MCA/D06
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) **Consider the group Z of integers under addition. Let H be the subset ofZ consisting of all multiples of 6. Show that H is a normal subgroup ofZ. Find the quotient group Z/H.**

(b) **Ket S_3** be a symmetric group over (1,2,3). Write elements and the multiplication table for S_3.

2(a) **Determine all values of x from the given field, which satisfy the given equation.**

(i) **x+1 =-1 over Z_2, Z_3 and Z_5**
(ii) **2x+1 =2 over Z_3 and Z_5**

3(a) **Give an example of a finite integeral domain and prove that it is field.**
(b) Ket M be the set of non-singular 2x2 matrices over the set of real numbers. Prove that M under multiplication is a non-abelian group.

4(a) **Determine the type of the grammar G which consists of the productions, and the language defined by G respectively.**

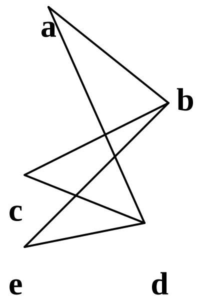
(i) **$S \rightarrow asb$, $S \rightarrow AB$, $A \rightarrow a$, $B \rightarrow b$**
(ii) **$S \rightarrow aB$, $B \rightarrow AB$, $aA \rightarrow b$, $A \rightarrow b$, $B \rightarrow Aa$**

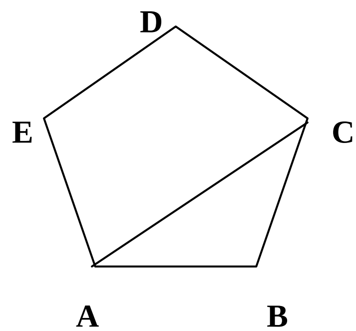
(b) Define finite sate machine and construct a finite state machine which will accept the language L={$a^m b^n$:m and n are positive integers) over A= {a+b}

UNIT-II

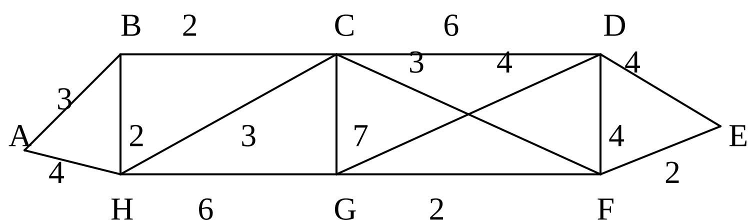
5(a) **Define Eulerian graph and Hamiltonian graph. Draw a graph with six vertices which is Eulerian but not Hamiltonian.**

(b) Define isomorphism of graphs. Verify whether the following graphs are isomorphic or not.





6(a) Describe two methods for finding minimal spanning tree from the following graph.



(b) Enumerate the nodes of the arithmetic tree for the expression $(x+y)^2 - 3x(x+y) + 6x^2y$ in preorder and postorder respectively

7(a) consider the diagraph G= {v,E}, V={a,b,c,d}, E={(a,b), (a,d), (b,c), (b,d), (c,a), (d,c). Using a suitable method determine how many paths of length 3 exist in G and which vertices are connected by a path of length three.

(b) Define acyclic diagraph and prove that acylic diagraph has at least one source and one sink.

UNIT-III

8(a) Let N be set of natural numbers and less than or equal to be a relation R on N. Prove that R is a parital order and draw the Hasse diagram forR.

(b) Define bounded lattice. Give an example each for bounded lattice and unbounded lattice.

9(a) Consider the Boolean expression on

(B2 ={0,1},-, +,.)

Y= A.b.C. + A.B.C. +A.B.

(i) Draw the circuit (gate) diagram for Y.

(ii) Draw the switching (on-off) circuit for Y

(iii) Simplify Y algebraically if possible.

(b) Static the principle of duality for Boolean Algebras and state the dual of

(i) av[(bva) ^b) =1,

(ii) (a^b) ^b = av b.

10(a) Define Boolean Algebra and atoms of Boolean Algebra. Give an wxample to show that atoms of Boolean Algebra. B generate the Non-zero element of B.

(b) Consider the Boolean expression

$(x_3 \wedge x_2) \vee (x_2 \wedge x_3) \vee (x_2 \wedge x_3)$ on [B, -v, ^], B={0,1}.

Find min term normal form of f.