MAY 2012 **P/ID 17401/RBA**

Time : Three hours Maximum : 75 marks

PART A — ($5 \times 5 = 25$ marks)

Answer ALL questions.

All questions carry equal marks.

1. (a) (i) Show that for any two sets A and B $A-(A \cap B) = A - B$. (3)

(ii) Give an example of a relation which is neither reflexive nor irreflexive. (2)

Or

(b) Let A be given finite set and $\rho(A)$ is a power set. Let $\subseteq$ be the inclusion relation on the elements of $\rho(A)$. Draw Hasse diagram of $\langle \rho(A); \subseteq \rangle$ for (i) $A = \{a, b\}$ (ii) $A = \{a, b, c\}$.

2. (a) Show that

$((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q)$
$\vee (\neg P \wedge \neg R)$ is a tautology.

Or

(b) Negate the following statements in different forms.

(i) Ottawa is a small town.

(ii) Every city in Canada is clean.

3. (a) (i) Define semigroup homomorphism. (2)

(ii) Define Monoid with suitable example. (3)

Or

(b) Find a *cfg* G which generates the language L which consists of all words of the form $a^r b^s c^t, r, s, t > 0$ i.e a's followed by b's followed by c's.

4. (a) Define :

(i) isomorphic graphs

(ii) simple path

(iii) reachable.

Or

(b) Write the algorithm for preorder.

5. (a) Let the grammar G be defined by

$S \to AB$

$A \to Aa \mid bB$

$B \to a \mid Sb$

Draw derivation trees for

(i) baabaab

(ii) bBABb.

Or

(b) How do you diagnose the faults in combinatorial circuits?

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

All questions carry equal marks.

6. (a) Obtain distinctive normal forms of $\neg(P \vee Q) \rightleftharpoons (P \wedge Q)$.

(b) Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \to R, P \to M$, and $\neg M$.

7. (a) Show that the formula $Q \vee (P \wedge \neg Q) \vee (\neg P \vee \neg Q)$ is a tautology. (5)

(b) Obtain the principle conjunctive normal form of the formula S given by $(\neg P \to R) \wedge (Q \rightleftharpoons P)$. (5)

8. (a) Prove that $(A \cap B) \times (C \cap D) = (A \times C) \cap (B \times D)$. (5)

(b) Let $X = \langle 1,2,...,7 \rangle$ and $R = \{\langle x, y \rangle \mid x - y$ is divisible of by 3}. Show that R is an equivalence relation. Draw the graph of R. (5)

9. (a) Write short notes on any five partial order relations which are frequency used. (5)

(b) Write an algorithm to check whether the given number is perfect or not using recursion. (5)

10. (a) Prove that for any commutative monoid $\langle M, * \rangle$, the set of idempotent elements of M form a submonoid. (5)

(b) Write an algorithm to convert the given infix expression into postfix from. (5)

11. (a) Prove that the kernel of every group homomorphism is a normal subgroup. (6)

(b) In a simple diagraph, $G = \langle V, E \rangle$, prove that every node of the diagraph lies in exactly one strong component. (4)

12. Discuss WARSHALL and MINIMA algorithms with respect to adjacency matrix.

13. Explain the algorithm for generating a fault matrix with an example.