Name: _____ Date: _____

CS270 Homework Assignment 1
"Number Crunching"

Due Thursday, September 5 (start of class)
Homework and programming assignments are to be done individually.

Goals

To understand data representation in a computer, including Boolean, integer, floating point, and character values, and the associated logical and arithmetic operations.

Please write the answers clearly in the space provided. You must show all work if you wish to be eligible for partial credit. If necessary, show your work on a separate sheet, clearly labeled with the question number, and attach it to your submission.

The Assignment

Question 1 (10 points): Suppose that there are 20 keys on a certain keypad. If each key is to be represented by a single, unique combination of bits, what is the minimum number of bits needed to represent all 20 keys? If you use exactly this minimum number of bits, how many additional keys could you represent?

Minimum number of bits: _____

Number of additional keys you could represent: _____

Question 2 (10 points): What are the binary and hexadecimal representations of the decimal value 43218765?

Binary: _____

Hexadecimal: 0x_____

Question 3 (10 points): What is the range of unsigned integers that can be stored using 13 bits? What is the range for signed integers stored represented in 1's and 2's complement, with the same number of bits?

Range of unsigned integers: _____ to _____

Range of signed integers: _____ to _____ (1's complement)

Range of signed integers: _____ to _____ (2's complement)

Question 4 (10 points): Show the 2's complement addition of -27 plus +31, with both numbers in binary using 6 bits. Hint: make sure that the resulting binary number corresponds to the correct answer.

_____ (-27) + _____ (31) = _____ (4)

Question 5 (10 points): Show the 2's complement subtraction of +12 from +25, with both numbers in binary using 6 bits. Hint: make sure that the resulting binary number corresponds to the correct answer.

_____ (28) - _____ (12) = _____ (16)

Question 6 (10 points): Show the results of the following bitwise operations (using the same number of bits as shown in each problem):

NOT(1011 0101 0100) = _____

1110 1001 OR 0101 0001 = _____

0100 0110 AND 0111 0100 = _____

1101 0100 XOR 1111 0110 = _____

NOT(0000 0101 XOR 0100 1011) = _____

Question 7 (10 points): Show the results of the following bitwise operations:

~(0xA345 & 0xB789) = 0x_____

(0xFFF2 ^ 0xA1E2) | 0xD357 = 0x_____

Question 8 (10 points): Find the floating-point numbers from the following values (assuming IEEE-754 32-bit floating-point representation):

0x40D00000 = _____f

1 10000001 00010000000000000000000 = _____f

Question 9 (10 points): Find the binary and hexadecimal numbers for the following floating-point values in IEEE 16-bit floating-point representation (note that this is different from the format in the book – review the lecture notes and see http://en.wikipedia.org/wiki/Half_precision):

42.75f = 0x_____ (hexadecimal)

12.625f = _____ (binary)

Question 10 (10 points): Translate the following strings into ASCII values and vice versa:

"FlipFlop" = 0x_____

0x4162737472616374696f6E = "_____"

Submission Instructions

All written homework assignments are due at the beginning of class Thursday on the due date.

Late Policy

Late assignments will be accepted up to 24 hours past the due date with a deduction of 10%. Late assignments should not be will not be accepted after that. Late submissions must be made via RamCT (.txt or .pdf files only).