

Paper Id: 

214103
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Roll No: 

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

## SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21
- 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*.
  - Let L be the set of all factor of 30 and let ' $\mid$ ' be the divisibility relation on L. Then show that  $(L, \mid)$  is a lattice.
  - State and Prove the De-Morgan's Laws of Boolean Algebra.
  - Consider  $p : \text{He is intelligent}$ ,  $q : \text{He is tall}$  be two propositions. Write each of the following statement in symbolic form using  $p$  and  $q$  :
    - He is tall but not intelligent.
    - He is neither tall nor intelligent.
    - He is intelligent or he is tall.
  - 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
- Prove by mathematical induction :  $n^4 - 4n^2$  is divisible by 3 for all  $n \geq 2$
  - Prove the Associative and Commutative laws for set theory.
4. Attempt any *one* part of the following: 7 x 1 = 7
- Define the "Distributive Lattice". Prove that in a Distributive Lattice, if an element has a complement then this complement is unique.
  - 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
- Draw Karnaugh map (K-map) and simplify the following Boolean expression:  
 $F = ABC + ABC' + A'BC' + A'B'C'$ .
  - In the Boolean algebra  $(B, +, \cdot, ', 0, 1)$  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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