Roll No. ..... Total No. of Pages : 2

MCA/D11 4518

Discrete Mathematical Structures

Paper : MCA-103

Time : Three Hours] [Maximum Marks : 80

Note :– Attempt **FIVE** questions. Question No.**1** is compulsory and attempt **ONE** question from each Unit.

1. (a) Prove that a subgroup of an abelian group is a normal subgroup.

   (b) Find order of each element of permutation group P_3 over $\{1, 2, 3\}$.

   (c) State necessary and sufficient condition for a graph to represent as an Euler circuit.

   (d) Differentiate between reachability matrix and adjacency matrix of a digraph.

   (e) What is splitting field ?

   (f) Find complement of each element of the lattice $L = \{1, 2, 3, 5, 10, 30\}$ under the relation divides.

   (g) Write join and meet operation table for the lattice $L = \{1, 2, 3, 6, 10, 30\}$.

   (h) Prove that the polynomial $x^2 + x + 1$ is reducible over z_3. 24

UNIT–I

2. (a) Let G be a finite group under the operation multiplication and (H, *) be a subgroup of (G, *). Prove that the set of left cosets of H in G partitions the set G. 8

   (b) Write generating set for each element of (z_6, t_6). Describe whether (z_6, t_6) is a cyclic group or not. 6

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3. (a) Find the regular expression that defines the language consisting of all words in which the pattern abb appears. Draw finite state machine for the language. 10

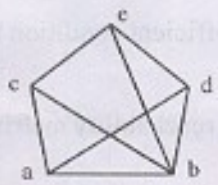
   (b) Characterize the language defined by the regular expression $(b)^* + [(b^*)\,(a)\,(b)^*\,(a)\,(b)^*]^*$. 4

UNIT–II

4. (a) Write algorithm for breadth first-search tree and breadth first spanning tree. 7

   (b) Define Planar graph, and state and prove Euler's formula for this graph. 7

5. Write Warshall's algorithm to find reachability matrix and find the reachability matrix for the following digraph : 14



UNIT–III

6. (a) Let $L = \{1, 2, 3, 4, 5, 6, 7, 8\}$ and R be a relation $\leq$ on L. Verify whether L is a lattice. 7

   (b) Define complement lattice and distributive lattice. Prove that if a lattice is complement and distributive then complement of each element is unique. 7

7. Define Boolean algebra. Verify the set D_{105} of positive divisors of 105 under the relation divides is a Boolean algebra or not. 14

UNIT–IV

8. Find splitting for the polynomial $f = x^2 + 1$ over z_3. 14

9. (a) Write an example of an integral domain that is not a field. 7

   (b) Write an example of a field. 7