MCA/D08
Discrete Mathematical Structures
MCA -103

Time : 3 Hours **MM:50**

Note:- Attempt Five questions by selecting One Question from each unit, and Question no 1 is compulsory.

1(a) **Write an example of a cycle group**
(b) **Define finite state machine and write an example for it.**
(c) **What is meant by edge connectivity of a graph? Prove that edge connectivity of graph is less than or equal to (2e/n).**
(d) **Prove that an Acyclic diagraph can be topologically sorted.**
(e) **Define partial order relation. Write the relation set for the relation 'divides' in D_{50} where D_{50} is the set of all positive divisors of 50.**
(f) **Write join and meet operation tables for the relation 'divides' in D50**
(g) **Verify whether the polynomial x_2+1 is reducible over(Z_2+2) and (R_1+1) respectively or not.**
(h) **Write definition for field. Is Z, the set of integers, a field or not? Give reason in support of your answer.**

UNIT-II

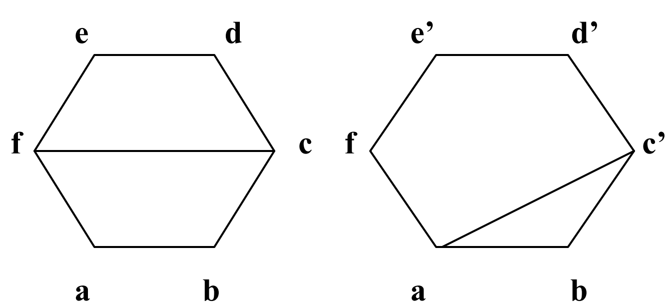
2(a) **Let n ≥ 2. Prove that he set of even permutations is Sn(a symmetric group on {1,2,3….n) is a proper subgroup of Sn and also a normal subgroup,and the order of this subgroup is n!/2.**

(b) **Prove that Kernal of group homomorphism is a normal subgroup.**
(c) **Find a subgroup of (Z_7+7) where Z_1={0,1,2,3,4,5,6} is the set of integers modulo 7 and addition modulo 7 is the operation.**

3(a) **Define regular expression and regular language respectively. Prove that L={$a^m b^m$: m snd n positive} the language aver A={a,b} is a regular language.**
(b) Define a grammar. Can we find a grammar for the language L={ $a^n b^n$:n>0} over A={a,b} explain.

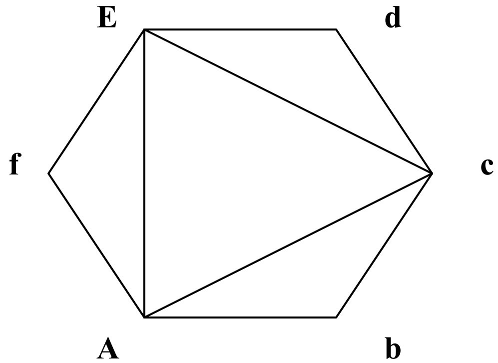
UNIT-III

4(a) **Determine whether the following graphs are isomorphic or not.**

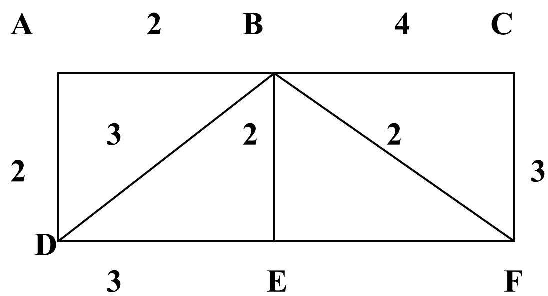


(b) **Define planar graph and state Euler's formula. Which complete graphs and complete bi-partite graphs are plannar?**

5(a) **Find all directed paths of length 3 in the following diagraph.**



(b) **Find shortest path in the following weighted diagraph fromA to f**



UNIT-III

6(a) **Define Lattice. Verify whether L={1,2,3,4,5,6,7,8} w.r.t. the relation divides is a lattice or not.**

(b) **Define Boolean algebra. Verify whether B={1,3,5,6,10,15,30} w.r.t. the relation divides is a Boolean algebra or not.**

7 **Consider the Boolean function:**

$F(x_1,x_2,x_3,x_4) = x_1 + (x_1 + x_4) + x_3 . (x_2 + x_4)$

(a) **Simplify f falgebraically**

(b) **Draw theswitching circuit for f and for simplified f.**

(c) **Draw the circuit (gate) diagram for f and for simplified f.**

UNIT-IV

8 **Define Integral domain. Verify whether Z10 the set of integers modulo 10w.r.t. the operations addition modulo 10 and multiplication modulo 10 is an Integral domain or not. When Zn is an Integral domain?**

9(a) **Write an example of a finite field**

(b) Prove that a polynomial of degree n over a field F has at most n roots.