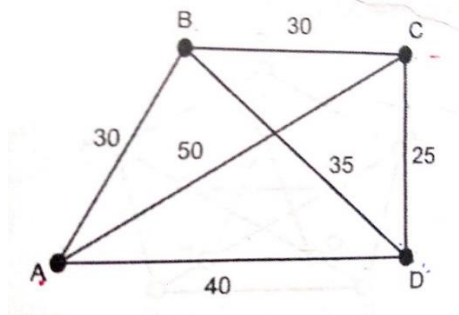
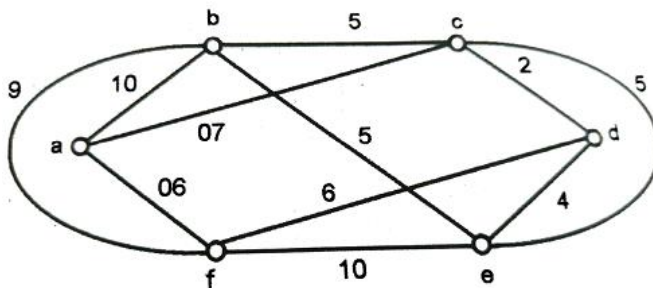


K. K. Wagh Institute of Engineering Education and Research, Nashik
Department of Information Technology
Discrete Mathematics
S. Y B Tech 2023-24 (Semester-I)
EndSem Question Bank

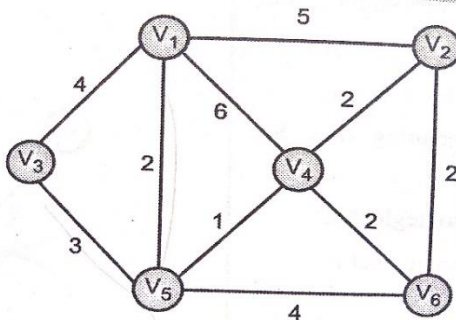
- (1) What is Quantifiers? Explain the types of Quantifiers with suitable Example. [6 Marks]
- (2) What is Hamilton Path and Hamilton Circuit? Find the Hamilton circuit using nearest neighbor method. (6 Marks)



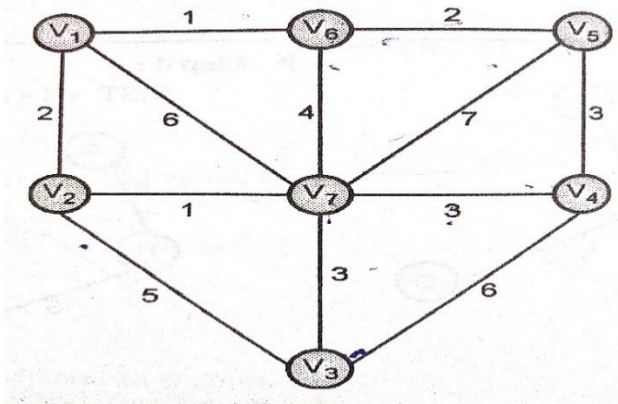
- (3) Suppose that 100 out of 120 mathematics students at a college take at least one of the languages French, German and Russian also suppose: 65 study French, 20 study French and German, 45 study German, 25 Study French and Russian, 42 Study Russian, 15 study German and Russian
- Find the number of students who study all the three languages.
 - Determine the number K of students who study exactly one language.[6Marks]
- (4) Use Nearest Neighbour method to find the Hamiltonian Circuit, starting from a in the following graph. Find its weight. [6 Marks]



- (5) Find minimum spanning tree for the graph shown below using Kruskal's algorithm. (4 Marks)



- (6) Define the following Term
- Depth-First Traversal
 - Breadth First Traversal [4 Marks]
- (7) Define the following Term
- Binary Tree
 - Level and Height of a Tree [4 Marks]
- (8) Define the following Term
- Properties of trees
 - Optimal Binary Tree [4 Marks]
 -
- (9) Find the minimum spanning tree for the graph given below using Prim's algorithm. (4 Marks)



- (10) Suppose data items A, B, C, D, E, F, G occur in the following sequences

Data Items	A	B	C	D	E	F	G
Weight	10	30	5	15	20	15	5

Construct a Huffman code for the data.

What is minimum weighted path length? [4 Marks]

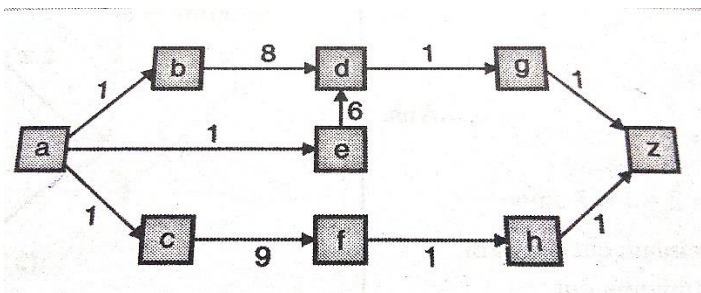
- (11) What is expression tree?

Represent the expressions: (i) $(x + xy) + x / y$ (ii) $x + ((xy + x / y)$

Using binary trees. Write each of these expressions in:

- (a) Prefix notation (b) Postfix notation [8 Marks]

- (12) Explain the Basic terminologies use in Network Flows. Find the maximum flow for the Following transport network.



What is an equivalent relation? Identify whether the given relation is an equivalent relation where $A = \{1, 2, 3, 4\}$, relation $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 1), (3, 3), (1, 3), (4, 1), (4, 4)\}$ Also

find the equivalent classes. [5 Marks]

(13) Use Warshall's algorithm to find transitive closure of the following relation on the set. $\{1, 2, 3, 4\}$, $R = \{(1, 2), (1, 3), (1, 4), (2, 3), (2, 4), (3, 4)\}$ [5 Marks]

(14) Draw the Hasse diagram of relation R on A .

Let $A = \{1, 2, 3, 4, 5\}$ and $R = \{(1, 1), (2, 1), (2, 2), (3, 1), (3, 2), (3, 3), (4, 1), (4, 2), (4, 3), (4, 4), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5)\}$ (5 Marks)

(15) Define the closure of Relation. Explain the following closure properties write examples

- (i) Reflexive Closure
- (ii) Transitive Closure (5 Marks)

(16) Find the transitive closure of R by Warshall's algorithm where $A = \{1, 2, 3, 4, 5, 6\}$ and $R = \{(x, y) \mid x - y = 2\}$ and draw its digraph. (6 Marks)

(17) Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 18, 24\}$ be ordered by the relation X divides Y (Y divides by X). Show that the relation is a partial order and draw Hasse diagram. (6 Marks)

(15) Explain Euclid's Algorithm. Find $\gcd(102, 30)$ by using Euclid's Algorithm. (5 Marks)

(16) Solve the following by using Chinese Remainder Theorem

$$X \equiv 7 \pmod{12345}, X \equiv 3 \pmod{11111} \quad (5 \text{ Marks})$$

(17) Define Semigroup and Monoid. Also show that $\langle \mathbb{Z}_6, + \rangle$ is an abelian group (5 Marks)

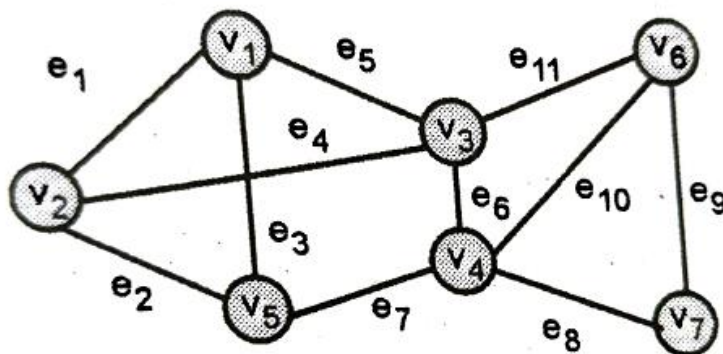
(18) Define the following terms with suitable examples

- (i) Group
- (ii) Abelian Group (5 Marks)

(19) Prove that $G = \{0, 1, 2, 3, 4, 5\} = \mathbb{Z}_6$ is an abelian group of order 6 with respect to addition Modulo 6. (6 Marks)

(20) Let $(\mathbb{Z}, *)$ be an algebraic structure, where \mathbb{Z} is the set of integers and the operation $*$ is defined by $n * m = \max(n, m)$. Show that $(\mathbb{Z}, *)$ is a semigroup. Is $(\mathbb{Z}, *)$ a monoid? Justify your answer. (6 Marks)

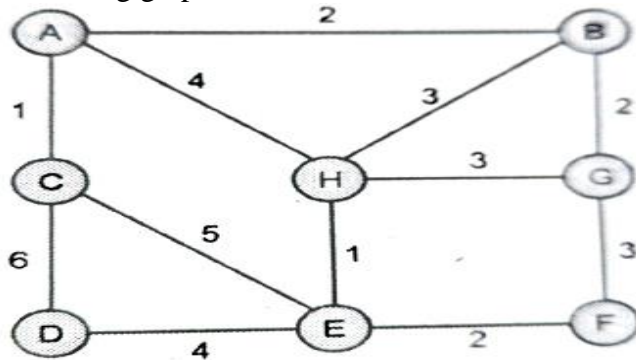
(21) Find the fundamental system of cut sets for the graph G shown below with respect to the spanning tree T [4 Marks]



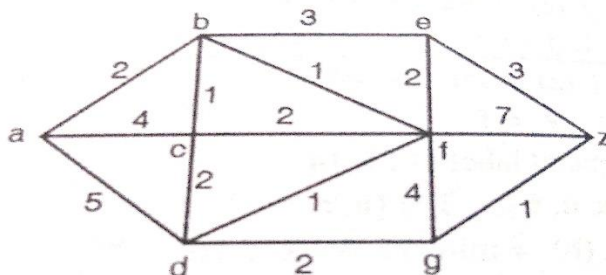
(22) For the following sets of weights, construct an optimal binary prefix code for each

weight in the set , give the corresponding code word: 8, 9, 10, 11, 13, 15, 22 [8 Marks]

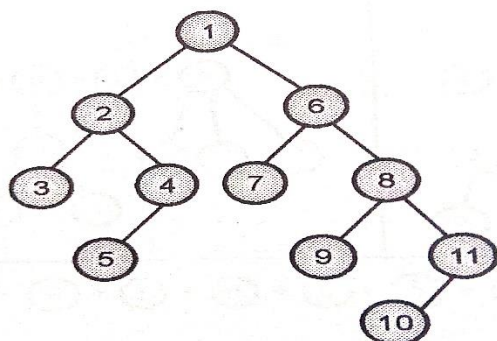
- (23) Give the stepwise construction of minimum spanning tree using Prim's algorithm for the following graph. Obtain the total cost of minimum spanning tree. [8 Marks]



- (24) Explain the Representation of relations with example. (5 Marks)
- (25) Explain the properties of relation with suitable example. [5 Marks]
- (26) Draw the graph and equivalent Hasse diagram for divisibility on the set :
 $\{1, 2, 3, 6, 12, 24, 36, 48\}$ [5 Marks]
- (27) Find the transitive closure of R by Warshall's algorithm where $A = \{1, 2, 3, 4, 5, 6\}$ and $R = \{(x,y) | x-y=2 \text{ and draw it digraph [6 Marks]}$
- (28) Find gcd (102,30) and write in the form $102x+30y$ for $x,y \in \mathbb{Z}$ [5Marks]
- (29) Define terms 1)Algebraic system 2)Semi-Group 3) Monoid 4)Group 5) Subgroup (5 Marks)
- (30) Show that set of all non-zero real numbers is a group with respect to multiplication.(5 Marks)
- (31) What is abelian group?show that $(\mathbb{Z}_6, +)$ is an Abelian Group? [6 Marks]
- (32) Consider the group $(\mathbb{Z}, +)$. Prove that $(\mathbb{Z}, *)$ is an abelian group where $*$ is binary operation defined by $a*b=a+b+1$ for all $a,b \in \mathbb{Z}$ [6 Marks]
- (36) Explain the principle of inclusion and exclusion. Assume that 100 out of 120 students study at least one of the three languages Japanese, French and Russian. It is given that 65 students study Japanese, 45 study French and 42 study Russian, 20 students study Japanese and French, 25 students study Japanese and Russian and 15 study French and Russian. Find the number of students who study: [6 Marks]
- Only Japanese and French but not Russian
 - Only Japanese and Russian but not French
- (37) Use dijktra algorithm to find shortest path between a and z.



- (38)Build a binary search tree for the words banana, peach, apple, pear, coconut, mango and papaya using alphabetical order. Write sequence of visiting words in preorder and post-order traversal. [4 Marks]
- (39) Determine the preorder, postorder and inorder traversal of following binary tree. (8 Marks)



(40) What is an equivalent relation? Identify whether the given relation is an equivalent relation where $A = \{1, 2, 3, 4\}$, relation $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 1), (3, 3), (1, 3), (4, 1), (4, 4)\}$ Also find the equivalent classes. [5 Marks]

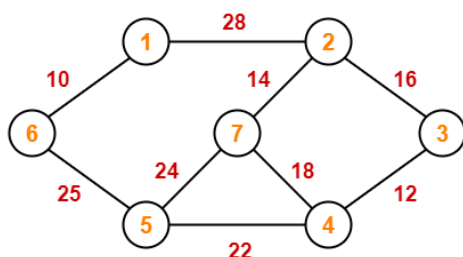
(41) Let $A = \{1, 2, 3, 4\}$ and let $R = \{(1, 1), (1, 2), (1, 4), (2, 4), (3, 1), (3, 2), (4, 2), (4, 3), (4, 4)\}$.

Find Transitive closure of R using Warshall's Algorithm. [5 Marks]

(42) Find gcd (630, 96) by using Euclid's Algorithm. (5 Marks)

(43) Show that the set of all positive rational numbers forms an abelian group under the Composition $*$ defined by $a * b = (ab)/2$. (6 Marks)

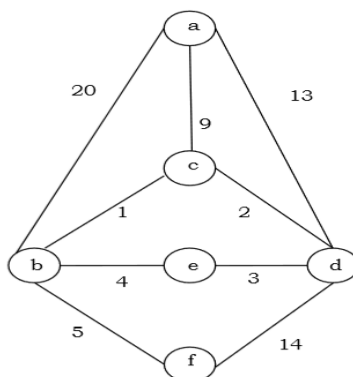
(44) Construct the minimum spanning tree (MST) for the given graph using Prim's Algorithm-



(45) Let $A = \{a, b, c, d\}$ and let R be a relation on A whose relation is $R = \{(b, a), (c, b), (a, d), (b, d), (c, d)\}$

Find transitive closure using Warshall's algorithm.

(46) For instance, consider the following graph G and identify the minimum spanning tree using Prim's algorithm.



(47) Prove the statement is true using mathematical induction: $n^3 + 2n$ is divisible by 3 for all $n \geq 1$. [5 marks]

(48) A survey of 70 high school students revealed that 35 like folk music, 15 like classical music And 5 like both, many of the students surveyed do not like either folk or classical music?

(49) Determine the number of edges in a graph with 6 nodes, 2 nodes of degree 4 and 4 nodes of degree 2. Draw two such graphs.

(50) A graph has 24 edges and degree of each vertex is k , then which of the following is possible number of vertices?