Printed pages: 2 Paper id: 1403 Sub Code: RCA103

Roll No. | | | | | | | | | | |

M.C.A.
(SEM I) THEORY EXAMINATION 2017-18
DISCRETE MATHEMATICS

Time: 3 Hours *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. What do you mean by power set? Illustrate with an example.

b. Let f and g: R → R, be defined as follows:
$f(x) = x + 2$, $g(x) = 1 / (x^2 + 1)$. Compute f o g(x)

c. State and prove De Morgan's law for logic.

d. What do you mean by equivalence relations?

e. Draw the hasse diagram of poset (D_{72}, '|'). '|' represent the divisibility operation.

f. Write and prove 'Modus Ponens' rule of inference.

g. Let A = {1, 2, 3, 4, 5, 6}. Compute (4, 1, 3, 5) o (5, 6, 3).

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. Show that for any two sets, A and B:
$A - (A \cap B) = A - B$.
Also draw Venn diagrams for both.

b. Define linearly orders set and partially ordered set. Explain the properties, a poset must satisfy?

c. Using mathematical induction, show that $11^{n+1} + 122^{n-1}$ is divisible by 133 for all $n \geq 1$.

d. Solve the following recurrence relations:
(i) $f_n = 5 f_{n-1} + 6 f_{n-2}$
(ii) $d_n = 2d_{n-1} - d_{n-2}$

e. Prove the validity of the following argument without using truth table:
"If I get the job and work hard, then I will get promoted. If I get promoted, then I will be happy. I will not be happy. Therefore, either I will not get the job or I will not work hard" .

SECTION C

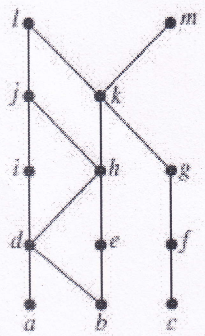
3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Prove that the relation "Congruence Modulo m", given by 'Ξ' = { (x, y) | x – y is divisible by m}, over the set of positive integers is an equivalence relation.
Also, show that if X1 Ξ y1 and x2 Ξ y2, then (x1 + x2) Ξ (y1 + y2)

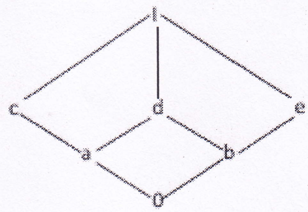
(b) What do you mean by function? Explain different types of functions with proper examples.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) Define Supremum and infimum for a partial order. Determine LUB and GLB of following subsets for Hasse diagram given below:
(i) {a, b, c}
(ii) {f, g, h}



(b) What do you mean by distributed lattice and complemented lattice? Consider the bounded lattice L, given below. Check whether it is distributive or not.



5. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Use a K-map to find a minimal sum for:
$E = y't' + y'z't + x'y'zt + yzt'$
Also draw the circuit diagram for the expression obtained.

(b) Define minterms and maxterms with examples. Express the Boolean function $f(x, y, z) = x + y'z$ as a sum of minterms.

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Write the following conditional statement in symbolic form. Also give the converse, inverse and contra-positive of the statement:
"If the flood destroys Mohan's house or the fire destroy Mohan's house, then Mohan's insurance company will pay him."

(b) What do you mean by existential quantifiers and universal quantifiers? Explain with proper examples.
Find a counterexample, if possible, to these universally quantified statements, where the domain for all variables consists of all integers.
(i) $\forall x(x2 \geq x)$
(ii) $\forall x(x > 0 \vee x < 0)$
(iii) $\forall x(x = 1)$

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Solve the following linear nonhomogeneous recurrence relation with constant coefficient:
$a_n = 5a_{n-1} + 6a_{n-2} + 3.5^n$ where $a_0 = 4$ and $a_1 = 7$
Verify your answer for a_2.

(b) Write short notes on following:
(i) Poyla's Counting Theorem
(ii) Pigeonhole Principle