CS/ECE 252: INTRODUCTION TO COMPUTER ENGINEERING
COMPUTER SCIENCES DEPARTMENT
UNIVERSITY OF WISCONSIN—MADISON

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Midterm Examination 1
In Class (50 minutes)
Wednesday, February 14, 2006
Weight: 15%

CLOSED BOOK, NOTE, CALCULATOR, PHONE, & COMPUTER.

The exam in two-sided and has **six** pages, including two blank pages at the end.

Plan your time carefully, since some problems are longer than others.

NAME: _____

ID# _____

Problem Number	Maximum Points	Actual Points
1	4	
2	3	
3	3	
4	4	
5	4	
6	4	
7	4	
8	4	
Total	30	

Problem 1 (4 points)

(a) What is the largest (most positive) integer that can be represented as an *unsigned* integer using 10 bits?

(b) What is the largest (most positive) integer that can be represented as a *two's complement* integer using 10 bits?

Problem 2 (3 points)

Consider bitwise logical operations:

(a) Compute **`0011 AND 1001`**

(b) Compute **`0011 OR 1001`**

(c) Compute **`NOT 1001`**

Problem 3 (3 points)

Convert the number **`-33`** (base ten) into two's complement representation with 8 bits.

Problem 4 (4 points)

Consider the 8-bit binary bit pattern **`11010111`**. What is its decimal (base ten) value if the bit pattern is interpreted as:

(a) An unsigned integer?

(b) A two's complement integer?

Problem 5 (4 points)

(a) Add the following 5-bit two's complement binary numbers: **`01110 + 10110`**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

(b) Add the following 5-bit two's complement binary numbers: **`11101 + 11111`**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

Problem 6 (4 points)

(a) Convert the hexadecimal number (base sixteen) number **`6A1F`** into binary

(b) Convert the binary number **`10011101`** into a hexadecimal number (base sixteen)

Problem 7 (4 points)

(a) Why do most computers represent numbers in binary (base two) rather than decimal (base ten)?

(b) What is the name given to the hardware/software interface?

Problem 8 (4 points)

(a) Given an example of a number that **can** be represented in *32-bit IEEE 754 floating-point,* but **cannot** be represented as a *32-bit two-complement integer*. Explain why.

(b) Computer C1 has an instruction for addition but no instruction for multiplication. Computer C2 has instructions for both addition and multiplication. Can computer C2 solve more problems than computer C1? Why or why not?

Scratch Sheet 1 (in case you need additional space for some of your answers)

Scratch Sheet 2 (in case you need additional space for some of your answers)