# CPE 325: Embedded Systems Laboratory
Laboratory Assignment #9

Assignment   [150 pts]

1. **[50 pts]** Write a C program to interface the 3-dimensional accelerometer, ADXL335. Your program should sample x, y and z axes 10 times per second. Calculate the accelerations in terms of 'g' (acceleration due to gravity) and send the samples to your workstation. Samples should be sent such that they are displayed in the UAH serial app as three separate lines. Please revisit the previous Lab 8 assignment to see how to use the UAH serial app. *Hint: You can position your accelerometer to display X=1, Y=1, or Z=1 at any given time. Total magnitude of acceleration measured when not moving should be ~1g.*

2. **[50 pts]** An accelerometer can be used in a car as a crash sensor to deploy airbags. When the magnitude of acceleration reaches some critical value (a crash was detected), a signal is sent to the airbag system. Modify the program from part 1 (do not remove any existing functionality), so that it calculates the magnitude using data from all three axes: $M = \sqrt{x^2 + y^2 + z^2}$. If M reaches the critical value of 3g, the RED LED should turn on, indicating airbag deployment, otherwise RED LED should be turned off all the time.

3. **[50 pts]** For our Digital to analog conversion, we will use the following circuit.
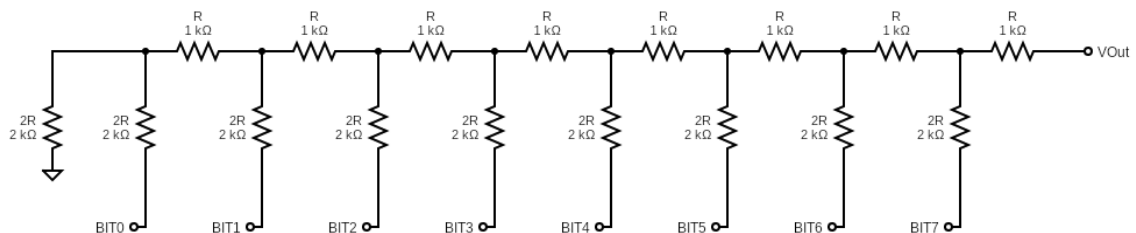
You may connect this device to any port on the MSP430F5529 which has all 8 bits exposed.

- The Desired functionality is as follows:
  - Waveforms should be generated at 30 Hz by default.
  - When no Switches are held, a sine waveform should be generated using a lookup table.
  - When SW1 is held, a Saw-Tooth waveform should be generated on the fly (no lookup table in use).
  - When SW2 is held, the frequency should Quadruple.

Questions to answer:

1. Explain why you chose the sampling rate you used for the accelerometer.

2. Explain how you chose a threshold value for the bubble level

Theory

Accelerometers
ADC and DAC

Deliverables

1. Lab Report: Source files (Indented, formatted Code)
2. Flowchart for Part 2.
3. Script used for generation of Look-up Table.
4. Formulas for Accelerometer ADC and angular deviation.
5. Source code for parts 1-3 (1 and 2 can be in the same file)