

Homework 2 CS/ECE 252: Sec 1 & 2 [Due at lecture on Wed, Feb 05]

Primary contact for this hw: Sujith Surendran [sujiths at cs dot wisc dot edu]

**Instructions:** You must do this homework alone. Please hand in ONE copy of the homework listing your section number, full name (as appear in Learn@UW) and UW ID. You must staple all pages of your homework together to receive full credit.

**Problem 1 (2 points)**

Assume that UW-Madison is hosting an Athletic Meet this Spring, and 300 athletes have registered for the event. Since you are a volunteer for the event, you've been assigned the task of designing T-Shirts **for all the registered athletes** with unique numbers printed on each of them . Assume that you came up with a design similar to that shown in Fig 1. But instead of printing numbers in decimal (like 20 shown in figure), assume that you decided to print numbers in binary !!



*Fig. 1 Sample T-shirt*

a) What is the minimum number of bits that you need to print on each side of the T-shirt, so that the number is unique for each registered candidate?

b) How many more athletes can you accommodate in the event, without increasing the number of bits printed on the t-shirt?

**Problem 2 (1 point)**

Convert the following bit sequence to hexadecimal:

0010 0011 1100 1010

**Problem 3 (4 points)**

The binary number 1100 1001 is a string of 0s and 1s that can be interpreted differently depending on its data type. Please find the decimal value of this binary number if its data type is:

- a) An unsigned integer
- b) A signed-magnitude integer
- c) A 1's complement integer
- d) A 2's complement integer

**Problem 4 (5 points)**

Convert the following decimal numbers to 6-bit 2's complement binary numbers. If the number cannot be converted to 6-bit 2's complement binary number, specify that it is not possible and also indicate what is the minimum number of bits required for representing this number in 2's complement notation.

- a) 31
- b) -31
- c) 32
- d) -32
- e) -33

**Problem 5 (8 points)**

The table below shows two sets of values for inputs A, B and various operations performed on them. Complete the rest of the table with the results of these operations. Assume that the values of A, B are in 4-bit 2's complement form

A	B	A + B	A - B	A AND B	A OR (NOT (B))
0100	0001				
1100	1111				

**Problem 6 (1 point)**

What conditions indicate overflow has occurred when two 2's complement numbers are added?

**Problem 7 (4 points)**

Write the decimal equivalents for the following IEEE single-precision floating-point numbers.

1. 0 01111110 100000000000000000000000
2. 1 10000000 010000000000000000000000

**Problem 8 (4 points)**

Represent the decimal 5.25 in

- a) Fixed point notation
- b) IEEE single-precision floating point notation

**Problem 9 (1 point)**

Convert the ASCII string "Hw\_2" to its hexadecimal representation. Only represent the characters within the quotation marks and assume it is null terminated.