

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  $R^2 = R \circ R$ .

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

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

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:
- The material is interesting and the exercises are challenging.
  - The material is uninteresting, the exercises are not challenging, and the course is not enjoyable.
  - If the material is not interesting and the exercises are not challenging, then the course is not enjoyable.
  - The material is interesting means the exercises are challenging, and conversely.
  - Either the material is interesting or the exercises are not challenging, but not both.

(b) Show that the following argument is fallacy:

$$p \rightarrow q, \neg p \vdash \neg q$$

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

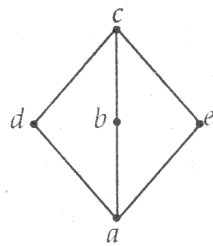
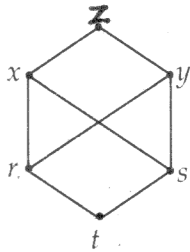
(b) Show that :

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

### 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  $x \cdot y + x' \cdot z + y \cdot z$ .

(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
$S_0$	$\{S_0, S_1\}$	$S_1$
$S_1$	$\phi$	$\{S_0, S_1\}$

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.