EASTERN UNIVERSITY, SRI LANKA
DEPARTMENT OF MATHEMATICS
FIRST YEAR EXAMINATION IN SCIENCE (2013/2014)
SECOND SEMESTER (April / May, 2016)
CS 106 – COMPUTER ORGANIZATION AND ARCHITECTURE

Answer all questions   Time allowed: 02 hours

Computer Architecture is the design of the systems visible to the programmer or those attributes that have a direct impact on the logical execution of a program.

a) Explain *Instruction Set Architecture* (ISA) in detail.

b) Explain the possible functions of computer with appropriate examples.

c) Discuss the main concepts behind the *Von Neumann architecture*.

d) Define and describe the following terms related to computer architecture:

    i.   Random Access Memory (RAM);
    ii.   Input / Output subsystem;
    iii.   Control Unit (CU);
    iv.   Registers;
    v.   Buses;

e) Discuss the main factors which depend on the performance of a computer.

a) Signed numbers are required to encode negative numbers in binary number system.
    i. What are the three common ways of representing signed numbers?
    ii. Explain any two of which you have mentioned in part a(i) with examples.

b) Convert the following octal numbers to binary numbers:
    i. 72;
    ii. 53.42;

c) Convert the following hexadecimal numbers to octal numbers:
   i. AB7;
   ii. F8.92;

d) Simplify the following Boolean expressions:
   i. $(A + \bar{B} + \bar{C})(A+\bar{B}C)$;
   ii. $(\overline{X+Y})(\overline{\bar{X}+\bar{Y}}) + XY$;

e) Briefly explain how a *Full adder* works in a digital circuit to perform arithmetic operations.

03. All Boolean expression regardless of their form can be converted into standard forms.

a)
   i. What is meant by the term *"Standard POS forms"* (Standard Product form)?

   ii. Write down the rules which can be used for the conversion from POS to S POS?

b) Convert the following Boolean expression into standard POS form :
   $(A+\bar{B})(B+\bar{C}+\bar{D})(\bar{A}+B+\bar{C}+\bar{D})(A+\bar{B}+\bar{C}+\bar{D})(A+B+\bar{D})$

c) Express the Boolean function, $F(A, B, C) = (A+\bar{B}C)(A+C)$ in a sum of minterm an aid of a truth table.

d) A *Karnaugh Map* (K-Map) is a two dimensional representation of Boolean which uses to simplify Boolean expressions easily.

   i. Describe the rules of simplification in the development of the K-Map.

   ii. Discuss the advantages and disadvantages of K-Map representation.

e) Reduce the following term as a minimized SOP form using K-Map.

$$F(a, b, c, d) = \sum m(0, 1, 3, 5, 7, 10, 11, 12, 13, 14, 15)$$

a) What is *Direct Memory Access* (DMA)? Discuss the process involved in the DMA controller.

b) Describe briefly the *Instruction-Execution cycle*.

c) While processing a sequence instruction execution there may be *interrupts*.
State any four factors which are responsible for the occurrence of an interrupt and briefly explain what will happen after the arrival of an interrupt signal.

d) *Pipelining* technique is the best method than sequentially processing each instruction.
   i.   Briefly explain the technique, "Pipelining" which is used in advanced microprocessors.
   ii. *"The smooth execution of the pipeline can be disrupted by several hazards".* Verify the validity of this statement.

e) Distinguish between *Reduced Instruction Set Computers* (RISC) and *Complex Instruction Set Computers* (CISC).