B.E. Computer Science & Engineering (Model Curriculum) Semester-IV

SE201CS - Discrete Mathematics-III

P. Pages : 3 **GUG/W/23/13806**

Time : Three Hours Max. Marks : 80

* 7 3 9 3 *

Notes : 1. All questions carry equal marks.
2. Use of non-programmable calculator is permitted.

1. a) Prove that **8**

i) $A \cap (B - C) = (A \cup B) - (A \cup C)$

ii) $(A \cap B) - C = (A - C) \cap (B - C)$

b) Let $A = \{1, 2, 3\}$. The relation M_R and M_S are given by **8**

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}, \; M_S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Find $M_R - 1, M_S - 1, M_{R \cup S}, M_{R \cap S}$

OR

2. a) A T. V Survey shows that 60 percent people see programme A. 50 percent see programme B. 50 percent see programme C. **8**
30 percent see programme A and B.
20 percent see programme B and C
30 percent see programme A and C
10 percent do not see any programme find

a) What percent see programme A, B & C?

b) What percent see exactly two programme?

c) What percent see programme A only?

b) List all possible. function from **8**
Set X = {a,b} to the set Y = {1,2,3} indicate in each case whether the functions is one-one on onto or both.

3. a) Prove by truth table **8**

i) $p \wedge (q \wedge r) = (p \wedge q) \wedge r$

ii) $(p \leftrightarrow q) \equiv (\sim p \vee q) \wedge (\sim q \vee p)$

b) Write converse, inverse, contrapositive and negation of "If the women in the family are literate then a family becomes literate" **8**

OR

4. a) Determine the validity of the following argument. **8**
'If there was a ball game, then travelling was difficult".
If they arrived on time, then travelling was not difficult. They arrived on time".
$\therefore$ there was no ball game.

b) Write converse, inverse and contrapositive of conditional $p \to q$. State which one of them is equivalent to $p \to q$ verify by truth table. **8**

5. a) Show that the set {0,1,2,3,4,5} is a commutative ring w.r to addition modulo 6 and multiplication modulo 6 as the composition **8**

b) If R is a ring such that $a^2 = a \ \forall a \in R$ then prove that **8**

i) $a + a = 0 \qquad \forall a \in R$

ii) $a + b = 0 \Rightarrow a = b \ \forall a, b \in R$

iii) R is a commutative ring.

OR

6. a) If G is group then **8**

i) For every $a \in G, (a-1)^{-1} = a$

ii) For every $a, b \in G, (a_0 \ b)^{-1} = b^{-1}{}_0 \ a^{-1}$

b) Let G be a set of all 2x2 Matrices $\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ where a and b are real numbers not both zeros such that $a^2 + b^2 = 0$, show that G is an abelian group under matrix multiplication. **8**

7. a) Construct the switching circuit for the following Boolean expression. Also construct an equivalent simplified circuit and verify equivalence by truth table **8**

(A+B). (B'+C) + (C'+A). (C+B)

b) Define Lattice, draw the Hasse diagram of Lattice D_{30}. Write complement of each element of D_{30}. **8**

OR

8. a) Show that the lattice $\left(L^3, \leq 3\right)$ of tupples of 0 and 1 is complemented. **8**

b) Let $\left(B, \wedge, \vee, 0, 1\right)$ be a Boolean algebra. Define the operator +, – on the element of B by **8**

$a \cdot b = a \wedge b$ for all $a, b \in B$ $a + b = \left(a \wedge b'\right) \vee \left(a' \wedge b\right)$

Show that

i) $a + b \neq b = a$

ii) a + b = a

iii) a + 1 = a’

iv) a . (b+c) = a . b + a . c

9. a) Define **8**

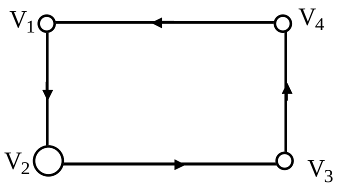
i) Strongly connected graph

ii) Forest

iii) Diameter of graph

iv) Binary tree

b) Find all the indegree and outdegree of the node of the graph. Give all elementary cycles of this graph. Obtain an acyclic diagraph by deleting one edge of the given graph. List all the nodes which are reachable from the node v_1 **8**



OR

10. a) Construct binary tree for the following expression. **8**

i) $\left(3-2\left(\cdot-\left(11-\left(\cdot 9-4\right)\right)\right)\right) \div \left(2+\left(3+\left(\cdot 4+7\right)\right)\right)$

ii) $\left(2x+\left(3-4x\right)\right)+\left(x-\left(3x11\right)\right)$

b) Draw the diagraph corresponding to the following adjacency matrices and determine whether they are isomorphic **8**

$$A = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

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