

EASTERN UNIVERSITY, SRI LANKA
EXTERNAL DEGREE IN SCIENCE
FIRST EXAMINATION IN SCIENCE 2002/03
SECOND SEMESTER (Sep./Oct., 2005)

EXCS106 -- Computer Organization and Architecture

Answer All Questions

Time Allowed: 2 Hours

Q1

Explain the terms:

- (i). Combinational circuits
- (ii). Sequential circuits

Give examples to each circuit.

A device accepts natural binary numbers in the range 0000 to 1111, which represent 0 to 15. The output of the circuit is true if the input to the circuit represents a prime number and is false otherwise. Note that zero (0000) and one (0001) are not considered as prime numbers.

- (a) Construct a truth table and obtain the logical expression.
- (b) Simplify the expression using Karnaugh map.
- (c) Design a circuit to implement this simplified expression.

Q2

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

Give a method to detect overflow in the computation involving 2's complement numbers. Give examples.

- (b). Explain the meaning of the following terms in the floating-point representation:
- (i). excess notation
 - (ii). normalized mantissa
 - (iii). hidden bit

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

Represent the following decimal numbers in the single precision IEEE format:

- (a) 576.375 (b) -0.0025 (c) 0.001

Q3

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

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

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

(b) 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 | // Out put the content of A to an output unit |
| HALT | | // Stop the execution |

Write a program to this computer to read three numbers A, B, C, compute $P=A+B-C$ and output P.

Q4

Write short notes on the following:

- (a) Bus system
- (b) Cache memory structure
- (c) Direct memory access (DMA)