

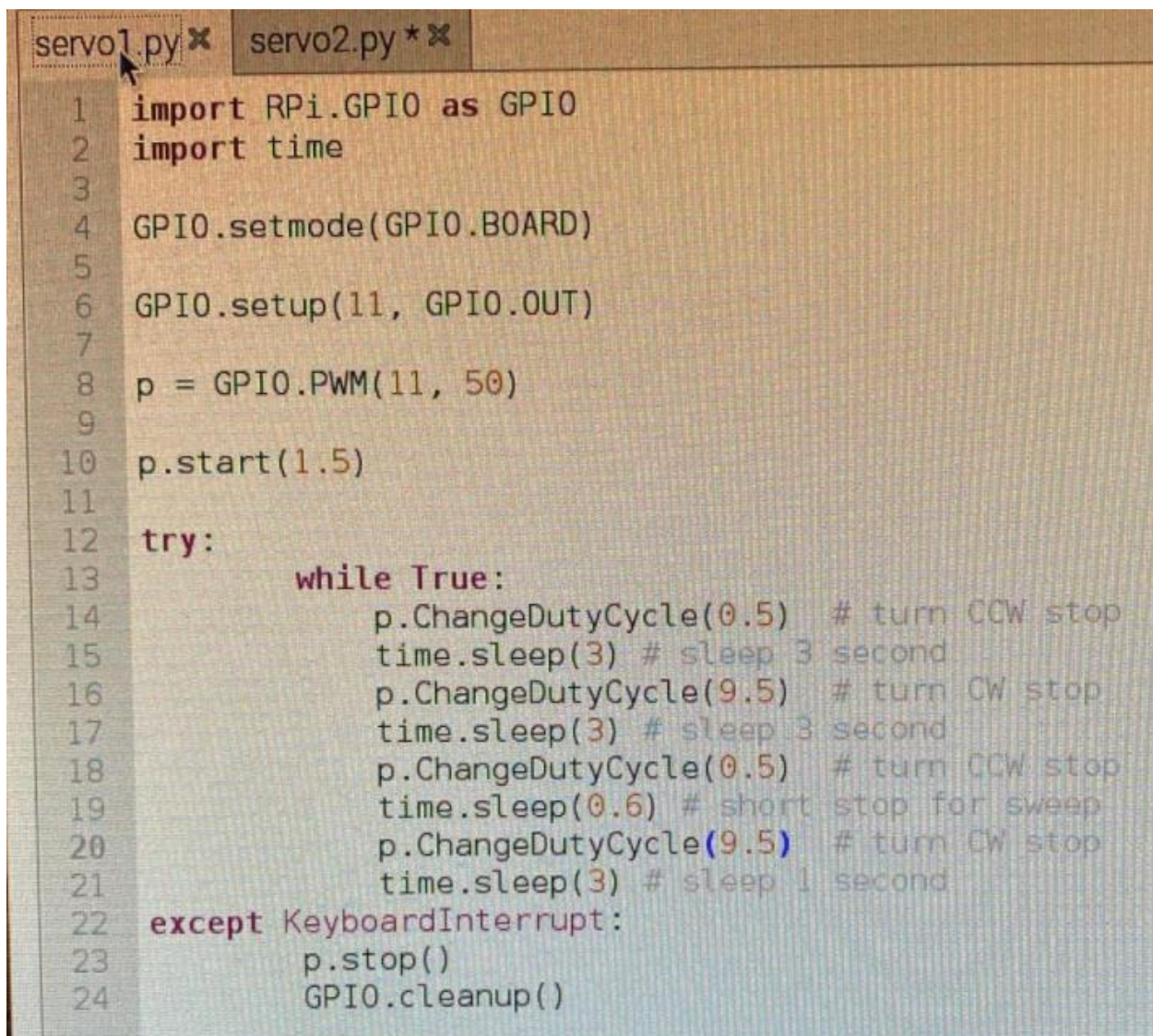
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ECE-350-001

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Lab 2: Servo Actuator Control

Servo Sweep Python Script:

A screenshot of a code editor showing a Python script for controlling a servo motor. The editor has two tabs: 'servo1.py' and 'servo2.py'. The script is in 'servo1.py' and consists of 24 lines of code. It imports RPi.GPIO as GPIO and time. It sets the GPIO mode to BOARD, sets up pin 11 as an output, and creates a PWM object on pin 11 with a frequency of 50. It starts the PWM with a duty cycle of 1.5. A try block contains a while True loop that changes the duty cycle to 0.5 (CCW stop), sleeps for 3 seconds, changes it to 9.5 (CW stop), sleeps for 3 seconds, changes it back to 0.5 (CCW stop), sleeps for 0.6 seconds (short stop for sweep), changes it back to 9.5 (CW stop), and sleeps for 3 seconds. An except block for KeyboardInterrupt calls p.stop() and GPIO.cleanup().

```
1 import RPi.GPIO as GPIO
2 import time
3
4 GPIO.setmode(GPIO.BOARD)
5
6 GPIO.setup(11, GPIO.OUT)
7
8 p = GPIO.PWM(11, 50)
9
10 p.start(1.5)
11
12 try:
13     while True:
14         p.ChangeDutyCycle(0.5) # turn CCW stop
15         time.sleep(3) # sleep 3 second
16         p.ChangeDutyCycle(9.5) # turn CW stop
17         time.sleep(3) # sleep 3 second
18         p.ChangeDutyCycle(0.5) # turn CCW stop
19         time.sleep(0.6) # short stop for sweep
20         p.ChangeDutyCycle(9.5) # turn CW stop
21         time.sleep(3) # sleep 1 second
22 except KeyboardInterrupt:
23     p.stop()
24     GPIO.cleanup()
```

- Simple code outputting the change in duty cycle to GPIO17.

Servo Protractor Python Script:

```
servo1.py x servo2.py x
1 import RPi.GPIO as GPIO
2 import time
3
4 GPIO.setmode(GPIO.BOARD)
5
6 GPIO.setup(11, GPIO.OUT)
7
8 p = GPIO.PWM(11, 50)
9
10 p.start(1.5)
11
12 try:
13     while True:
14         p.ChangeDutyCycle(0.5) # turn CCW stop
15         time.sleep(3) # sleep 3 second
16         p.ChangeDutyCycle(1.6) # turn to 36 degrees
17         time.sleep(3) # sleep 3 second
18         p.ChangeDutyCycle(3.3) # turn to 72 degrees
19         time.sleep(3) # sleep 3 second
20         p.ChangeDutyCycle(5) # turn to 108 degrees
21         time.sleep(3) # sleep 3 second
22         p.ChangeDutyCycle(7.5) # turn to 144 degrees
23         time.sleep(3) # sleep 3 second
24         p.ChangeDutyCycle(9.5) # turn CW stop
25         time.sleep(5) # sleep 5 second
26 except KeyboardInterrupt:
27     p.stop()
28     GPIO.cleanup()
```

- Code written after a lot of trial and error. This code gave the most favorable outcome.

Questions:

1) What is the duty cycle?

Initial duty cycle = 1.5ms; Period = 20 ms; Duty Cycle = $(1.5/20) * 100 = 7.5\%$

2) Servo Position Angle vs. Command Duty Cycle Plot:

