## 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 Morgon's Theorem.

- (a) Prove that  $(A+B)(\overline{AB}) = A.\overline{B} + \overline{A.B}$
- (b) Simplify the following expressions

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

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

(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:

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)

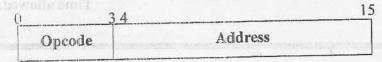
(ii) Program Counter (PC)

(iii) Memory Data Register (MDR)

(iv) Accumulator (ACC) - Man A for management was made 3 and 2 and 3 and

(v) Memory Address Register (MAR)

Consider a computer with the following instruction format:



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- (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 highspeed device such as a disk drive.