Seat No. :

BACHELOR OF TECHNOLOGY (CBCS - 2023)
B. Tech. Sem-III INFORMATION TECHNOLOGY : WINTER: 2025
SUBJECT: DISCRETE STRUCTURE & GRAPH THEORY

Day : Tuesday
Date : 09/12/2025

W-29243-2025

Time : 10:00 AM-01:00 PM
Max. Marks : 60

NB :
1. All questions are COMPULSORY.
2. Figures to the right indicate FULL marks for the question.
3. Draw neat labelled diagrams WHEREVER necessary.
4. Assume suitable data, if necessary.

Q. 1 Consider the statement: 'Everyone likes someone'. Express the possible meanings using quantifiers and explain the ambiguity that arises from different quantifier orders. (10)

OR

Q. 1 Design a real-world scenario involving three sets (e.g., students who play different sports). Formulate and solve a problem using a Venn diagram and the principle of inclusion-exclusion (10)

Q. 2 Given the relation R on set A={1,2,3,4} with the following adjacency matrix: (10)

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

Apply Warshall's algorithm to compute the transitive closure.

OR

Q. 2 Given a relation R on set A={1,2,3} defined by R = { (1,1), (2,2), (3,3), (1,2), (2,3)} determine if R is reflexive, symmetric or transitive. Justify your answer. (10)

Q. 3 A bag contains 3 red, 4 green, and 2 blue balls. Two balls are drawn one after the other without replacement. Define the sample space and list all possible events where both balls are of the same colour. (10)

OR

Q. 3 A discrete random variable X has the following probability distribution: (10)

X	1	2	3	4
P(X)	0.2	0.3	0.4	0.1

Find the mean, variance, and standard deviation of X.

Q. 4 Draw a planar graph with 6 vertices and 9 edges and verify Euler's formula V - E + F = 2 (10)

OR

Q. 4 Solve the Travelling Salesman Problem for the following graph given by vertices pair : edge weights, using the Nearest Neighbour algorithm: (10)

A-B: 10, A-C: 15, A-D: 20, B-C: 35, B-D: 25, C-D: 30

What is the total distance of path?

Q. 5 Define binary search tree. Construct a binary search tree (BST) by inserting the following elements in order: [50, 30, 20, 40, 70, 60, 80]. Explain each step of insertion. (10)

OR

Q. 5 Explain the difference between Kruskal's and Prim's algorithms with step-by-step procedures. (10)

Q. 6 Define a semigroup and a monoid. Show that the set of natural numbers under addition is a monoid but not a group. (10)

OR

Q. 6 Define a group homomorphism. Give an example and prove whether it is injective or surjective. (10)

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