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

SE201CS - Discrete Mathematics

P. Pages : 3 **GUG/S/25/13806**

Time : Three Hours * 2 2 5 9 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Assume suitable data wherever necessary.
3. Use of non-programmable calculator is permitted.
4. All questions are compulsory.

1. a) Prove that $A \times (B \cap C) = (A \times B) \cap (A \times C)$. **4**

b) If $A = \{4, 5, 7, 8, 10\}$ **4**

$B = \{4, 5, 9\}$

$C = \{1, 4, 6, 9\}$

Then verify that

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

c) Let f be the set of all one-one & onto mapping from x to x, where $x = \{1, 2, 3\}$. Find all elements of f & also find inverse of each elements. **8**

OR

2. a) Prove that **8**

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

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

b) Let function $f(x) = x - 3$, $g(x) = x + 1$ & $h(x) = 4x$ for $x \in R$ where R is the set of Real number find : **8**

i) $f \cdot g$ ii) $g \cdot f$

iii) $f \cdot f$ iv) $f \cdot h \cdot g$

v) $h \cdot f \cdot f$

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 & 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 "If my brother stands first in class then I will give him a watch. He stood first or I was but of station I did not give him a watch." $\therefore$ I was out of station. **8**

b) Using rules of inference, determine whether the following inference is valid or not- **8**

$\sim p \rightarrow \sim q$

$\sim pr$

$p \rightarrow s$

$q \vee r$

$\therefore s$

5. a) Show that the set of matrices **8**

$$A\alpha = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix},\ \alpha \in R$$

Forms a monoid.

b) Show that the $\{0,1,2,3,4\}$ is a finite abelian group of order 5 under addition modulo 5 as composition. **8**

OR

6. a) H & K are any two subgroups of a group G, then show that $H \cap K$ is also a subgroup of G. Is $H \cup K$ a subgroup of G? **8**

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

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

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

iii) R is a commutative ring

7. a) Draw the Hasse diagram of the lattice D_{30}. Write the complement of each element. **8**

b) Construct the switching circuit for the following Boolean expression. Simplify & draw equivalent circuit verify the equivalence by truth table. **8**

$(A \cdot B) + (A \cdot B') + (A' \cdot B')$

OR

8. a) Show that every chain is distributive Lattice. **8**

b) Let S & T be two finite set such that $S = \{a, b, c\}$ & $T = \{1, 2, 3\}$ then show that $(P(S), \subseteq)$ & $(P(T), \subseteq)$ are isomorphic. **8**

9. a) Define: **8**

i) Strongly connected graph

ii) Forest

iii) Diameter of graph

iv) Binary tree

b) Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ **8**

$T = \{(2,3), (2,1), (4,5), (4,6), (5,8), (6,7), (4,2), (7,9), (7,10)\}$.

Identify the root & show that T is a rooted tree. Also give corresponding binary tree.

OR

10. a) Draw the diagraph corresponding to the following adjacency matrices & determine whether they are isomorphic. **8**

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

b) Construct binary tree for the following expression. **8**

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

ii) $(2x+(3-4x))+(x-(3x11))$

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