LCD Interfacing and ADC Control

**PURPOSE**

In this three-week lab, you will interface an LCD to the EVB and practice the ADC and PWM features.  Interrupt will be used.

**PRELAB (30%):** Complete the prelab assignments as teams. Remove any syntax error before you turn in prelab codes.

(1)  (Week 1: 10%)  For Experiment (1), study LCD_SPI.c.  For Experiment (2), turn in the part of the C code that displays an "unsigned char" in hexadecimal on the LCD.  Although the code segment calls some functions from LCD_SPI.c, do not turn in any code from LCD_SPI.c.

(2)  (Week 2: 10%) Write the C code for Experiment (4).  Refer to tone_interrupt.c for relevant information.

(3)  (Week 3: 10%)  Draw a simple circuit diagram and then write a code for Experiment (6).

**EXPERIMENT (70%)**

(1) (10%) Study LCD_SPI.c and three corresponding PDF files under c:\ceg4330\LCD.   (Those four files are also available on the course pilot website under labs\LCD.)  Connect an LCD display (NHD-0216K3Z-FL-GBW-V3) to the SPI port of an EVB.  Create a CodeWarrior project based on LCD_SPI.c and record its execution results.√

(2) (10%) Based on adc_scan.c, write a C program that reads a DC voltage (0 to 5 volt), connected to PAD6, pin 37 on EVB, and displays the corresponding digital value <u>in hexadecimal</u> on the LCD.  Use a DC power supply to provide the ADC input when the code in being developed.√√

(3) (5%) Follow instructions in CodeWarrior_interrupt_and_tone.pdf under c:\ceg4330\LCD (which is also available on the course pilot website under labs) and create a CodeWarrior project based on tone_interrupt.c so that LED1 flashes at 0.5 Hz (one second on and one second off).

(4) (20%) Write a C program that measures the frequency of a square wave (500 to 2,000 Hz) connected to PT6, pin 38 on EVB.  The frequency value in Hz should be displayed on the LCD.  The timing measurement should be based on channel 6 <u>input-capture interrupt</u>. Use a signal generator to produce the square wave.√√

(5) (10%) Connect an LED and a resistor in series to PP5, pin 9 on EVB.  Write a C program that produces a PWM signal on PP5 using the HCS12's PWM feature.  Change the HCS12 PWM registers' values and observe the resulting waveforms with an oscilloscope.√

(6) (15%) Combine previous programs so that the duty cycle of the PWM signal is proportional to the ADC input voltage, which comes from a voltage divider that contains a force sensitive resistor (Sparkfun SEN-09376) and a fixed-value resistor.  The more force is imposed the lower the DC voltage should be.  The frequency of the PWM signal should be fixed at about 24 KHz.   In addition the LED connected to PP5 should flash at a frequency that is equal to $F_{in}$/2,000, where $F_{in}$ is the frequency of the square wave connected to timer channel 6.  For example, if $F_{in}$ is 2 KHz, then the LED should flash at 1 Hz.  In that case, the LED is off for 0.5 second, and then "on" (brightness controlled with the PWM signal) for 0.5 second.√√