Sub Code:RCA103

Paper Id: 214103 Roll No:

MCA
(SEM-I) THEORY EXAMINATION 2019-20
DISCRETE MATHEMATICS

Time: 3 Hours *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** **2 x 7 = 14**
   a. Define the Inverse function with example.
   b. Solve the recurrence relation: $a_n - 5a_{n-1} + 6a_{n-2} = 0$.
   c. Write down all Possible subsets of $A = \{2,3\}$ *and* $B = \{a, b, c\}$.
   d. Find two incomparable elements in the poset:($\{1, 2, 4, 6, 8\}$)
   e. State complement axiom of Boolean algebra.
   f. Write down the procedure for testing the validity of an Argument using Truth table.
   g. Define the *Complete Lattice* with example.

SECTION B

2. **Attempt any *three* of the following:** **7 x 3 = 21**
   a. If a relation R is defined as: "$R = \{(a, b) \in R^2 (a - b) \leq 3\}$" .Then determine whether relation R is *reflexive, symmetric, antisymmetric and transitive.*
   b. Let L be the set of all factor of 30 and let '/' be the divisibility relation on L.Then show that (L, '/') is a lattice.
   c. State and Prove the De-Morgan's Laws of Boolean Algebra.
   d. Consider $p : He\ is\ intelligent$, q: $He\ is\ tall$ be two propositions. Write each of the following statement in symbolic form using p *and* q :
      i) He is tall but not intelligent.
      ii) He is neither tall nor intelligent.
      iii) He is intelligent or he is tall.
   e. Find the minimum number of students in a class to be sure that *four* out them are born in the same month.

SECTION C

3. **Attempt any *one* part of the following:** **7 x 1 = 7**
   (a) Prove by mathematical induction : $n^4 - 4n^2$ is divisible by 3 for all n≥2
   (b) Prove the Associative and Commutative laws for set theory.

4. **Attempt any *one* part of the following:** **7 x 1 = 7**
   (a) Define the "Distributive Lattice". Prove that in a Distributive Lattice, if an element has a complement then this complement is unique.
   (b) If A ={1,2,3,4,6,8,12,16,24,48} be ordered by the relation "a divides b". Then draw the Hasse diagram.

5. **Attempt any *one* part of the following:** **7 x 1 = 7**
   (a) Draw Karnaugh map (K-map) and simplify the following Boolean expression:
   $F = ABC + ABC' + A'BC' + A'B'C'$.
   (b) In the Boolean algebra $(B, +, ., ', 0, 1)$ express the Boolean function:
   $f(x, y) = (x + y')(x' + y)(x' + y')$ In its Disjunctive normal form.

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

(a) Show that $\sim r$ is a valid conclusion from the premises: $p \rightarrow \sim q$, $r \rightarrow p$, q
i) with truth table.
ii) without truth table.

(b) State identity law and De-Morgan's law of algebra of proposition and prove the Distributive law of algebra of proposition.

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

(a) Solve the following recurrence relation:
$a_n - 4a_{n-1} + 4a_{n-2} = 0$ with initial condition $a_0 = 1$ *and* $a_1 = 6$

(b) Find the number of possible ways in which the letters of the word *COTTON* can be arranged so that the two T's do not come together.

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