TUTORIAL MANUAL

SUBJECT:

DISCRETE STRUCTURE

CLASS:
(Computer / I.T)
Semester III

Discrete Structure

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TUTORIAL NO 1

TITLE :-SET THEORY

OBJECTIVE:-To study set theory.

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1>Sets,Venn diagram,set membership table
2>Laws of set theory.
3>Partitions of set.
4>Power set.

TUTORIAL QUESTIONS:-

Q1>State true/false with reasons

E=[{ 1,2,3} ,{2,3},{a,b}], F= [{ a,b},{1,2}]

a>$\Phi \subset \{ \Phi \}$
b>{}={{}}
c> Φ subset of Φ
d>{a,b} $\subseteq$ F
e> F $\subseteq$ E
f>1$\in$E
g>$\emptyset \subseteq$ F

Q2>Define following terms . Draw Venn diagrams. Shade the region under consideration.

a>Proper subset.
b>Complement of set A with respect to universal set.
c>Complement of set A with respect to set B.
d>Symmetric difference.
e>Partition of a set.

Q3>Find PP{{a,b}}

Q4>Find ((BU C) $\cap$ A $\cap\Phi$)

Q5> Find |{ Φ } U {{ Φ }}|

Q6>Show order of evaluation using parenthesis A U B ∩D^c U E^c

Q7>Let Z be a set of integers,N be a set of natural numbers ,R is a set of real numbers,C is a set of complex numbers . Show the set containment.

Q8> Find partition of a set containing different letters from word “INSIDEINDIA”.

Q9> The students in a dormitory were asked whether they had a dictionary (D) or a thesaurus (T) in their rooms. The results showed that 650 students had a dictionary, 150 did not have a dictionary , 175 had a thesaurus, and 50 had neither a dictionary nor a thesarus. Find the number K of students who :-
a> live in the dormitory,
b> have both a dictionary and a thesarus, and
c> have only a thesarus

Q10> Find symmetric difference between set A & set B.A is a set of vowels in English. B is a set of different letters in sentence”Discrete paper is easy”.

TUTORIAL NO 2

TITLE :-SET THEORY AND LOGIC

OBJECTIVE:-To study set theory and logic

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1>Sets,Venn diagram,set membership table
2>Laws of set theory.
3>Partitions of set.
4>Power set.

TUTORIAL QUESTIONS:-

Q1>Write down statement in symbolic form

Let p be the “sam is rich “ and let q be “sam be happy”. (Assume “sam is poor “ means “sam is not rich “, i.e. , ~p).

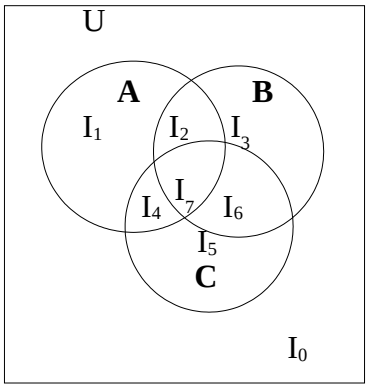
a> sam is poor but happy.
b>sam is neither rich nor haapy
c> sam is either rich or unhappy.
d>sam is poor or else the is rich and unhappy.

Q2>Given that value of p->q is true,determine value of (¬pV¬q)->q.

Q3>If p->q is false ,determine ¬pV(p<->q).

Q4>Construct te truth table of (p---> q) ----> (p Λ q).

Q6>



U is universal set ,A,B,C are subsets of U. Show complete intersection of U generated by A,B,C with the help of venn diagram. Given $A \cap B \cap C \neq 0$.Give equations also.

TUTORIAL NO:- 3

TITLE:-RELATIONS

OBJECTIVE:-To study relations and properties possessed by relations

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1.Relations.
2.Path
3.Diagraph

TUTORIAL QUESTIONS:-

Q1>Find matrix & diagraph of of relation R on set A
a>A={1,2,3,4,8,10,12} aRb if and only if a=b.
b>A={1,2,3,4,8,9, 10 ,11,12} aRb if and only if a-b>=4

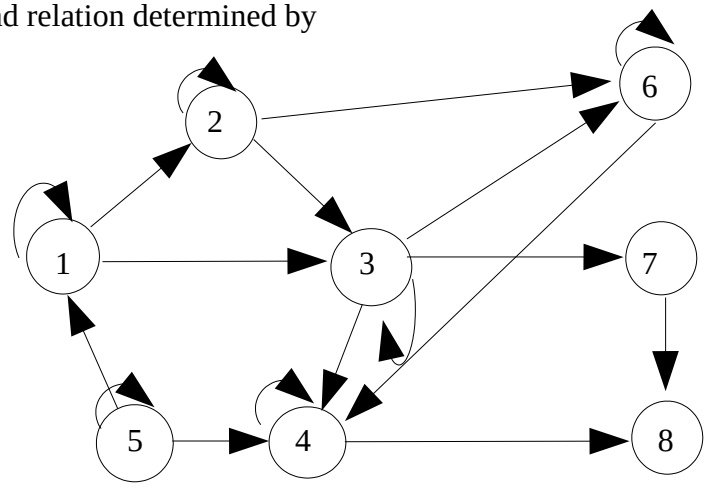
Q2>Let a={1,2,3,4}

$M_R = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$

Give digraph.

Q3>Find relation determined by

a>



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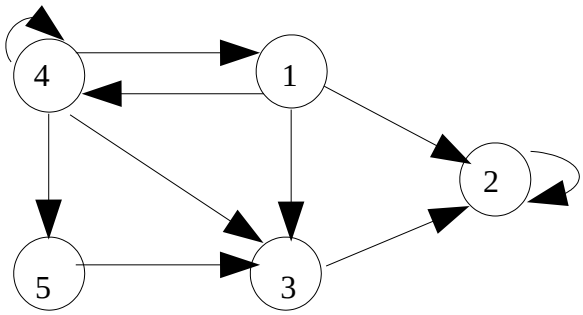
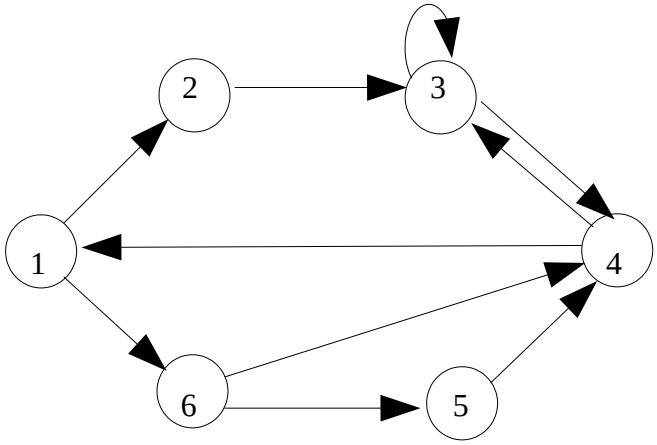


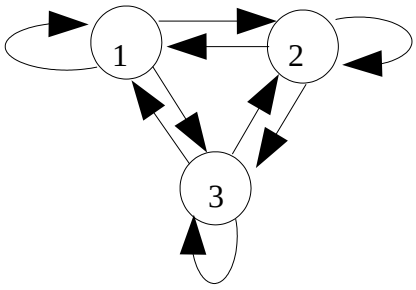
Q4>



i>Draw digraph of R^2
ii>Find $M_R{}^2$

Q5>Determine whether relation R whose digraph is given is equivalence

a>



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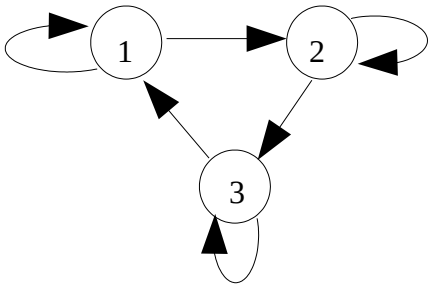

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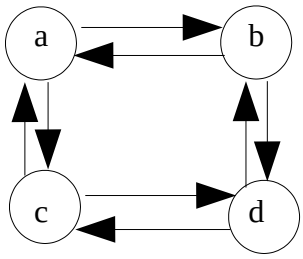


Q6>Find partitions corresponding to R∩S
Let A={1,2,3,4,5,6}
R={(1,2),(1,1),(2,1),(2,2),(3,3),(4,4),(5,5),(6,6),(5,6),(6,5)}
S={(1,1),(1,2),(1,3),(2,1),(2,2),(2,3),(3,1),(3,3),(3,2),(4,6),(4,4),(6,4),(6,6),(5,5)}

TUTORIAL NO :-4

TITLE:- RELATIONS

OBJECTIVE:-1.To study Relations,Paths and Diagraphs.
2.To study Manipulation of Relations, Closures,Warshall's Algoritms.
3.To study Posets and Hasse Diagram

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PRE-REQUISITE:-

1.Properties of Relations.
2.Reflexive ,Transitive and Symmetric Closures
3.Posets (Pratial Order Set).
4.Hasse Diagram

TUTORIAL QUESTION:-

Q1> Find Reflexive and Symmetric Closure on the Set A
A={1,2,3,4,5}
R={(2,1) (4,3) (2,4) (5,1) }

Q2> Find S^{∞}

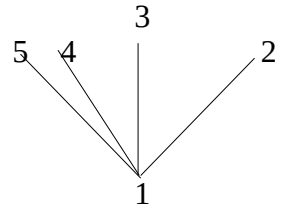
$$M=\begin{vmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \end{vmatrix}$$

Q3>Draw Hasse Diagram of Relation R on A.
A={ 1,2,3,4,5}

$$M=\begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \end{vmatrix}$$

Q4> Determine Matrix of Partial Order whose Hasse Diagram is

(a)



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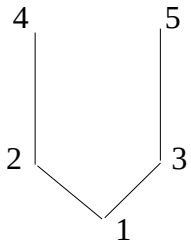
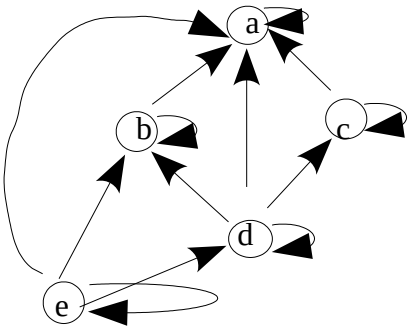


Q5> Draw Hasse Diagram of Poset whose Diagraph is



TUTORIAL NO :-5

TITLE:-LATTICES

OBJECTIVE:- 1.To study Lattice.

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

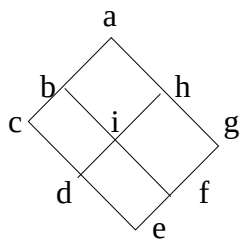
PRE-REQUISITE:-

1.Lower Bound
2.Upper Bound
3.Least Upper Bound
4.Greatest Lower Bound
5.Posets
6.Hasse Diagram
7.Lattice

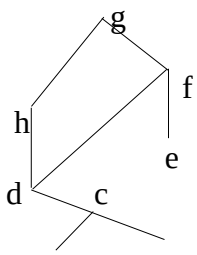
TUTORIALQUESTIONS:-

Q1>Determine whether following diagram are Lattice.

fig(1)

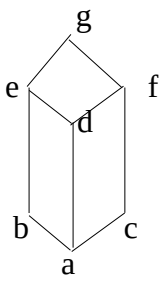


fig(2)

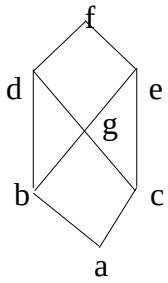


a b

fig(3)



fig(4)



Q2> Is Poset (A,<=) under operation of divisibility a lattice.
A={1,2,3,4,6,8,9,12,18,24}

Q3> If L1 and L2 are Lattices, Draw Hasse Diagram for (L1 X L2).

Q4>Find all Sub Lattices of D_{72} containing at least 5 elements.

TUTORIAL NO :-6

TITLE:- TYPES OF LATTICES

OBJECTIVE:- 1.To study Complemented Lattice.
2.To study Distributive Lattice

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

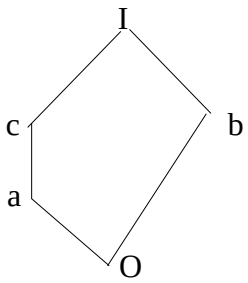
3.Previous Questions Papers.

PRE-REQUISITE:-

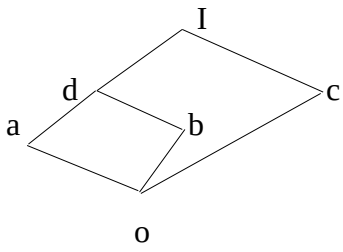
1.Complemented Lattice
2.Distributive Lattice

TUTORIAL QUESTIONS:-

Q1> Find Complement of element c



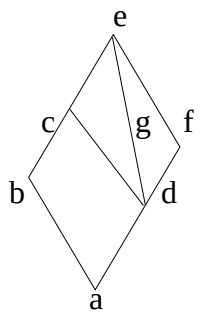
Q2> Find Complement of element b



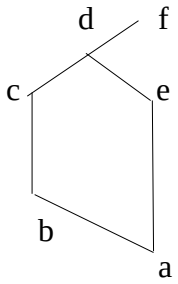
Q3> Find Complement of each element in D_{60} and D_{105} .Are they Complemented Lattices

Q4> Which of the following Lattices are Distributive,complemented or both

fig(1)

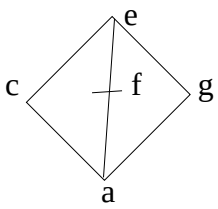


fig(2)



fig(3)

fig(4)



TUTORIAL NO:- 7

TITLE :- FUNCTION

OBJECTIVE:-To study functions and properties possessed by function

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1.Definitions Of
- a>Function
- b>Domain
- c>Codomain
- d>Range
- e>Injective
- f>Surjective
- g>Bijective
- h>Composite Functions
- i>Inverse Function

TUTORIAL QUESTIONS:-

Q1>State which of the following are functions & properties possessed by them
Let A={a1,a2,a3} B={b1,b2,b3} C={c1,c2} D={d1,d2,d3,d4}
f_1 : A->B = {(a1,b2),(a2,b3),(a3,b1)}
f_2 : A->D = {(a1,d2),(a2,d1),(a3,d4)}
f_3 : D->B = {(d1,b1),(d2,b2),d3,b1)}

Q2>Determine whether f-1 exists? Let f : :A->B, A={1,2,3,4} , B={a,b,c,d}
- i>f = {(1,a),(2,a),(3,c),(4,d)}
- ii>f = {(1,a),(2,c),(3,b),(4,d)}

Q3>Let A be set of real numbers, B={0,1} & Z be set of integers. Let f : A-> B . Then for any real number a let f(a)=0 if a ∉ Z & f(a)=1 if a ∈ Z State whether it is function or not?

Q4>Determine whether function is one to one & onto. Let f : A->B
- a>Let set A->B=set of integers f(a)=a-1.
- b>Let set A=set of real numbers. B{x/x is real & x>=0} f(a)=|a| .

Q5>Let f,g,h be functions from Z->Z where Z is set of integers.
f(n)=n+5 g(n)=n-2 h(n)=n^2 Find fog , f^3, fogoh

TUTORIAL 8

TITLE :-GROUP

OBJECTIVE :-To study groups & properties of groups

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1>Monoids, Semigroup,Groups
2>Product and quotients of algebraic structures
3>Isomorphism, homomorphism, automorphism
4>Normal subgroup

TUTORIAL QUESTIONS :-

Q1>Consider binary operation * defined on the set A = {a,b,c,d} by the following table

	a	b	c	d
a	a	c	b	d
b	d	a	b	c
c	c	d	a	a
d	d	b	a	c

Compute
a> c*d & d*c
b>b * d & d*b
c>a*(b*c) & (a*b)*c
d>Is * commutative? Is * associative?

Q2>Let A={a,b} which of the following tables define a semigroup on A?Which define a monoid on A?

	a	b
a	a	b
b	a	a

	a	b
a	a	b
b	b	b

	a	b
a	a	a
b	b	b

	a	b
a	b	b
b	a	a

Q3> Let R^+ be the set of all positive real numbers. Show that the function f : R^+->R defined by f(x)=ln(x) is an isomorphism of semigroup (R^+,*) to the semigroup (R,+) where * & + are ordinary multiplication & addition respectively.

Q4>Determine whether the set together with binary operation is a group. If it is a group ,determine if it is abelian ,specify the identity & inverse.
i>The set of odd integers under operation of multiplication.
ii>Q ,the set of all rational numbers under operation of addition.

Q5>Let G be a group of integers under operation g addition & let H={3*K / K € Z} Where Z is set of integers. Is H subgroup of G?

Q6>Prove that function f(x)=|x| is a homomorphism from group G of nonzero real numbers under multiplication to group G' of positive real numbers unde multilication.

Q7>Let Q be set of positive rational numbers which can be expressed in the form 2a3b where a & b are integers. Prove that algebraic structure (Q,*) is a group.

Q8>Let s={x/x is a real number; x≠0,1} Consider following functions .f_i : S->S, i=1,2,3,4,5,6 $f_1(x)=x$ $f_2(x)=1-x$ $f_3(x)=1/x$ $f_4(x)=1/(1-x)$ $f_5(x)=1-(1/x)$ $f_6(x)=x/(x-1)$ Show that G={f_1,f_2,f_3,f_4,f_5,f_6} is group under operation of composition . Give operation table of (G,*).

Q9>Let G={e,a,a^2,a^3,a^4,a^5} be a group under operation $a^i a^j = a^r$ where i+j=r (mod 6). Prove that G & Z_6 are isomorphic.

TUTORIAL NO :-9

TITLE:- GRAPHS

OBJECTIVE:- 1.To study graph concepts
2.To study paths and curcuits :(Eulerian, Hamiltonian)

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross, Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

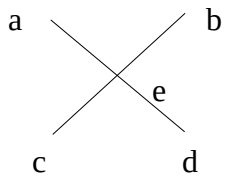
PRE-REQUISITE:-

1.Notation and Definition
2.Paths and Connectivity
3.Types of Graphs
4.Subgraphs
5.Isomorphic Graphs
6.Homomorphic Graphs
7.Representation of graphs
8.Eulerian and Hamiltonian Graphs

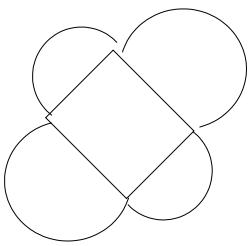
TUTORIAL QUESTION:-

Q1>Determine whether following graphs have Euler's and Hamiltonian path, Circiut. Give reason.

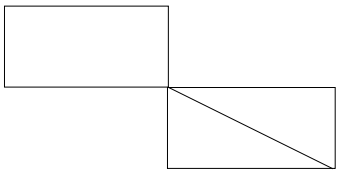
Fig(1)



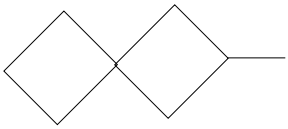
Fig(2)



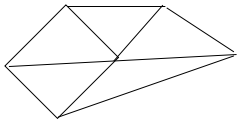
Fig(3)



Fig(4)

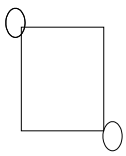


Fig(5)

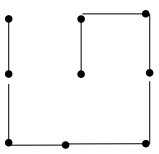


Q2> Verify $\sum_{i=1}^{n} \deg(V_i) = 2|E|$ if graph is planar

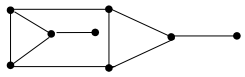
Fig(1)



Fig(2)

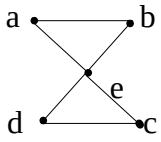


Fig(3)

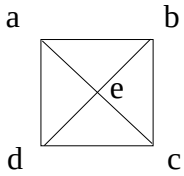


Q3>Which of the undirected graphs in fig's have an Euler circiut ? Write Euler circuit and path in each of the graphs

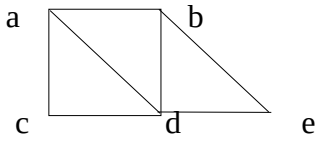
fig(1)



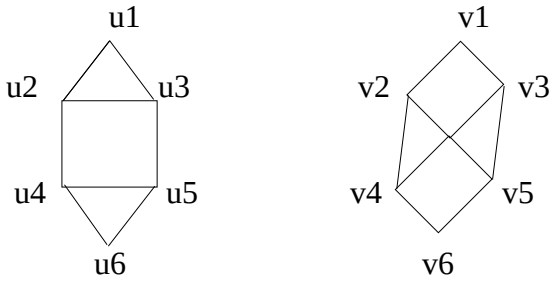
fig(2)



fig(3)



Q4> Determine graph G and H shown in figure are isomorphic or not ? Justify your answer



TUTORIAL NO :-10

TITLE:- RINGS AND FIELDS

OBJECTIVE:-

1.To study Rings and Fields concepts
2.To study Ring isomorphism and homomorphism

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross,Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PRE-REQUISITE:-

Definitions:-
1.Rings
2.Fields
3.Integral Domain
4..Ring Isomorphic

TUTORIAL QUESTION:-

Q1> Let $G=\{e,a,a^2,a^3,a^4,a^5\}$ be a group under operation $a^i a^j = a^r$ where $i+j=r(\text{mod } 6)$ Prove that G & Z_6 are isomorphic.

Q2> Let Z be a group of integers under addition and Let H be a Subgroup of Z consisting of the multiples of 5. Show that H is normal Subgroup of Z and find quotient group Z/H.

Q3> Show that Ring Z_{29} of integers modulo 29 ia an Integral Domain Where Ring Z_{105} of integers modulo 105 is not an Integral Domain

Q4>Let R={ 0,2,4,6,8} Show that R is Commutative Ring under + and X modulo 10. Verify whether it is an Integral Domain or Field or both

Q5>Show that the set $R=\{x \mid x = a+b\sqrt{2}$; a,b are integers $\}$ is a Ring with ordinary addition and multiplication

Q6>Show that (I, + ,.) is a commutative Ring identify where the operations + and . are defined as follows:- a+ b= a+b -1
a.b=a+b-ab

Q7> Let R= {0,2,4,6,8} Show that R is Commutative Ring under addition and multiplication modulo 10.

	0	2	4	6	8
0	0	2	4	6	8
2	2	4	6	8	0
4	4	6	8	0	2
6	6	8	0	2	4
8	8	0	2	4	6

TUTORIAL NO:-11

TITLE:-ENCODING

OBJECTIVE:-To study encoding function.

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross, Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1.Hamming distance.
2.Group codes.
3.Encoding using parity check matrix.

TUTORIAL QUESTIONS:-

Q1>Find distance between x & y.
a> x=1100010 y=1010011
b> x=0110110 y=0011010

Q2>Consider the (2,6) encoding function e : B^2->B^6 defined by
e(00)=000000
e(10)=101010
e(01)=011110
e(11)=111000

i>Find minimum distance of e.
ii>How many errors will e detect.

Q3>Show that (2,5) encoding function e : B^2->B^5 defined by
e(00)=00000
e(01)=01110
e(10)=10101
e(11)=11011
is a group code.

Q4> Let

$$H=\begin{bmatrix}0&1&1\\0&1&1\\1&0&0\\0&1&0\\0&0&1\end{bmatrix}$$

be a parity check matrix. Determine the (2,5) group code function e : B^2->B^5

Q5>Let

$$H=\begin{bmatrix}1&0&0\\0&1&1\\1&1&1\\1&0&0\\0&1&0\\0&0&1\end{bmatrix}$$

be a parity check matrix. Determine the (3,6) group code function e : B^3->B^6

TUTORIAL NO:- 12

TITLE:-DECODING,PIGEONHOLE PRINCIPLE

OBJECTIVE:-To study maximum likelihood principle,pigeonhole principle, permutation functions.

REFERENCE:-

1.Discrete mathematical structures by Kolman ,Busby and Ross, Fourth Edition.

2.2000 Solved problems in discrete mathematics ,Schaum's series , McGraw Hill publication , International edition 1992.

3.Previous Questions Papers.

PREREQUISITE:-

1. Maximum likelihood principle.
2. Pigeon hole principle.
3. Permutation functions.

TUTORIAL QUESTIONS

Q1>Consider (3,6) group encoding function e : B^3->B^6 defined by

e(000)=000000	e(100)=1000101
e(001)=000110	e(101)=100011
e(010)=010010	e(110)=110111
e(011)=010100	e(111)=110001

Decode the following words relative to maximum likelihood decoding function
a>011110 b>101011 c>110010

Q2>Consider (3,8) encoding function e:B^3->B^8 defined by

e(000)=00000000	e(100)=10100100
e(001)=10111000	e(101)=10001001
e(010)=00101101	e(110)=00011100
e(011)=10010101	e(111)=00110001

& let d be (8,3) maximum likelihood decoding function associated with e. How many errors can (e,d) correct?

Q3>Show that if any 5 numbers from 1 to 8 are chosen ,then two of them will add to 9.

Q4> Show that if 4 numbers from 1 to 7 are chosen , then two of them will add to 8.

Q5> Show that at least 2 people out of 13 must have their birthday in same month when they are assembled in the same room.

Q6> Let A={1,2,3} Let f : A-> A .f(a)=a.

a>Find all permutations of A.

b>Compute P_4^{-1} Where P_4 is 4^{th} permutation of A.

c>Compute $P_3 o P_2$ Where P_3 & P_2 are 3^{rd} & 2^{nd} permutations of A.