Computer Architecture (EE 204)

Assignment # 1, Total marks 70. Due Date: 16 – 09 -2016

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You need to submit hardcopy. Please show your work clearly.

Assignment Description:
Assignment covers concepts related to Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations and Arithmetic Logic Shift Unit.

Question1: Number Representations (10 marks)

a) Convert $(234.125)_{10}$ to Binary.

b) What is the minimum number of bit needed to represent -145 in 2's complement signed representations?

c) Write down 2's complement signed representation of -115 using 8 bits

d) Perform the addition of following 8-bit signed binary numbers

i. 01110101

ii. 11011011

e) Perform the subtraction of following unsigned decimal numbers

10110 - 10010

<u>Question2:</u> Convert the following to 32-bit floating point representations.

(3+3+1+1+1+1 marks)

i. 300.375
ii. -20.0
iii. +inf
iv. –inf
v. 0
vi. NAN

<u>Question3:</u> The 8 bit registers, AR, BR, CR, and DR initially have the following values.

AR = 11101011

BR = 10110011

CR = 11010000

DR = 10101010

Determine the 8 bit values in each register after the execution of the following sequence of micro operations. (10 marks)

CR ← cil CR

AR ← ashl AR

CR←CR + DR, BR←shl BR

AR←AR - CR

AR←AR ^ BR

Question 4: **Circuit Design** **(15 marks)**

A sequential circuit 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.

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

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

Note: State table is similar to Truth Table but in this case, you determine the next state based on present state. For reference, you can see table 1-4 in chapter-1 on page 32.

Question 5: **(10 marks)**

Design 2-bit binary counter using JK flip flops which supports parallel load and circular right shift as well. Clearly state the input required to trigger each input.

Question 6: **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)