# Laboratory 4
# Using Interrupts

**Due Date**: 25 Mar 2020 Name: _____

**Points**: 100 Points
Work individually.

**Objective**: The purpose of this laboratory is to develop your understanding of using interrupts on the PIC32MX microcontroller. In this lab, you will also apply what you have done on previous labs using digital I/O and timers. You will be using c function libraries that are included using the *#include <plib.h>* command in your c source file. The c library reference manuals are posted on UNM Learn.

**Activities**:

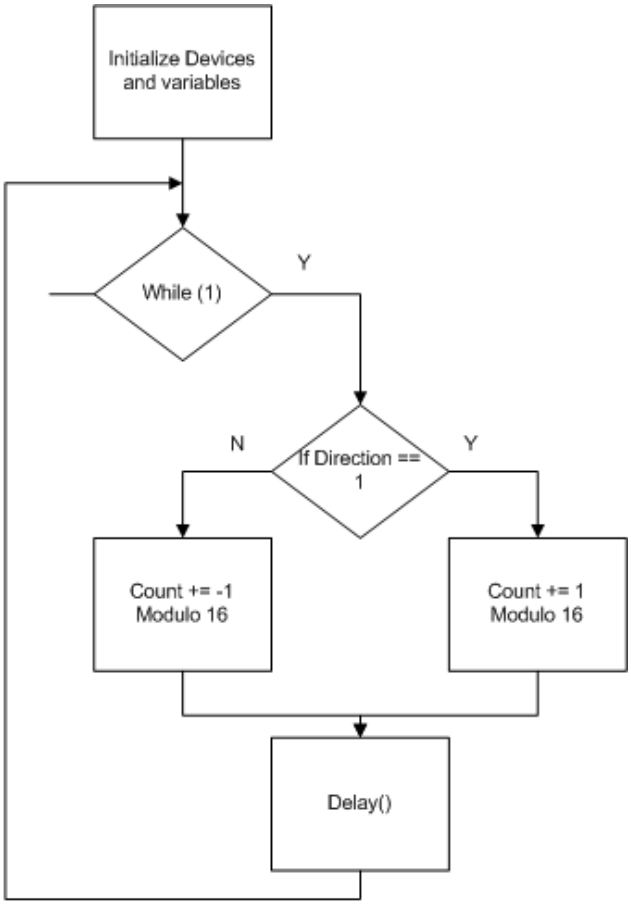
**Part 1**. For the first part of this assignment, you will write a **main** routine which after initializing the components, implements a loop in which you implement a counter that counts from 0 to 255. The count will be incremented once a second. The LEDs on the 8-LED module connected to PMOD connector B will be illuminated to indicate the current count. You will also configure the hardware to cause the LED1 to toggle between on and off twice a second and LED4 to toggle every 4 seconds. The blink functions will be implemented in an interrupt service routine that is triggered by a timer. In your report, show your calculations of how you configured your timer to generate the one quarter second, one second time, and the three second time intervals. Note, all can be driven by the same ISR and this time base can also be used to implement the count in the main routine.

**Part 2.** For this part of the assignment, you will write a **main** routine which also implements a four bit counter, which counts from 0 to 15. Your counter will count up or down, depending on the value of a direction bit. You will use the LEDs, LD1-LD4, to indicate the count. Use timer 1 to implement the main program delay function, in a manner that is similar to what was done on lab 3. Your counter should increment every ½ sec.

Demonstrate that your program will count correctly in either the up or down direction by initializing a global direction variable to either 0 or 1.

After you have your main program operational, you will now use timers to generate an interrupt every 10 seconds. In the interrupt service routine, you will change the direction variable to be the opposite of its current value.

A recommended flow for your main program counter is shown in the drawing below:




**Documentation**: Your lab activities must be documented following the guidelines that are provided on the course UNM Learn site. You must also demonstrate that your project functions properly to one of our TAs; who will then sign your copy of this assignment sheet.

**Reference Information:**

- Cerebott MX7™ Board Reference Manual
- PIC32MX5XX/6XX/7XX Data Sheet
- PIC32 Peripheral Libraries for MPLAB C32 Compiler

**Suggestion**: Keep all of your files on a USB memory device as there is no guarantee that any information you store on lab machines will be preserved. On occasion, the machines must cleared and reloaded, so any information stored on them will be lost.