



EASTERN UNIVERSITY, SRI LANKA
 SECOND EXAMINATION IN SCIENCE 2002/2003 (Repeat)
 FIRST SEMESTER (June/July, 2003)

CS 206 Computer Organization and Architecture

Answer all Questions

Time allowed: 2 Hours

Q1 State and prove De Morgan's Theorem.

(a) Prove that $(A + B)(\overline{AB}) = A\overline{B} + \overline{A}B$

(b) Simplify the following expressions

i. $\overline{A.(C + \overline{B}) + A.\overline{C} + (\overline{B} + A)}$

ii. $\overline{\overline{A + B.C} + D.(E + \overline{F})}$

(c) State the characteristics of a flip-flop.

Construct RS flip-flop using NOR gates and describe its function.

Q2 Answer all parts

(a) Describe, with the aid of examples, the properties of 2's complement numbers. What is the range of two's complement numbers in n bits and what will happen if we violate this range? Provide examples.

(b) Explain why floating point representation is used in a computer.

A particular computer allocates 16-bits to represent a floating-point number, using 6-bits exponent in **excess-32** and 10-bits two's complement **normalised mantissa**.

Explain the meaning of the bolded terms.

Perform the following calculations:

i.
$$\begin{array}{r} 123.5 \\ +113.4 \\ \hline \hline \end{array}$$

ii.
$$\begin{array}{r} 123.5 \\ -112.8 \\ \hline \hline \end{array}$$

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

Q3 Answer all parts

(A) Describe the function of the following registers in a computer:

- (i) Instruction Register (IR)
- (ii) Program Counter (PC)
- (iii) Memory Data Register (MDR)
- (iv) Accumulator (ACC)
- (v) Memory Address Register (MAR)

Consider a computer with the following instruction format:



- (i) What is the length of the instruction register?
- (ii) How many bits are there in the PC register?
- (iii) How many words can be directly addressed?

(B) Explain the steps involved in instruction execution.

Describe the **Pipelining** technique in the instruction execution of a computer. Illustrate with an example.

Q4 Answer all parts

(a) Describe the different bus systems in a computer.

(b) Illustrate, with the aid of a diagram, the use of a **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.

(c) 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.