HOMEWORK VI
ECE 3710 — Microcomputer Hardware and Software
Utah State University
Due date: **November 1, 2013**

Problem 1. You are part of a team implementing a traffic control system and it is your job to write the code that controls a traffic light. The light is lit according to the following sequence: red for 20 seconds, green for 30 seconds, and yellow for 5 seconds (then back to red); this pattern should repeat forever. Assume that the red, green, and yellow lights are connected to `PC.0--2`, respectively, and that to turn a light on its pin is asserted high and to turn it off it is set low. Rather than using an internal oscillator for a timer source, you have decided to connect a chip that generates a 5 Hz square wave to the external input for timer one/a and use it as the timer source. Your code must make use of this external timer source. Since only one uC will be used for the entire system, it will have to be capable of running many task simultaneously; thus you need to use an interrupt service routine with timer one/a to change the lights so you don't block other tasks from executing. Do this in assembly and C.

Problem 2. Let's say that you have two devices capable of communicating via UART that you need to connect together but that one of them operates at 28,800 baud and the other operates at 57,600 baud. This is a common problem that can be solved with a *serial buffer*. A serial buffer is a device that receives data at a faster rate than it sends it and, to prevent any information being lost, stores received data in memory until it can be transmitted.

For this problem, you are to write a serial buffer program in C that configures the M3/4 to receive data at 57,600 baud and transmit it at 28,800 baud, using interrupts. Data should be buffered (stored) in data space and transmitted in a first in, first out (FIFO) manner. Your serial buffer implementation needs to be capable of transmitting data at the same time as it is receiving it (hence the need for interrupts). Prioritise receiving data over sending it. You may find it useful to employ a circular buffer.

Problem 3. (EXTRA CREDIT) Implement the DuhES encryption routine from `http://dominionofawesome.com/cryptobox/`.