EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE 2001/2002 (Repeat)

FIRST SEMESTER (April, 2002)

CS 106 - Computer Organization and Architecture

Answer All Questions

Time: 2 hours

Q1

(i) Simplify the following Boolean Expressions:

(a) $(X+Y+Z)(\overline{X}+Y+Z)(\overline{X}+Y+\overline{Z})$

(b) $\overline{W}XZ + WZ + XY\overline{Z} + \overline{W}XY$

(ii) Show that

(a) $X + \overline{Y} + \overline{X}Y + (X + \overline{Y})\overline{X}Y = 1$

(b) $(W + X + YZ)(\overline{W} + X)(\overline{X} + Y) = XY + \overline{W}YZ$

(c) $(X+Y)(\overline{X}+Z)(Y+Z) = (X+Y)(\overline{X}+\overline{Z})$, using De Morgan's theorem.

(iii) Derive a Boolean expression for an output S which is true when the four inputs a, b, c, d have odd parity.

Explain why floating point representation is used in a computer. A particular 16 bit word computer combines two adjacent words to store floating point numbers using a **signbit**, a 8 bit **exponent** in **excess-128** format and a 23 bit **normalized fraction**.

Explain the meaning of the bolded terms.

Give the range of positive and negative numbers which can be represented in this system. Show how the numbers – 0.0625 and 1026.875 could be stored in the system

(i)   Describe the functions of the following registers in a computer
        (a)   MAR
        (b)   MBR
        (c)   PC
        (d)   ACC
        (e)   IR

(ii)   Explain the steps involved in instruction execution.

(iii)   Suppose you are given a Computer with 7 single address instructions.

        The instructions are

        LDA A   // Load accumulator
        STO A   // Store accumulator
        ADD A   // Add
        SUB A   // Subtract
        IN A   // Read from an input unit and store
                        at the address A
        OUT A   // Output the content of A to an
                        output unit.
        HALT   // Stop the execution

        Write a program to this computer to read three numbers X, Y, Z, compute P=X+Y-Z, and output P.

        Explain, with the aid of diagrams, the working of your program within the CPU.

What are the purposes of the following **Buses**

     (i)   Data Bus
     (ii)   Address Bus
     (iii)   Control Bus

(a)   Describe the steps involved in interrupt servicing procedure to cater to the I/O requirement.

(b)   Draw a schematic diagram for a DMA transfer and describe the steps involved in the DMA transfer of one word.

(c)   Illustrate with the aid of a diagram, the use of a **Cache memory**.