CS 341 – Lab 10
Servo Motor

Background Information
A servo motor is a motor that can be set to spin continuously at various speeds, or set to a specific position. In manufacturing, a servomotor may control a robot arm to hold a tool in position for the required work. In a petroleum or chemical plant, a servomotor may open or close a valve controlling flow in a pipe. Servo motor is a close-loop device. The user provides an input (e.g. speed, position etc) and the servo motor makes use of a sensor (known as a resolver) to provide constant feedback to a controller that adjusts parameters to match the user’s input. To learn more about how a servo motor works, checkout this 3 minute video.

In this lab we will make use of an emulation of a position-controlled DC servo motor that can turn from 0 degree to 180 degrees. The user can provide a desired angle to turn and the motor will use a feedback mechanism and rotate to the desired position. The simulator also supports a continuous rotation mode that can rotate in a clockwise as well as anti-clockwise direction. The user input will control the direction as well as the speed of the rotation. An input number of 0-90 will make the motor rotate in a clockwise direction and 90-180 will rotate in a counter-clockwise manner.

In this lab, we will use an analog slider (0 to 5V) to provide user input and this is fed into an analog pin of the computer. Previously we had only made us of digital pins. When we wrote and read digital pins the values were either HIGH (1) or LOW(0). The computer reads analog values from the slider and translates the [0 to 5V] to a number ranges from [0 to 1023]. We will use this
analog input to control the position of the servo or the speed/direction in the continuous rotation mode.

If this lab were in person we would use a potentiometer (a “pot”) across +5 volts and ground (0 volts) and connect the center tap wire to the analog pin A0 which our code will read from. The center tap is controlled by the position of a knob/shaft and in each position it presents a voltage value that varies between 0 and +5 volts on the wire to the input pin. To simulate this we will use a slider connected to pin A0. The library analogRead function to lets us read an int value between 0 and 1023 that corresponds to the voltage/position of the knob on the potentiometer.

The Code

This lab won’t require you to modify the starter code.

Setting Up the Hardware

1. Find the Servo motor (labeled “SERVO”) and the analog slider (bottom right of your screen)
2. Write A0 in the slider’s box to connect it to analog pin A0
3. Write 09 in the servo motor’s box to connect it up to pin 9
4. (once running) Try clicking the box in the bottom left of the Servo (marked O) to select the continuous rotation mode. Move the slider to observe the different rotation direction and speed.

Lab Report
Please answer the following questions in the “Results” section of your report:

1. With the code \( y = map(x, 0, 1023, 0, 180); \)
   a. If \( x \) is 0 what will \( y \) be?
   b. If \( x \) is 512 what will \( y \) be?
   c. If \( x \) is 768 what will \( y \) be?

2. What happens when we use analogRead on a digital pin?

3. If we use digitalRead on pin A0 what kind of values do we get?

You can submit your lab report by email to jack.davis001@umb.edu. Please cc all group members so that my replies reach everyone.