IECE 553/453 Cyber-Physical Systems
Fall 2023

Prof. Dola Saha
Associate Professor
Department of Electrical & Computer Engineering
University at Albany, SUNY

Lab Assignment 2 - Due Sep 14
Total Points - 30

1. **(10 points)** Write a C program that reads a GPIO pin to check if a button is pressed and turns on an LED when the button is pressed `N` times. When it is pressed `N` times again, it turns it off. The value of `N` should be an input through command line argument. Enable internal pull-down resistor for this program. Make sure that you use a circuit that can take care of the jitter as well as utilize the Interrupt Service Routine (not polling) to free up the processor.
2. **(10 points)** Write a C program that reads a value `0x0` through `0xD` using a 4×4 Matrix Keyboard. Use that hexadecimal input, convert it to binary and use 4 LEDs connected to 4 GPIO pins to represent the binary number. Consider each LED to represent one bit of a four bit binary number, where LED state 'off' denotes a value of '0' in that bit and 'on' state denotes a bit value of '1'. Implement a shift register using the LED output. Shift the output to the right or left in an infinite loop and exit the program gracefully (turn off all LEDs) when `Ctrl+C` is pressed. The right or left shift (L/R) should be an user input in the command line argument.

   For example, if the program is run as `./shiftReg R`, and then button `3` is pressed using the Matrix Keyboard, the LED output should be `0011`. This output should change to `1001`, `1100`, `0110` and `0011` in a forever loop. When `Ctrl+C` is pressed, the output of LED will be `0000` and the program should stop execution.
3. **(10 points)** Setup your code running in lab on Sep 15. You need to show both the software and hardware running together to get the full credit.

Submission Instructions:
Name your files using the following convention: `yourLastName_labN_problemM.extension`. Upload a single tar or zip file in blackboard.