Roll No. .....

67011

M.C.A. Ist Sem. w.e.f. Dec. 2011 (Old)

Examination – December, 2012

(For Re-appear Candidates)

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper : MCA-101

Time : Three hours] *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complain in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all by selecting at least ***one*** question from each Unit. All questions carry equal marks.

UNIT – I

1. (a) Given A = {1, 2, 3, 4}. Consider the following relation in A

R = {(1, 1), (2, 2), (2, 3), (3, 2), (4, 2), (4,4) }

(i) Draw its directed graph.

(ii) Is the relation R is reflexive, symmetric, transitive or antisymmetric.

(iii) Find $R^2 = R \circ R$.

(b) Define recursive functions. Let n denote a positive integer, Suppose a function L is defined recursively as follows

$$L(n) = \begin{cases} 0 & \text{if } n = 1 \\ L([n/2]) + 1 & \text{if } n > 1 \end{cases}$$

Find L(25).

2. (a) Define monoid. Prove that the fourth roots of unity will form the abelian group with multiplication as binary operation.

(b) Define Cosets. Prove that in a group the inverse of any element is unique.

UNIT – II

3. (a) Let p denote the statement, "The material is interesting," and q denote the statement, "The exercises are challenging," and r denote the statement, "The course is enjoyable." Write the following statements in symbolic form:

(i) The material is interesting and the exercises are challenging.

(ii) The material is uninteresting, the exercises are not challenging, and the course is not enjoyable.

(iii) If the material is not interesting and the exercises are not challenging, then the course is not enjoyable.

(iv) The material is interesting means the exercises are challenging, and conversely.

(v) Either the material is interesting or the exercises are not challenging, but not both.

(b) Show that the following argument is fallacy:

$$p \to q, \neg p \vdash \neg q$$

4. (a) Explain conjunctive normal form and obtain the cnf of the form $(p \wedge q) \vee (\sim p \wedge q \wedge r)$.

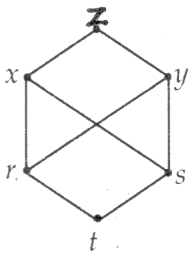
(b) Show that :

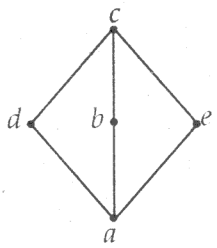
$$1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + n^3 = (1 + 2 + 3 + \ldots\ldots + n)^2$$

UNIT – III

5. (a) Define bounded and complemented lattice. Prove that for a bounded distributive lattice L, the complements are unique if they exist.

(b) Determine whether the posets shown below are lattices or not





6. (a) Simplify the Boolean expression $x.y + x'.z + y.z$.

(b) Obtain principle disjunctive normal form of

$$x \wedge (y \vee z)' \vee (((x \wedge y) \vee z') \wedge x)$$

UNIT – IV

7. (a) Explain Kleene closure. Let A = { a, b, c} , describe the language L(r) when r= ab*c* and when r = a*v b*v c*.

(b) Construct a DFA for the NFA given below

Let $M = (S, I, A, f, S_0)$

Where $S = \{S_0, S_1\}$, $I = \{0, 1\}$, $A = \{S_1\}$

And the next state function f is given by

State	Input	
	0	1
S_0	$\{S_0, S_1\}$	S_1
S_1	ϕ	$\{S_0, S_1\}$

8. (a) Let A = {0, 1}. Construct an finite automaton M such that L(m) will consist of words in which number of 0's and 1's are even.

(b) Explain Mealy machine.