CMR Technical Campus

B. Tech Mid Question Bank (R22 Regulation)

Academic Year: 2023-24   **Semester: III semester**

Subject Name: Discrete Mathematics
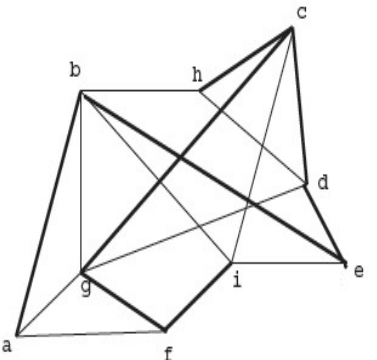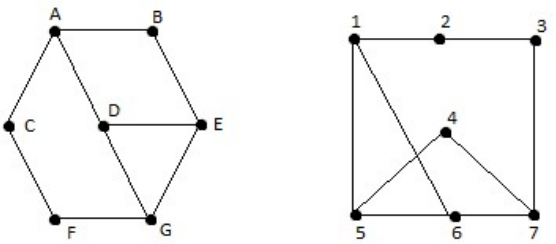
Faculty Name: G. Aravind, V Prema Tulasi

PART-A

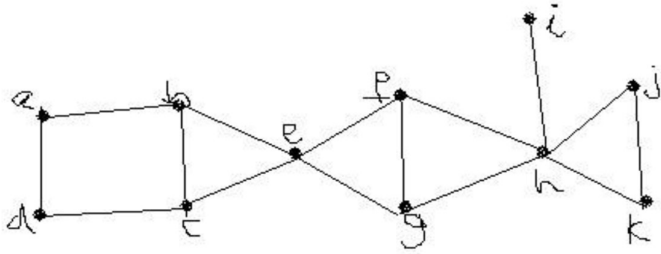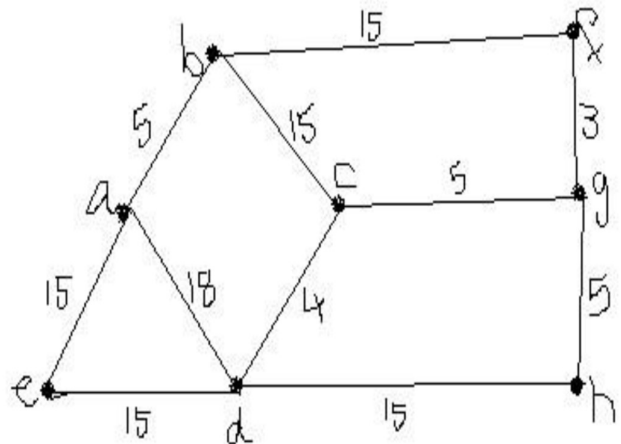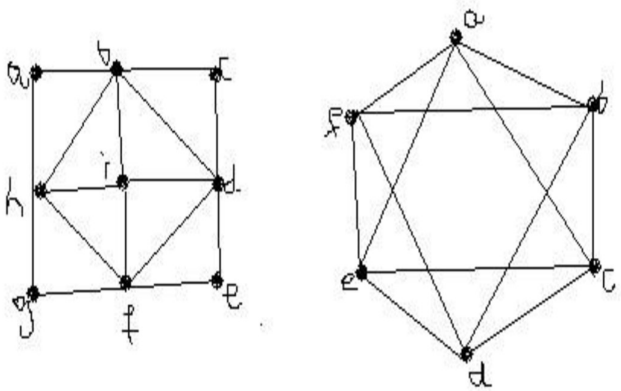| MID-I Questions					
Q.No	Questions	Marks	BL	CO	Unit No
1	Write the following statements in symbolic form a. Mark is poor but happy b. Mark is rich or unhappy c. Mark is neither rich nor happy d. Mark is poor or he is both rich& unhappy	2	1	1	1
2	Show that (¬P->Q) ->(Q->P) is a tautology.	2	3	1	1
3	a. Define Conjunction, Disjunction with Example. b. Define Implication, Bi-conditional with Example.	2	1	1	1
4	a. Define Contradiction, Contingency with Example. b. Define Preposition with an example.	2	1	2	1
5	Define Converse, Inverse & Contrapositive with Example.	2	1	2	1
6	Examine Whether the following argument is valid. a. If I drive to work, then I will arrive tired. I am not tired (when I arrive at work)/ Therefore I do not drive to work. b. Write the following Propositions in symbolic form & find its negation " All integers are rational numbers & some rational numbers are not integers".	2	4	1	1
7	a. Define Relation. List some of the properties of binary relations. b. Define Set. List out the set operations with examples.	2	1	1	2
8	Define Cartesian Product. If A={1,2,3,4} and B={4,5} find i) AXB ii) BXA	2	1	1	2
9	Let X= {1,2,3} and R = {(x, y)/x>y}. Draw the graph of R& also give its matrix?	2	1	1	2
10	Let X = {1,2,3 } and f,g,h &s be the functions from X to X given by f={ (1,2), (2,3), (3,1)} g = { (1,2) (2,1) ,(3,3) and h= { (1,1),(2,2),(3,1)} find fog, fohog?	2	1	1	2
11	a. Define function & set with an example? List out Set operations. b. Find the inverse of the following function f(x) =x²+1	2	1	1	2
12	Define Reflexive , Irreflexive, Symmetric,	2	1	1	2

	Asymmetric ,Antisymmetric & Transitive with examples.				
13	Show that the set N of natural numbers is a semigroup under the operation x*y=max{x, y}. Is it a monoid.	2	2	2	3
14	Show that the set {f0, f1, f2, f3} of functions under the operation of composition is an abelian group of order 4.	2	1	1	3
15	Find all the subgroup of a. (Z12,+12) b. (Z5,+5)	2	1	2	3
MID-II Questions					
16	a. Define Lattice and write the properties of Lattice, b. What is monoid.	2	2	1	3
17	a. Give an example of group which is abelian but not cyclic. b. Prove that the intersection of two sub monoids of a monoid is a monoid.	2	1	1	3
18	What is an Algebraic structure? Explain semi group and monoid with examples.	2	1	2	3
19	A group of 8 scientists is composed of 5-psychologists and 3-sociologists, in how many ways can a committee of 5 be formed that has 3-psychologists and 2-sociologists.	2	2	1	4
20	A book binder is to bind 10 different books in red, blue and brown cloth. In how many ways can he do this if each color of cloth is to be used for at least one book?	2	1	1	4
21	How many words of three distinct letters can be formed from CAKE?	2	1	1	4
22	Give any three applications of Pigeonhole principle.	2	2	1	4
23	From 6 boys and 4 girls, 5 are to be selected for admission for a particular course. In How many ways can this be done if there must be exactly 2 girls?	2	1	1	4
24	Find how many different words that can be formed with the letters in the word "MATHEMATICS".	2	1	1	4
25	a. Define Graph and Trees with examples. b. Define planar graph.	2	1	1	5
26	a. Explain about graph colouring. b. What is a subgraph? Explain in detail?	2	2	2	5
27	a. Explain multi graph with example. b. Define minimum spanning tree.	2	2	1	5
28	a. Define Euler's Formula with examples. b. What is Euler circuit? Give some examples?	2	1	2	5
29	Define the term Isomorphism and conditions for the graph to be Isomorphic.	2	1	1	5
30	Define Chromatic number and give some examples.	2	1	1	5

PART-B

Q.No	Questions	Marks	BL	CO	Unit No
	MID-I Questions				
1	Construct truth table for a. [(pvq)^ (¬r)] <-> (q->r) b. Obtain the Principal Disjunctive normal of P<->q	4	3	2	1
2	Construct PDNF and PCNF for (~PV~Q)-→(P<->~Q)	4	3	2	1
3	Show that SVR is tautologically implied by (PVQ) ^ (P->R)^(Q->S)	4	3	1	1
4	Show that R->S can be derived from the set of premises P->(Q->S), ¬RVP and Q	4	3	1	1
5	Construct PDNF of the formula (P^Q)V(~P^R).	4	3	1	1
6	Construct PCNF of the formula (¬P->R) ^(Q<->P)	4	3	2	1
7	a. Show that ¬(P<->Q) and P<->¬Q are logically equivalent. b. Show that (P->Q)<->(¬Q->¬P) is a tautology without using truth table.	8	3	2	1
8	Show that RVS follows logically from the premises CVD, (CVD)->¬H, ¬H->(A^¬B) & (A^¬B)-> RVS	8	3	2	1
9	Show that the following is logically equivalent a. [¬P^(¬q ^r)] V(q^r) V (p^r)⇔r b. Show that the following set of premises are inconsistent using indirect method of proof: P->Q, Q->R, ¬(P^R), PVR=> R.	8	3	2	1
10	Define Partial Ordering relation along with example.	4	1	2	2
11	Draw the Hasse diagram for the divisibility on the set A={1,2,3,4,6,9,12,18,36}	4	3	2	2
12	a. Let A= {0,2,4,6,8,10} B= {0,1,2,3,4,5,6} and C= {4,5,6,7,8,9,10} find i). A^B^C ii) AUBUC b. Let f & g be the function from the set of integers to defined by the f(x) =2x+3, g(x)= 3x+2 what is the composition of f & g? What is the composition of g & f	4	2	1	2
13	Let f: R-> R be given by f(x) = X²-2 find f⁻¹	4	2	2	2
14	Let f: R-> R and g: R-> R, where R is the set of real numbers find fog & gof, where f(x) = X²-2 & g(x) =X+4 state whether these functions are injective , surjective & bijective?	4	1	3	2
15.	a. Describe the sets A & B given that A-B = {1,2,4}, B-A = {7,8} & AUB = {1,2,4,5,7,8,9} b. Construct the Hasse diagram for the divisibility relation on following sets i) A={3,6,12,36,72} ii) A={1,2,3,5,6,10,15,30}	4	3	3	2
16	a. Given a set S= {1,2,3,4,5} find the equivalence relation on S which generates the partition {{1,2}, {3}, {4,5}} draw the graph of the relation. b. Draw the Hasse diagrams of the following sets under partial ordering relation "divides "	8	3	3	2

	a. {2,6,24} b. {1,2,3,6,12} c. {3,9,27,54}				
17	Show that the relation R={(a,b)}/a-b is divisible by n} is an equivalence relation on the set of integers where n be a positive integer>1.	8	3	2	2
18	For each of these relations on the set {1,2,3,4} a. Define whether it is reflexive, symmetric, transitive i) {(2,2), (2,3), (2,4), (3,2), (3,3), (3,4)} ii) {(1,3), (1,4), (2,3), (2,4), (3,1), (3,4)} iii) {(1,1), (1,2), (2,1), (2,2), (3,3), (4,4)} b. Let X= {1,2,3} and f, g, h be the functions from X to X given by f= {(1,2), (2,3), (3,1)} g= {(1,2), (2,1), (3,3)} h={(1,1),(2,2),(3,1)} find fog,fohog	8	1	3	2
19	Let G be the set of real numbers not equal to -1 and * be defined by a*b=a+b+ab Show that <G,*>is an abelian group	4	3	2	3
20	Let (S1, *1), (S2, *2) and (s3, *) be semi groups and f: S1->S2 and g: S2->S3be homeomorphisms. Show that the mapping of gof:S1->S3 is homomorphism.	4	3	3	3
21	Show that H={0,2,4} forms a subgroup of (Z6,+).	4	3	2	3
22	Let S is a semi group. If for all x y€s, x²y =y x² .Show that S is an abelian group.	4	3	3	3
MID-II Questions					
23	Determine all subgroups of each of the following groups: i) The additive group Z_3; ii)The multiplicative group Z_6^*.	4	3	3	3
24	In a lattice (L,≤, ∧,V)state and prove the laws idempotent, commutative, association and absorption	4	1	3	3
25	Show that every subgroup of a cyclic group is cyclic.	8	3	2	3
26	Generate all homomorphism's. i)f: $Z_2 \rightarrow Z_4$ ii)f:$Z_2 \rightarrow Z_5$	8	6	3	3
27	3 Americans, 3 Mexicans, 3 Canadians are to be seated in a row. How many ways can they be seated so that, no 3 countrymen sit together?	4	3	3	4
28	How many ways can we distribute 14 indistinguishable balls in 4 numbered boxes so that each box is non empty.	4	3	3	4
29	In how many ways can the letters {4.a, 3.b, 2.c} be arranged so that all the letters of the same kind are not in a single block?	4	2	2	4
30	A student is to answer 12 of 15 questions in an examination. How many choices does the student have: i)if he must answer the first two questions ii)if he must answer the first and second but not both iii)if he must answer exactly 3 of the first 5 questions iv)if he must answer at least 3 0f the first 5 question	4	2	3	4
31	In a group of 30 people, at least how many are born in the same month?	4	2	2	4
32	In how many ways can 23 different books be given to 5	4	2	3	4

	students so that 2 of the students will have 4 books each and the other 3 will have 5 books each.				
33	In how many ways can six coupons for free lunches at different restaurants be distributed among 10 students: i) If none is to receive more than one coupon? ii) If there is no restriction on the number of coupons that each student can receive?	8	2	3	4
34	A student council consists of 15 students. i) Suppose two members refuse to work together on projects. How many groups of seven can be chosen to work on a project? ii) Suppose two team members insist on eithe r working together or not at all on projects. How many groups of seven can be chosen to work on a project?	8	3	2	4
35	There are 40 computer programmers for a job. 25 know Java, 28 know Oracle and 7 know neither language. Using principle of inclusion exclusion find how many know both languages.	8	3	3	4
36	Explain spanning tree? Implement the BFS algorithm for the following example 	4	5	3	5
37	Generate the Chromatic number of the following two graphs? 	4	6	2	5
38	Construct spanning tree for the following graph using DFS algorithm.	4	3	3	5

39	Construct a minimal spanning tree for the following graph using krushkal"s algorithm?	4	3	2	5
40	State Which of the multigraphs have Euler paths, circuits, or neither?	4	1	3	5
41	a) Define graph? Explain about representation of graphs? b) Explain about Hamiltonian graph?	4	1	2	5
42	a) Define tree? List out the applications of tree? b) Find the minimum cost spanning tree for the given graph using kruskal algorithm?	8	1	3	5

43	Show that the following graphs are isomorphic.	8	3	3	5

44	Show whether the graphs G and G1 are isomorphic or not. Explain the reason.	8	3	2	5