Quiz 1, R01 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: $11200_3$, $7F_{16}$, $514_5$, $11110111_2$, and $209_8$.

Solution: The valid numbers are $11200_3$, $7F_{16}$, $11110111_2$.

$11200_3 = 3^2 \times 112_3 = 9 \times 14 = 126$; (1 pt)

$7F_{16} = 7 \times 16 + 15 = 127$; (1 pt)

$11110111_2 = F7_{16} > 7F_{16}$ (1 pt)

Hence, $11110111_2 > 7F_{16} > 11200_3$. (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 big endian byte order.

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

```
  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 | 57 |
| Byte 2 | F5 |
| Byte 1 | AA |
| Byte 0 | 24 |

(1 pt)

**Problem 3 (2 points)** Convert the binary number $0.100110_2$ to single precision IEEE 754 format in Hex.
(IEEE format is has 1 sign bit, 8 exponent bits and 23 fraction bits)

Solution: $0.100110_2 = +1.00110_2 \times 2^{-1} = +1.00110_2 \times 2^{126}$ after adding the excess 127.
The IEEE format in binary is 0 011 1111 0 001 1000 0000 0000 0000 0000. (1 pt)
The Hex form is 3F180000. (1 pt)