UNCA CSCI 255
Exam 2 Fall 2010
30 November, 2010

This is a closed book and closed notes exam. It is to be turned in by 4:25 pm. Calculators, PDA's, cell phones, and any other electronic or communication devices may not be used during this exam.

Name:_____

If you want partial credit for imperfect answers, explain the reason for your answer!

Problem 1 (12 points) Two's complement to decimal conversion
Convert the following four seven-bit two's complement numbers into signed decimal representation.

1100100	**0000011**
0100100	**1000000**

Problem 2 (10 points) Adding
Add the following pairs of seven-bit two's complement numbers **and indicate which additions result in an overflow**.

0111101 **+ 1001010**	**0010010** **+ 0110100**
1101010 **+ 1100110**	**1010001** **+ 1110000**

Problem 3 (12 points) Memories
A 2 kB memory has a 32-bit word size. How many words are contained in this memory?

A memory has 1k words. Each word contains 16 bits. How many bytes are contained in this memory?

A computer memory has a 24 bit words stored in 2M locations. What is the size of this memory in bytes?

How many bits are required to address the 2M words of this memory?

Problem 4 (16 points) Truth to Gates
Draw a circuit, at the gate level, that will implement the following truth table, where A, B, and C are inputs and where Z is the single output.

A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Problem 5 (10 points)
Describe how the following `while` loop can be expressed in C without using the `while`. Instead use the `if` and the `goto` and a couple of labels.

```
while (n < 320) {
     n = n + 50 ;
}
```

Problem 6 (10 points)
Describe how the following `if` statement can be expressed in C without using the `&&` operator. Be sure that the second operand of the `&&` is evaluated only when the first operand is true. In this case, that means that the `%` and `/` operations are never performed when `n` is 0.

```
if (n != 0 && 5%n > 0 ) {
     n = 5/n ;
}
```

Problem 7 (10 points)
Suppose `x` refers to a file register (data memory location) on a PIC24, write the PIC24 assembly code needed to set register `R4` to 3 times the value stored in `x`, that is, to perform `R4 = 3*x`.

Problem 8 (10 points)
Suppose `x` refers to a file register (data memory location) on a PIC24, write the PIC24 assembly code which sets `x` to the maximum of `x` and 5, that is, which executes the following C sequence. (Hint, use `cp` and `bra`.)

```
if  (x < 5) {
     x = 5 ;
}
```

This should be 24 binary bits

Problem 9 (10 points)
In the left column there are five PIC24 instructions. In the right column write the 16 binary bits needed to encode each instruction in PIC24 instruction set.

`add  SR`	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
`add  #30, W8`	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
`mov  SR, W8`	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
`mov  SR, WREG`	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
`mov  #30, W8`	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _