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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1006 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. V) EXAMINATION, 2007-08

DISCRETE STRUCTURE

Time : 3 Hours] *[Total Marks : 100*

*Note : Attempt **all** questions.*

1 Attempt any **four** of the following parts : 5×4

(a) If relations R and S are reflexive, symmetric and transitive, show that $R \cap S$ is also reflexive, symmetric and transitive.

(b) Prove that if R is an equivalence relation then R^{-1} is also an equivalence relation.

(c) Given $S = \{1, 2, ..., 10\}$ and a relation R on S where

$R = \{\langle x, y \rangle | x + y = 10\}$.

What are the properties of relation R ?

(d) Let $X = \{1, 2, 3, 4\}$ and $R = \{\langle x, y \rangle | x > y\}$. Draw the graph of R and also give its matrix.

(e) Given : $A = \{a, b, c\}$ and $B = \{a, b\}$

Find :

(i) $A \times B$

(ii) $B \times A$

(iii) $A \times A$

(f) Explain recursively defined function with suitable example.

2 Attempt any **four** of the following parts : 5×4

(a) Show that the set $\{1, w, w^2\}$ where $w^3 = 1$ is a group for multiplication composition.

(b) Find order of each element in the group $G = \{\pm 1, \pm i\}$ under multiplication.

(c) Prove that a group G is abelian if $b^{-1}a^{-1}ba = e \quad \forall a, b \in G$.

(d) If $\langle G, * \rangle$ is an abelian group, then for all $a, b \in G$ show that $(a * b)^n = a^n * b^n$.

(e) Using mathematical induction show that

$$B \cup \left(\bigcap_{i=1}^{n} A_i \right) = \bigcap_{i=1}^{n} (B \cup A_i).$$

(f) Explain Cosets with suitable examples.

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3 Attempt any **two** of the following parts : **10×2**

(a) Prove that a n-variable boolean function having sum of all minterms will be equal to 1.

(b) Simplify the expression

$T(x, y, z) = (x + y)[x'(y' + z')]' + x'y' + x'z'$.

(c) Use K-map to find simplified form of

$f(w, x, y, z) = \sum(1, 5, 6, 7, 11, 12, 13, 15)$.

4 Attempt any **two** of the following parts : **10×2**

(a) If a lattice L is distributive, then prove that

$(a \vee b) \wedge (b \vee c) \wedge (c \vee a) =$

$(a \wedge b) \vee (b \wedge c) \vee (c \wedge a) \; \forall a, b, c \in L$.

(b) Draw a finite automaton to accept odd number of 0's and even number of 1's.

(c) Show that there are only fine distrinct Hasse Diagrams for partially ordered sets that contain three elements.

5 Attempt any **two** of the following parts : **10×2**

(a) Obtain the principal disjunctive and conjuctive normal forms of the following formulas :

(i) $Q \wedge (P \vee \neg Q)$

(ii) $(Q \to P) \wedge (\neg P \vee Q)$.

(b) Show that $R \to S$ can be derived from the premises $P \to (Q \to S), \neg R \vee P$ and Q.

(c) Solve the recurrence relation
$C_n - 5C_{n-1} + 6C_{n-2} = 5n2^n$.

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