

GUJARAT TECHNOLOGICAL UNIVERSITY**MCA - SEMESTER-I • EXAMINATION – WINTER • 2014****Subject Code: 610003****Date: 30-12-2014****Subject Name: Discrete Mathematics for Computer Science****Time: 10:30 am - 01:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Answer the following,
1. Define Boolean algebra and Subboolean Algebra by giving suitable Example. **04**
 2. Define “Symmetric Boolean Expression”. Determine whether the following function is a symmetric or not : **03**
 $a'bc' + a'c'd + a'bcd + abc'd$
- (b) Define Binary Relation, Relation Matrix, Reflexive Relation, Partition, Covering, Antisymmetric Relation and Irreflexive Relation. **07**
- Q.2** (a) Answer the following.
1. Prove that if “All Children have an innocent smile” and “Jennifer is a child”, then “Jennifer has an innocent smile”. By using theory of inference. **04**
 2. Construct the truth table for the following. **03**
 - a) $P \rightarrow (Q \vee R)$
 - b) $(P \vee Q) \rightarrow R$

- (b) Define the compatibility relation and maximal compatibility block. Let the compatibility relation on a set $\{x_1, x_2, x_3, \dots, x_6\}$ be given by the matrix **07**

x2	1				
x3	1	1			
x4	0	0	1		
x5	0	0	1	1	
x6	1	0	1	0	1
	x1	x2	x3	x4	x5

Draw the graph and find the maximal compatibility blocks of the relation.

OR

- (b) Define an equivalence relation. Prove that the relation “congruence modulo m ” given by $\equiv = \{ \langle x, y \rangle / x-y \text{ is divisible by } m \}$ over the positive integer is an equivalence relation. Also draw the relation graph for this relation using $m = 5$ over the set $x = \{1, 2, 3, \dots, 10\}$. **07**
- Q.3** (a) Define complemented lattice and distributive lattice. Check whether the lattices $\langle S_n, D \rangle$ for $n = 30$ and $n = 45$ are complemented or not. Draw the hasse diagram of these lattices. **07**
- (b) Use the Karnaugh map representation to find a minimal sum-of-products expression of $f(a, b, c, d) = \sum(0, 5, 7, 8, 12, 14)$. **07**

OR

- Q.3 (a)** Answer the following. **04**
3. Write the following Boolean Expression in an equivalent sum-of-product canonical form in three variables x_1, x_2 and x_3
- 1) $x_1 * x_2$ 2) $x_1 \oplus x_2$
1. Show that **03**
- $$(x_1' * x_2' * x_3' * x_4') \oplus (x_1' * x_2' * x_3' * x_4) \oplus (x_1' * x_2' * x_3 * x_4) \oplus (x_1' * x_2' * x_3 * x_4') = x_1' * x_2'$$
- (b)** What do you mean by Boolean algebra? Show that lattice $\langle P(A), \cup, \cap \rangle$ is a Boolean Algebra, where $A = \{a, b, c\}$ and $P(A)$ denotes its power set. Draw the hasse diagram of this Boolean Algebra. **07**
- Q.4 (a)** Define group. Is $\langle Z_5^*, \times_5 \rangle$ a group? Is a group $\langle Z_5^*, \times_5 \rangle$ a cyclic group? If yes, then find its all generators. **07**
- (b)** Define subgroup of a group, left coset of a subgroup $\langle H, * \rangle$ in the group. Give a composition table of $\langle Z_6, +_6 \rangle$. Find left coset of $\{[0], [3]\}$ in the group $\langle Z_6, +_6 \rangle$. **07**
- OR**
- Q.4 (a)** Define isomorphic groups. Prove that groups $\langle Z_5^*, \times_5 \rangle$ and $\langle Z_4, +_4 \rangle$ are isomorphic where $Z_5^* = Z_5 - \{0\}$ **07**
- (b)** Define Abelian group, Order of a group, Group homomorphism, Kernel of homomorphism, Normal subgroup, Permutations of a Set S, Automorphism. **07**
- Q.5 (a)** When a simple digraph is said to be weakly connected, unilaterally connected and strongly connected? Define weak, strong and unilateral components. Write the strong, unilateral and weak components for the digraph given in Fig-1. **07**
- (b)** Define Graph, Directed edge of graph, Digraph, Mixed graph, Indegree of a node, Cycle and Length of a path with suitable example. **07**
- OR**
- Q.5 (a)** Give other three representation of tree expressed by $(V_0(V_1(V_2(V_3(V_4))(V_5(V_6(V_7)(V_8)(V_9))(V_{10}(V_{11})(V_{12}))))))$ Obtain binary tree corresponding to it. **07**
- (b)** Define Nodebase, Reachable set of a node, Isomorphic graphs, m-ary tree, Elementary path. Give an example of a graph of having 4 nodes and 4 edges which is not an isomorphic graph. **07**

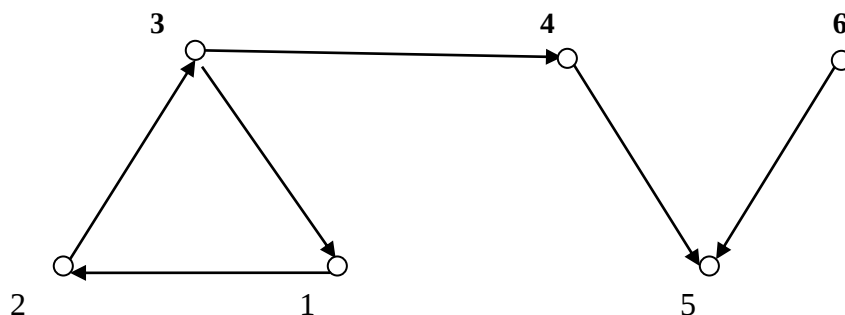


Fig - 1
