

# UNC Charlotte, ECGR 4892/6090/8090, Spring 2004: Practical Final Exam

Timers, interrupts, temperature sensing, and wireless communications

*This Practical Final Exam is to be worked on by each student on his or her own. You may not work with a lab partner. You may not consult with any other student in any way*

## Learning Objectives

Using your Renesas evaluation board and a Bluetooth communications board, send the temperature to a “Central monitoring computer”.

## General Information

The general steps for this lab are:

1. Create a new folder for the exam. Copy your files from lab 3 into the new folder.
2. Generate a new project using the files you just copied. Name your new project Exam.
3. Open and edit your main.c file to perform the lab functions.
4. Program the lab. Don't forget the necessary include files to get the correct functionality.
5. Compile the code into an .x30 file, and load onto the board.
6. Test the program and repeat steps 4, 5, and 6 until the program works as required.
7. Write your lab report.
8. Demonstrate for the professor and turn in your report and files.

## Prelab Activity

None.

## Laboratory Assignments

You may use the PCs in Smith 347 or your own PC to do this lab experiment. The machines in Smith 347 already have the software tools loaded. In this lab you will be utilizing onboard timers, onboard temperature sensing and the RS-232 port of the Renesas board to send data to a PC which also has a Bluetooth communications board.

Lab 3 required users to send data many bytes at a time, in a “packet” at a regular frequency. Also, the bytes in the pack should be sent at a speed most closely computed to 57,600 bps. Specifically, the packet for this lab should contain:

- Bytes 1 to 13: Bluetooth specific information: x02 01 20 13 00 0F 00 41 00 0B EF 14 00
- Bytes 14 to 15: Source board identifier – Board sending this packet (each group was given two identifiers, one for each board). Each lab partner will take one of these numbers. Send them in ASCII. If your board is x60, send x36 30.
- Bytes 16 to 17: a colon followed by a space, in ASCII
- Bytes 18 to 22: the temperature of the board, in Fahrenheit, to one decimal place, in five ASCII bytes. If the temperature is less than 100.0 degrees, pad the front with a space. For example, 70.3 degrees will be x20 37 30 2E 33
- Bytes 23 to 24: Bluetooth specific information: x00 9A

You should receive no response to your message.

## Steps

1. Modify the main.c file and include the appropriate files. Include commenting along the way.
2. Build your program slowly, testing along the way. Perform compiles and solve each requirement one at a time. Make sure comments are written as you progress.
3. Continue to build and test the program until all of the requirements have been met. Did we mention you should write your comments as you progress, not at the end?
4. If you run into problems, use the break point functionality of KD30 to step through the code until you find the problem.
5. Once all the requirements have been met, ensure that everything works.
6. Finish lab write-up and demonstrate for the professor.
7. Submit your report, C code (\*.c) and .map files on a floppy disk, CD ROM, or email.

## Requirements

- Req. 1 – The code generated is written in C for the MSV30262-SKP
- Req. 2 – The code is well commented and easy to follow.
- Req. 3 – Use the Bluetooth board and cables provided by the professor.
- Req. 4 – The maximum transmission distance is 10 meters.
- Req. 5 – The serial communications with the Bluetooth board should operate at 57600 baud 8,N,1
- Req. 6 – You will transmit the packet, specified above, once every three seconds.
- Req. 7 – The transmission frequency will be guided by a three second interrupt. The interrupt service routine will simply set a flag and return.
- Req. 8 – The main body of the while(1) loop will look for the flag in Req. 7. When found, it will read the temperature sensor, build the packet, queue the packet, and start the communications.
- Req. 9 – A queue must be used for the transmit packet, with interrupt also used to transmit all characters/bytes in the queue.
- Req. 10 – The LCD does not need to show characters, but can be used during debug.
- Req. 11 – The Bluetooth hardware should be powered by a USB cable.
- Req. 12 – You should hand the entire box and all cabling to the professor one you demonstrate the lab in order to avoid an “F” for the class.
- Req. 13 – You should receive no response to your message. If you do, ignore it.
- Req. 14 – To set up the Bluetooth communication module, use our PC.

## Lab Report

Include in your Exam report observations and procedure like the following:

*The general learning objectives of this exam were . . .*

*The general steps needed to complete this exam were . . .*

*Some detailed steps to complete this exam were . . . .*

1. *Step one*

2. *Step two*

3. *. . . .*

*Code generated for this exam ...*

*Some important observations while completing/testing this exam were . . .*

*In this exam we learned . . . .*

Send the code the .map file, and the report to Dr. Conrad via email.