Name: **Id#**

COE 301/ICS 233, Term 172

Computer Architecture & Assembly Language

Quiz# 5 Solution

Date: Tuesday, March 20, 2018

1. [3 Points] What is the decimal value of following single precision float:

   [1, 0111 1000, 0111 0000 0000 0000 0000 000]

   $= - (1.0111000000000000...0)_2 * 2^{(120-127)} = - (1.0111000000000000...0)_2 * 2^{-7}$
   $= -0.011230469$

2. [4 Points] Find the normalized single precision representation of –21.625.

   $21.625=(10101.101)_2 = (1.0101101)_2 * 2^4$
   Exp. = 4 +127=131
   Single precision binary representation:
   1100 0001 1010 1101 0000 0000 0000 0000

3. [2 Points] Find the smallest positive normalized float for single precision.

   - ✧ Exponent – bias = 1 – 127 = –126 (smallest exponent for SP)
   - ✧ Significand = $(1.000 \ldots 0)_2 = 1$
   - ✧ Value in decimal = $1 \times 2^{-126} = 1.17549 \ldots \times 10^{-38}$

4. [3 Points] Give the representation of Zero, -infinity, and NAN for single precision:

   +Zero: [0 , 00000000 , 000 0000 0000 0000 0000 0000]

   -infinity: [1 , 11111111 , 000 0000 0000 0000 0000 0000]

   NAN: [0 or 1, 11111111, any non-zero value]

5. [6 Points] Find the normalized <u>difference</u> between A and B by using rounding to nearest even. Perform the operation using **guard**, **round** and **sticky** bits

A= + 1.00000010000111110000001 × 2^4
B = +1.00001111100000010100000 × 2^{-3}

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        1.000 0001 0000 1111 1000 0001 000 x 2^4
-       1.000 0111 1100 0000 1010 0000 000 x 2^-3
-------------------------------------------------
       01.000 0001 0000 1111 1000 0001 000 x 2^4
-      00.000 0001 0000 1111 1000 0001 010 x 2^4  (align)
-------------------------------------------------
       01.000 0001 0000 1111 1000 0001 000 x 2^4
+      11.111 1110 1111 0000 0111 1110 110 x 2^4  (2's complement)
-------------------------------------------------
       00.111 1111 1111 1111 1111 1111 110 x 2^4
= +     0.111 1111 1111 1111 1111 1111 110 x 2^4
= +     1.111 1111 1111 1111 1111 1111 100 x 2^3  (normalize)
= +    10.000 0000 0000 0000 0000 0000     x 2^3  (round)
= +     1.000 0000 0000 0000 0000 0000     x 2^4  (renormalize)
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