ME 461 Prelab #3
Fall 2017
Due at the start of class on 09/27/2017

Suggested Reading:

ADC10 chapter in MSP430x2xx user's guide.
Lab 3 manual.

1. You and your partner solder the microphone circuit shown in Lab 3 exercise 3. Use the demo board as a guide. The soldering is due at the beginning of your lab time.

2. Suppose you want to sample and convert the voltage provided from a source with output impedance of 28 kΩ. Compute the minimum sample-hold time required to ensure an accurate ADC conversion on the MSP430F2272.

3. Now suppose the ADC conversion clock is running at 5 MHz. Write the configuration of the ADC10SHT bits in ADC10CTL0 that achieves as close as possible but greater than the sample-hold time from problem 2. With this configuration, what is the theoretical maximum rate at which the MSP430 could sample and convert the ADC10 channel. Remember that in addition to the sample and hold time the ADC10 takes an additional 13 clock cycles to convert the ADC channel.

4. Write out the contents of the ADC10CTL0, ADC10CTL1, and ADC10AE registers for sampling channel A3 with the software trigger (ADC10SC), V_{CC} and GND as the reference set, the sample-hold time you found in problem 2, and interrupt enabled. Use the ADC10OSC clock source.

5. Write out the code you would place in the Timer A ISR if you wanted to trigger ADC conversions every 10ms. Assume Timer A counts at 16MHz and TACCR0 = 16000.

6. What register contains the results of the analog-to-digital conversions? How precise is the result, assuming the only error is due to quantization with the ADC range being 0V to 3.6V? Where in your program can you read this register and be sure it has a valid and the most current result?

7. Write the formula for converting from digital ADC reading to analog voltage value. What is the digital reading that would result from sampling 1.25 volts using a reference set of V_{CC} (≈3.6V) and GND? What is the analog voltage corresponding to a digital reading of 351 decimal?

8. Suppose you want to use the F2272's ADC and the onboard temperature sensor to measure temperature. You sample the ADC in a room where a thermometer reads 25°C. The reading is consistently 1.27 V. What is the function that relates voltage to temperature for your specific device? You may use the data sheet published value for the slope.

9. If you obtained a reading of 2.05V after converting the temperature sensor voltage, what temperature would you surmise the chip is at?