National University of Computer and Emerging Sciences, Lahore Campus

	Course:	Computer Architecture	Course Code:	EE204
	Program:	BS(Computer Science)	Semester:	Fall 2017
			Total Marks:	80
	Due Date:	11-09-2017	Weight	3.3
	Section:	A, B,C	Page(s):	2
		Assignment 1		

Note: Submit hard copy of the assignment before 5pm.

Q1:

a) Using Boolean algebra proves that the following two functions are equal. (10 marks)

$$F(X,Y,Z) = \overline{(\overline{X})(\overline{Z}) + Z + Z(\overline{Y})} + (X+0)(\overline{Z}+Y)(\overline{Z}+\overline{Y})(Y+1)$$

$$G(X,Y,Z) = X(\overline{Z})$$

b) Represent the decimal number -18.625 into IEEE 754 binary representation

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Q2: Represent the following two numbers in normalized form using scientific notation (10 marks)

A = 1011 1110 1110 0000 0000 0000 0000 0000

B = 0100 0110 1101 1000 0000 0000 0000 0000

and then perform following operations showing all work

a. **A – B**
b. **A * B**

Q3: Design a 3-bit binary counter and shifter with parallel load and synchronous clear. (Arithmetic shifts are required)

Make Function table and draw the circuit diagram. (15 marks)

Q4: A = $(13)_{10}$ B = $(6)_{10}$

Use all three multiplier circuits studied in this course to compute A * B. Show the binary values of all the registers at every time step. (15 marks)

Q5: Draw a sequential circuit that has two D flip-flops, A and B, maintaining state, two inputs X and Y and one output Z. The output and next flip-flop states are given by the equations.

(15 marks)

$$A_{i+1} = \bar{X}Y + XA_i$$
$$B_{i+1} = X\bar{B}_i + X\bar{A}_i$$
$$Z = A_i(\bar{X}B_i + Y)$$

a) Draw the logic diagram of the circuit.
b) Tabulate the state table
c) Draw state diagram

Q6: Design a 4-bit ALU that supports the following operations: **(15 marks)**

1) A + B
2) A – B (2's complement subtraction)
3) 1-bit right shift (apply to input A)
4) 2-bit right shift (apply to input B)
5) 1-bit left shift (apply to input A)
6) 2-bit left shift (apply to input B)
7) A & B (bitwise AND)
8) A | B (bitwise OR)