CSE 379
Lab #5
Spring 2020

Objective
In this lab, you will learn how to service interrupts on the ARM board.

Description
Write an ARM assembly language subroutine, called *lab5*, which is an interrupt driven program that displays in real-time (in *PuTTy*) the number of times each of the four switches is pressed and the number of times a key is pressed in *PuTTy*. In other words, five tallies should be displayed on the screen: one for switch #2, one for switch #3, one for switch #4, one for switch #5, and one of the number of keystrokes. All counts should be displayed in decimal and should be updated on every press of a switch or a key. The program should end when the user hits *q* on the keyboard. You may assume that the user will only press one switch at a time. Polling may NOT be used to obtain data from the keyboard or the switches. The data must be obtained through the use of interrupts.

Startup Code
Use the startup code on the *labs* page of the course website, NOT the startup assembly file that you've been including in your project when you create a project in past labs.

Skeleton Code
The following skeleton code shown below can be used for *lab_5.s*.

```
        .text
        .global UART0_Handler
        .global Switches_Handler
        .global interrupt_init
        .global lab5

interrupt_init:
        STMFD SP!,{r0-r12,lr}   ; Store register lr on stack

            ; Your code is placed here

        LDMFD sp!, {r0-r12,lr}
        MOV pc, lr

UART0_Handler:
        STMFD SP!,{r0-r12,lr}   ; Store register lr on stack

            ; Your code is placed here

        LDMFD sp!, {r0-r12,lr}
        BX lr

Switches_Handler:
        STMFD SP!,{lr}    ; Store register lr on stack

            ; Your code is placed here

        LDMFD sp!, {lr}
        BX lr

        .end
```

Partners
You will work with a partner in this lab. Your partner *MUST* be the same partner you worked with on lab #4.

Documentation
Your program must be clearly commented, and documentation must also be provided. The documentation must follow the guidelines covered in lecture (found on the *Lectures* webpage of the course website). Your comments should describe what *each* section of your program does.   To receive full credit on your documentation, you must submit a draft of your flowchart before you start working on the lab in your regularly scheduled lab time on Wednesday, March 4 or Thursday, March 5.

Submissions
Your source code (C and assembly) must be submitted online using the submit command (submit_cse379 Your source code (C and assembly) and your documentation (as a PDF) must be submitted online using the submit command (*submit_cse379 lab_5_wrapper.c lab_5.s lab_5_library.s lab_5_documentation.pdf*) on *timberlake.cse.buffalo.edu* **before 11:59 PM on Tuesday, March 10, 2020**. A hardcopy of your documentation is due at the **beginning of class on Wednesday, March 11, 2020**. Your documentation will be used along with the code you submitted when you perform the debug exercise for Lab #5.