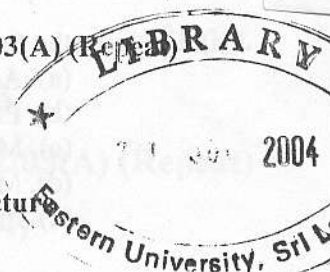


EASTERN UNIVERSITY, SRI LANKA
FIRST EXAMINATION IN SCIENCE 2002/03 & 2002/03(A) (Revised)
SECOND SEMESTER (April/May, 2004)



CS 106 – Computer Organization and Architecture

Answer All Questions

Time allowed: two hours

1. (i) Explain the terms

- (a). Combinational circuits
- (b). Sequential circuits

Give examples to each circuit.

Discuss the process of **synthesis** and **analysis** of a circuit.
Give examples.

(ii) Describe the function of a RS flip flop.

- (iii) (a). Describe the construction of a Full Adder.
- (b). Construct a Parallel Adder using Full Adders.

(iv) Show that

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

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

2. (i). Describe with the aid of examples, the properties of 2's complement numbers.

What is the range of 2's complement numbers in n bits and what will happen if we violate this range? Provide examples.

(ii). Explain the meaning of the following terms in the floating-point representation:

- (d) excess notation
- (e) normalized mantissa
- (f) hidden bit

(iii). Describe the single precision IEEE floating-point representation.

Perform the following calculations:

(a).
$$\begin{array}{r} 123.50 \\ +101.25 \\ \hline \end{array}$$

(b).
$$\begin{array}{r} 123.75 \\ -112.50 \\ \hline \end{array}$$

In each case show how the numbers would be stored in the computer.

In each case show how the numbers would be stored in the computer.

3.(i). Describe the functions of the following registers in a typical CPU:

- (a). Accumulator
- (b). Program Counter (PC)
- (c). Memory Address Register (MAR)
- (d). Memory Data Register (MDR)
- (e). Instruction Register (IR)

Discuss, with the aid of an example, the fetch/execute cycle with interrupt.

(ii). Suppose you are given a computer with the following 7 instructions:

```
POP  A //Popping from the stack and store it in A
PUSH A //Pushing A into the stack
MUL   //Multiply the two elements on the top of the stack and push onto the stack
DIV   //Divide the top element by the next element and push the result onto the
      stack
IN  A //Read from an input unit and store at the address A
OUT A //Out put the content of A to an output unit
HALT //Stop the execution
```

Write a program to this computer to do the following tasks:

- (a). read three numbers A, B and C.
- (b). compute $Z=X*A*B$, where $X=A*B/C$
- (c). output Z.

4. (i). Describe the different bus system in a computer.

(ii). Illustrate, with the aid of a block diagram, the use of **Cache memory** in alleviating the speed mismatch of memory and processors. Explain the terms **spatial locality** and **temporal locality** of reference of instructions in programs.

(iii). Draw a schematic diagram for a **DMA** transfer from input to memory and describe the steps involved in the **DMA** transfer of one word.

What is cycle stealing?

Briefly describe the procedure involved in transferring a block of data from a high speed device such as a disk drive.