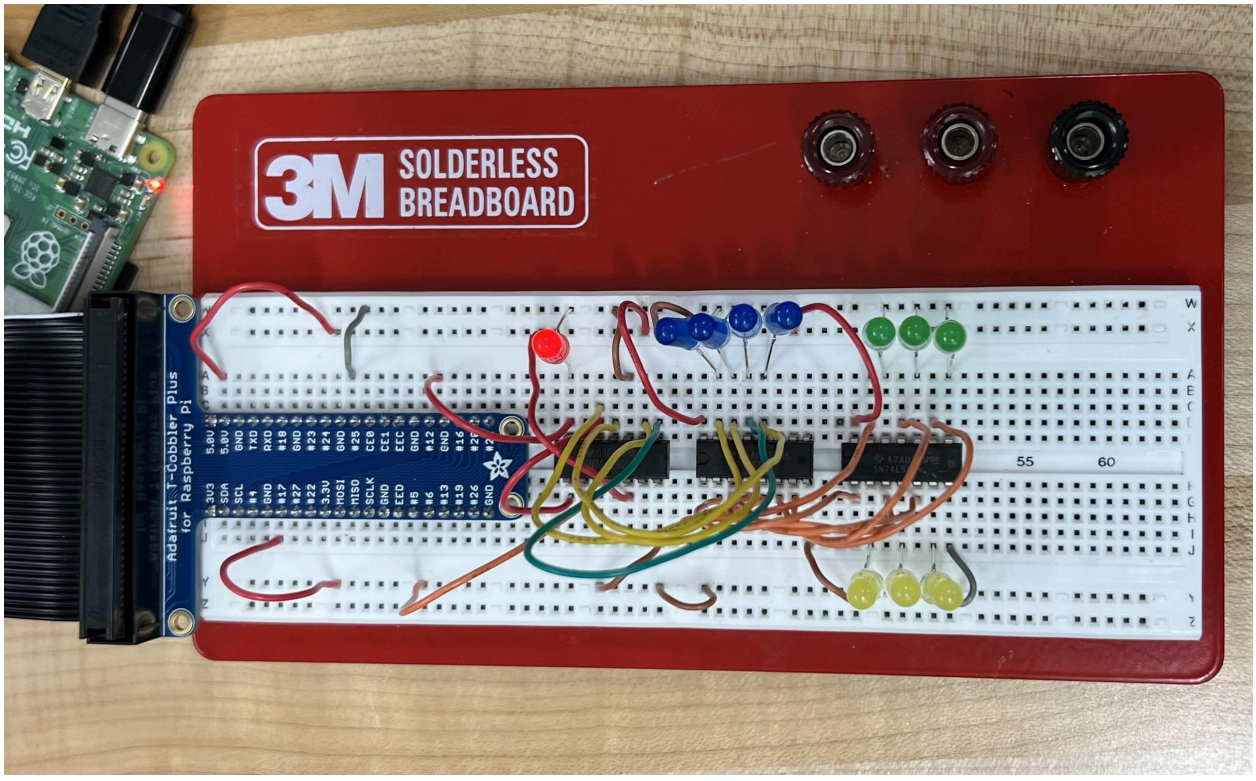
Name(s): Cole Walther & William Jedrzejczak

Circuit Design (Pages 8–31)

We followed the circuit schematic using the SN74LS90N binary counter, SN74LS42N 4-to-10 decoder, and SN74LS04N inverter. All connections for power, ground, output lines, and GPIO were made as instructed in the lab handout.

The connections were verified against the pinout and wiring diagrams, including the max-count loop (QA back into CKB), reset grounding, and GPIO clock signal sent from pin 12. Decoder outputs were also routed through inverters to drive LED indicators.

Insert Photo of Full Breadboard with ICs Here



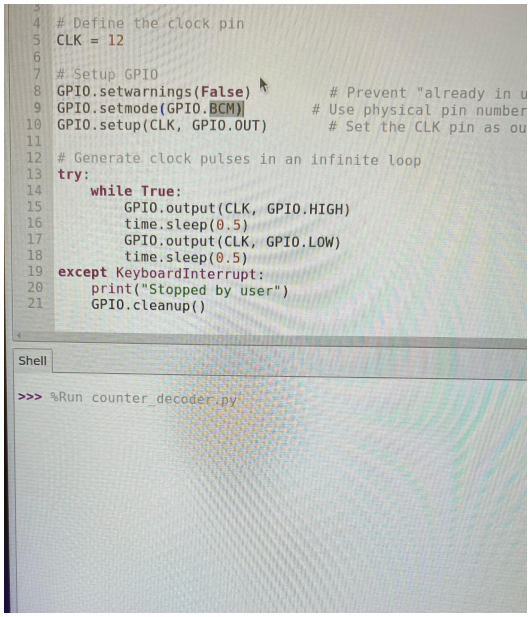
Python Code to Generate Clock Pulses

We created and executed a Python script on the Raspberry Pi to send square-wave pulses to the SN74LS90N clock input. This allows the counter to increment and drive the decoder and LEDs accordingly.

Python Code:

```
import RPi.GPIO as GPIO
import time
CLK = 12
GPIO.setmode(GPIO.BCM)
GPIO.setup(CLK, GPIO.OUT)
try:
        while True:
        GPIO.output(CLK, GPIO.HIGH)
        time.sleep(0.5)
        GPIO.output(CLK, GPIO.LOW)
        time.sleep(0.5)
except KeyboardInterrupt:
        GPIO.cleanup()
```

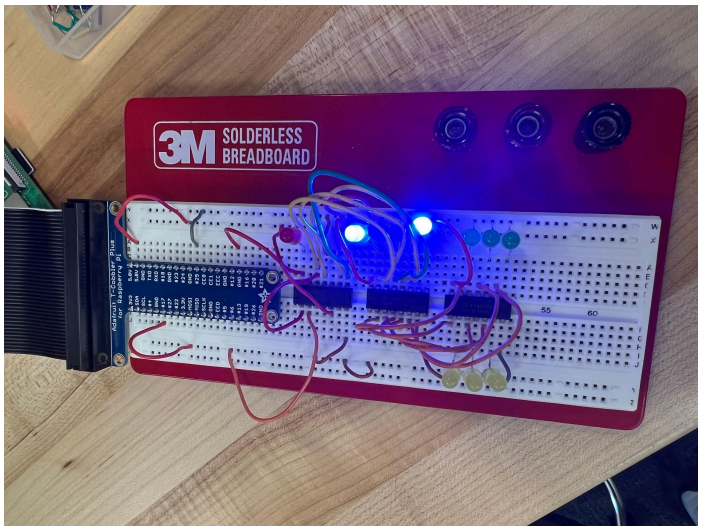
Python Output:

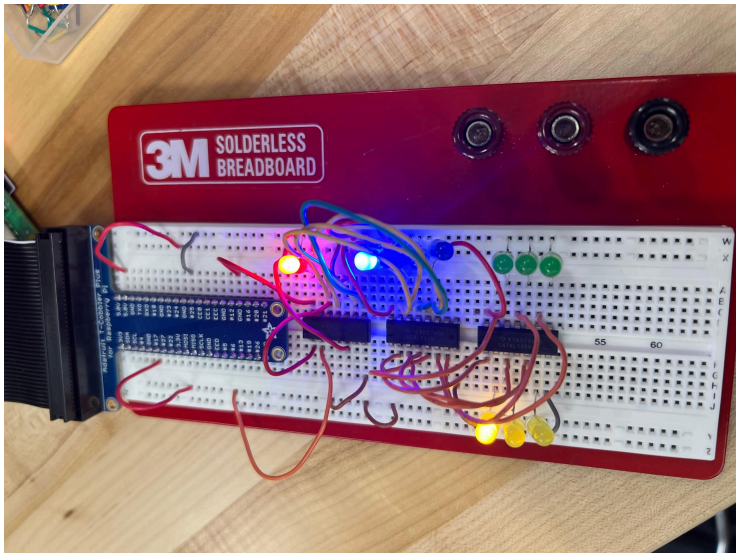


LED Behavior Test

After running the Python code, we observed LED behavior at various pulse counts. When 4 pulses were generated (binary 0100), the 4's column LED lit up. When 8 pulses were generated (binary 1000), the 8's column LED lit up. The decoder and inverter outputs also lit up their respective LEDs accordingly.

(Here are some photos)





Final Question Section

1. **(True / False) For IC SN74LS90N (Binary counter) to get powered, IC pin 5 connected to +5V and IC pin 10 connected to GND.**
   → True

2. **(True / False) For IC SN74LS42N (4 to 10 Decoder) to get powered, IC pin 16 connected to +5V and IC pin 8 connected to GND.**
   → True

3. **(True / False) GPIO pin 12 connected to IC SN74LS90N pin 14 for generating clock pulses.**
   → True

4. **(True / False) For IC SN74LS90N (Binary counter), IC pin 1 (CKB) connected to IC pin 12 (QA) to use maximum count length.**
   → True

5. **(True / False) When clock pulses start to generate, the red LED connected to GPIO pin 12 will keep blinking.**
   → True

6. **(True / False) The Binary counter OUTs 4 (QD), 3 (QC), 2 (QB), 1 (QA) count the clock pulses starting from 0 (0000) to 9 (1001).**
   → True

7. **(True / False) After ten clock pulses generated, all LEDs connected to SN74LS90N (Binary counter) pins 12, 9, 8, and 11 will be off.**
   → True

8. **(True / False) When four clock pulses are generated, blue LED connected to SN74LS90N (Binary counter) pin 8 will be on.**
   → True

9. **(True / False) When eight clock pulses are generated, blue LED connected to SN74LS90N (Binary counter) pin 11 will be on.**
   → True

10. **(True / False) When four clock pulses are generated (binary value 0100), green LED connected to SN74LS04N (Inverter) pin 8 will be on.**
    → True

11. **(True / False) If the green LED connected to SN74LS04N (Inverter) pin 10 turns on, blue LEDs connected to SN74LS42N (4 to 10 Decoder) pins 13 & 15 will be on.**
    → **False**