Lab 4 – Part 3
Serial Communications
The I²C Bus and the Dallas DS 1307 Real Time Clock

Introduction and Objectives

The Dragon12-Plus board has a Dallas Semiconductor DS 1307 Real Time Clock connected to the I2C bus of the MC9S12 microcontroller. You will program your MC9S12 to set the correct time in the DS 1307, and to display the time on your LCD display. A crystal connected to the DS 1302 oscillates at 32.768 kHz. Note that 32, 768 = 2^{15}, so dividing the oscillator by 2^{15} will result in a signal with a period of 1 second. The DS 1307 uses this 1 Hz signal to keep the date and time. It correctly takes care of leap years, and can be programmed to give the time in either 24 hour mode, or 12 hour mode with AM and PM indicators. It connects to a microcontroller using a two-wire I2C interface.

1. The Prelab

For the Prelab, write the functions iic_receive(), iic_receive_m1(), iic_receive_last(), and iic_swrcv() form Homework 10.

2. The Lab

1. Look at the datasheet for the DS 1307. Determine the addresses of the time registers.

2. Program the MC9S12 to set the time on the DS 1307. The lecture notes from last week discuss how to write to and read from slave devices on the I2C bus. Note that to access the DS 1307, you need to initialize the I2C subsystem, send a byte which contains the I2C address of the DS 1307 (which is listed in the datasheet), and indicate whether you are going to write to the device or read from the device. To write the time to the DS 1307 you need to first send the address of the first register you want to program, followed by the data for that register and the subsequent time registers

3. Write a C program to read the time and date from the DS 1307 and write it to the terminal using the printf command.

4. Program the MC9S12 to continuously display the time and date on the LCD display. The date should be displayed in the first line, and the time on the second line, of the LCD display. All you have to do is to convert the time and data from the DS 1307 into two strings, one for the data and the other for the time. This is easy to do since the data from the DS 1307 is in BCD format. For example, the year 2013 will be of the form 0x13. Here is some C code to display the year part of the date, where the date is in the form 13/04/05 for April 4, 2013.

Program 1 Code parts to display the year part of the the date.

```
char s [16] ;

openlcd ( ) ;                        // Set up LCD to write to first line
s[0] = ( year>>4)&0 x f f + '0';     // Get 4 MSB o f year, convert to ASCII
s[1] = year&0 x f f + '0';           // Get 4 LSB o f year, convert to ASCII
s[2] = ' / ' ;
. . .                                // Code for rest of date
s[8] = 0 ;                           // Terminate string with null character
puts 2lcd (s) ;                      // Display on first line of LCD
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5. For extra credit, add the code to the start of your program needed to load the program into EEPROM. Go ahead and load the program into EEPROM and verify that it works. Your Dragon12-Plus board can now be used as a wrist-watch (as long as you carry around a battery to power it).