Name: KEY **Id#**

ICS 233, Term 063

Computer Architecture & Assembly Language

Quiz# 3

Date: Monday, August 6, 2007

Q.1. Using the refined **signed multiplication** hardware, show the signed multiplication of: **Multiplicand=1101** by **Multiplier=1101**. The result of the multiplication should be an 8 bit signed number in HI and LO registers. Show the steps of your work by filling the table given below.

Iteration		**Multiplicand**	**Sign**	**Product = HI, LO**
0	Initialize (LO = Multiplier)	1101		0000 110**1**
1	LO[0] = 1 => ADD		1	1101 1101
	Shift Product = (HI, LO) right 1 bit	1101		1110 111**0**
2	LO[0] = 0 => Do Nothing		1	1110 1110
	Shift Product = (HI, LO) right 1 bit	1101		1111 011**1**
3	LO[0] = 1 => ADD		1	1100 0111
	Shift Product = (HI, LO) right 1 bit	1101		1110 001**1**
4	LO[0] = 1 => SUB (ADD 2's comp.)	0011	0	0001 0011
	Shift Product = (HI, LO) right 1 bit			**0000 1001**

Q.2. Using the refined **unsigned division** hardware, show the unsigned division of: **Dividend=1111** by **Divider=0110**. The result of division should be stored in the Remainder and Quotient registers. Show the steps of your work by filling the table given below.

Iteration		**Remainder**	**Quotient**	**Divisor**	**Difference**
0	Initialize	0000	1111	0110	
1	1: SLL, Difference	0001	1110	0110	1011
	2: Diff < 0 => Do Nothing				
2	1: SLL, Difference	0011	1100	0110	1101
	2: Diff < 0 => Do Nothing				
3	1: SLL, Difference	0111	1000	0110	0001
	2: Rem = Diff, set lsb Quotient	0001	100**1**		
4	1: SLL, Difference	**0011**	**0010**	0110	1101
	2: Diff < 0 => Do Nothing				

Q.3. Show the IEEE 754 binary representation for: **-13.53125** in **single precision**.

13.53215 =($1101.10001)_2$ = 1.10110001 x 2^3
Exponent= 3+127=130
Thus, the representation of the number in single precision is:

1100 0001 0101 1000 1000 0000 0000 0000

Q.4. Perform the following floating-point operation rounding the result to the nearest even., using guard, round and sticky bits.

```
  0100 0010 0000 0000 0000 0000 0000 0000
-  0011 1111 1000 0000 0000 0000 0001 0001

     1.000 0000 0000 0000 0000 0000 000      x 2^5
-    1.000 0000 0000 0000 0001 0001 000      x 2^0
=    1.000 0000 0000 0000 0000 0000 000      x 2^5
-    0.000 0100 0000 0000 0000 0000 101      x 2^5

=   01.000 0000 0000 0000 0000 0000 000      x 2^5
+   11.111 1011 1111 1111 1111 1111 011      x 2^5

=   00.111 1011 1111 1111 1111 1111 011      x 2^5
=   +0.111 1011 1111 1111 1111 1111 011      x 2^5
=   +1.111 0111 1111 1111 1111 1110 111      x 2^4
```

Then, we round to the nearest even and we add a 1. Thus, the result will be:

```
     +1.111 0111 1111 1111 1111 1111          x 2^4
```