

MCA/D07
Discrete Mathematical Structures
MCA -103

Time : 3 Hours

MM:50

Note:- Attempt Five questions by selecting One Question from each unit.

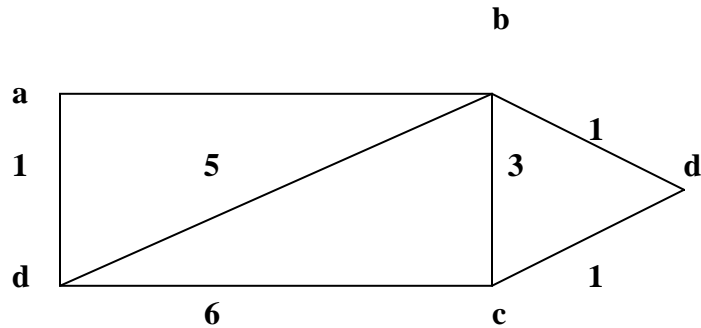
UNIT-I

- 1(a) Prove that the Set $G=(1,2,3,4,5,6)$ with the operation multiplication modulo 7 is a group. Find all the generators of the group G .
- (b) Give an example of Permutation group and its normal subgroup.
- 2(a) Let $A=[a,b]$. Construct a finite state machine which will accept precisely those words from A which end in two b 's. Find the regular expression for the language defined by this finite state machine, if possible.
- (b) Define Regular grammar. Find a regular grammar G which generates the language L which consists of all words over $A=\{a,b\}$ such that no two b 's appear next to each other.
- 3(a) Define Finite field. Give an example of a finite field.
- (b) Prove that a polynomial of degree n over a field F has at most n roots.
- 4(a) Prove that $x^2 + 1$ is an irreducible polynomial over Z_3 Find its splitting field.
- (b) Give an example of a subgroup of a group showing that order of subgroup divides the order of the group.

UNIT-III

- 5(a) Give an example for each of the following.
 - (i) Complete graph with minimum five vertices.
 - (ii) Complete bi-partite graph.
 - (iii) Planar graph with minimum five vertices and give its number of regions.
 - (iv) Euler Circuit
- (b) Write Depth-first search algorithm and explain its use with suitable example.
- 6(a) When a digraph is called strongly connected? Find reachability matrix for the digraph $D=(V,E)$ where $V=\{W, X, Y, Z\}$ AND $E = \{(W,X), (X,W), (W,Y), (Z,X), (Z,Y)\}$. Determine whether the digraph D is strongly connected or not.
- (b) Give an example of acyclic digraph and show that its nodes can be topologically sorted.

- 7 Write an algorithm to find shortest path between two vertices of a diagraph D. Implement the algorithm to following diagraph for finding shortest path from a to c.



UNIT-III

- 8 Define Boolean algebra. Verify whether D60 under the relation divides is a Boolean algebra or not. If yes, find its atoms.

- 9 Consider the Boolean expression

$$Xyz + xyzc + xyz + xyz$$

- Simplify the expression using basic Boolean algebra laws.
 - Draw Gate circuit for the given expression.
 - Draw switching circuit for the given expression.
 - Draw gate Circuit and Switching circuit for the simplified expression.
- 10 Verify whether the following lattices are complemented and distributive.

