Quiz 1, R03 Sept 21st, 2009

Name___________________________________ ID#_____________________

Calculators or any other electronic devices are NOT allowed.

You must show steps to gain credits.

Problem 1 (4 points) Sort all valid numbers among the following: 12100_3, 174_7, $6E_{16}$, 11110111_2, and 209_8.

Solution: The valid numbers are 12100_3, $6E_{16}$, 11110111_2.

$12100_3 = 3^2 \times 121_3 = 9 \times 16 = 144$; (1 pt)

$6E_{16} = 6 \times 16 + 14 = 110$; (1 pt)

$11110111_2 = F7_{16} = 15 \times 16 + 7 = 247$. (1 pt)

Hence, $11110111_2 > 12100_3 > 6E_{16}$. (1 pt)

Problem 2 (4 points) Two 32-bit numbers in 2's complement form:
A = 1011 0001 0011 0101 0111 1001 1011 1101,
B = 1000 1100 1000 1010 1000 0100 0110 0110.
First, find A – B and state whether overflow/underflow occurs. Then store the result 32-bit number in Hex into the following memory block using small endian byte order.

Solution: –B is:
0111 0011 0111 0101 0111 1011 1001 1010. (1 pt)
Add it and A, and we get:

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  0111 0011 0111 0101 0111 1011 1001 1010
+ 1011 0001 0011 0101 0111 1001 1011 1101
1 0010 0100 1010 1010 1111 0101 0101 0111
Hex: 2    4    A    A    F    5    5    7  (1 pt)
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A and –B have different signs, so there is neither overflow nor underflow, even though there is 1 carry bit (which we ignore). (1 pt)

Byte 3	24
Byte 2	AA
Byte 1	F5
Byte 0	57

(1 pt)

Problem 3 (2 points) Convert the binary number 10.0110_2 to single precision IEEE 754 format in Hex.
(IEEE format is has 1 sign bit, 8 exponent bits and 23 fraction bits)

Solution: $10.0110_2 = +1.00110_2 \times 2^1 = +1.00110_2 \times 2^{128}$ after adding the excess 127.
The IEEE format in binary is 0 100 0000 0 001 1000 0000 0000 0000 0000. (1 pt)
The Hex form is 40180000_{16}. (1 pt)