UNC Charlotte–ECGR4101/5101-Midterm Exam –10/8/08

Name: _____ Mosaic User ID _____

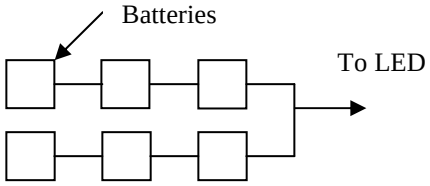
Question	1	2	3	4	5	6	7	Total
Score	/5	/10	/10	/15	/10	/40	/60	/150

You are permitted 75 minutes to take this test, no more. This is an open book/open notes test. You are allowed the following items for the test: calculator, books, notes, homework, labs, pencils and erasers. You are not permitted to have any of the following on your desk during the test: computer, cell phone, or other electronic assistance. Failure to abide by this policy will result in a zero for the test and a visit to the UNC Charlotte honor board. **Put your answers on paper provided, and turn in this sheet and the answer pages - use only that paper.**

Please read and sign this statement: I have not received from anyone nor assisted others while taking this test. I have also notified the test proctor of any of these violations noted above.

Signature: _____

1. You have several 200mAh 1.5V batteries and a LED that has an average drain of 3.5mA at 4.5V. If you had the following battery configuration how long would the LED stay lit? (5 points)



2. Show how the C array **int a[5][3];**is laid out in memory for our Renesas board and compiler. Remember to pay attention to endianness, indicating which byte is located where. (10 points)

Address	**Array Element**	**Which byte?**
a		
a+1		
a+2		
a+3		
a+4		
a+5		
a+6		
a+7		
a+8		
a+9		
a+10		
a+11		
a+12		
a+13		
a+14		
a+15		

Address	**Array Element**	**Which byte?**
a+16		
a +17		
a +18		
a +19		
a +20		
a +21		
a +22		
a +23		
a +24		
a +25		
a +25		
a +27		
a +28		
a +29		
a +30		
a +31		

3. Given the following information of a particular analog to digital converter, determine the value of the digitally represented voltage and the step size of the converter. (10 points)
   - The device is a 8-bit ADC with a + reference voltage of 5 volts and a – reference voltage of -0 volts.
   - The digital representation is: 0011 0010.

4. Examine the assembly language code to the right. Assume that the variable x is stored in -6[FB] and variable y is stored in - 4[FB]. Write the C code for this Assembly Language code. (15 points)

```
mov.w - 6[FB], R0
cmp.w # 0001H, R0
jeq L8
cmp.w # 001fH, R0
jeq L9
jmp L10
L8:
add.w # 0003H, - 4[FB]
jmp L7
L9:
sub.w # 0011H, - 4[FB]
jmp L7
L10:
sub.w # 0001H, - 4[FB]
L7:
```

5. What are the benefits of a microprocessor/microcontroller-based embedded system over an ASIC-based embedded system? (10 points) (in three to five sentences)

6. Imagine you have an embedded system that uses your SKP board. The system will:
   - Req. 1: Use the C programming language.
   - Req. 2: Continually poll SW1. While it is pressed, light the green LED.
   - Req. 3: Continually poll SW2. While it is pressed, light the yellow LED.
   - Req. 4: Continually poll SW3. While it is pressed, light the red LED.
   - Req. 5: Two or three LEDs can be lit at the same time.
   - Req. 6: Include a few comments, including headers.

   Write the algorithm (general steps) which implements the above functionality (40 points)

7. In one main program, write the code for the algorithm from problem 6. Assume that the standard sfr62p.h file is available, attached. You do not need comments. (60 points)