Assignment # 2
(CLO2 -> PLO2)
Computer System Architecture
Submission Deadline: 23rd Nov 2015

Note: Students should score 40% in OBE specific questions to ensure their accumulated scores towards respective PLOs are above 40%

1. This problem covers 4-bit binary multiplication. Fill in the table for the Product, Multplier and Multiplicand for each step. You need to provide the DESCRIPTION of the step being performed (shift left, shift right, add, no add). The value of M (Multiplicand) is 1011, Q (Multiplier) is initially 1010.

Product	Multiplicand	Multiplier	Description	Step
0000 0000	0000 1011	1010	Initial Values	Step 0
				Step 1
				Step 2
				Step 3
				Step 4
				Step 5
				Step 6
				Step 7
				Step 8
				Step 9
				Step 10
				Step 11
				Step 12
				Step 13
				Step 14
				Step 15

2. Consider 2's complement 4-bit signed integer addition and subtraction. Since the operands can be negative or positive and the operator can be subtraction or addition, there are 8 possible combinations of inputs. For example, a positive number could be added to a negative number, or a negative number could be subtracted from a negative number, etc. For each of them, describe how the overflow can be computed from the sign of the input operands and the carry out and sign of the output. Fill in the table below:

Sign (Input 1)	Sign (Input 2)	Operation	Sign (Output)	Overflow (Y/N)
+	+	+	+	
+	+	+	-	
+	+	-	+	
+	+	-	-	
+	-	+	+	
+	-	+	-	
+	-	-	+	
+	-	-	-	
-	+	+	+	
-	+	+	-	
-	+	-	+	
-	+	-	-	
-	-	+	+	
-	-	+	-	
-	-	-	+	
-	-	-	-	

3. This problem covers 4-bit binary unsigned division (similar to Fig. 3.11 in the text). Fill in the table for the Quotient, Divisor and Dividend for each step. You need to provide the DESCRIPTION of the step being performed (shift left, shift right, sub). The value of Divisor is 4 (0100, with additional 0000 bits shown for right shift), Dividend is 6 (initially loaded into the Remainder).

Quotient	Divisor	Remainder	Description	Step
0000	0100 0000	0000 0110	Initial Values	Step 0
				Step 1
				Step 2
				Step 3
				Step 4
				Step 5
				Step 6
				Step 7
				Step 8
				Step 9
				Step 10
				Step 11
				Step 12
				Step 13
				Step 14
				Step 15

4. Assuming single precision IEEE 754 format, what decimal number is represent by this word:
   1 01111101 00100000000000000000000
   (Hint: remember to use the biased form of the exponent.)

5. The floating-point format to be used in this problem is an 8-bit IEEE 754 normalized format with 1 sign bit, 4 exponent bits, and 3 mantissa bits. It is identical to the 32-bit and 64-bit

formats in terms of the meaning of fields and special encodings. The exponent field employs an excess-7 coding. The bit fields in a number are (sign, exponent, mantissa). Assume that we use unbiased rounding to the nearest even specified in the IEEE floating point standard. Encode the following numbers the 8-bit IEEE format:

(1) 0.0011011_{binary}

(2) $16.0_{decimal}$

(3) Decode the following 8-bit IEEE number into their decimal value: 1 1010 101

(4) Decide which number in the following pairs are greater in value (the numbers are in 8-bit IEEE 754 format):

0 0100 100 and 0 0100 111

6. Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 single and double precision formats.