

BACHELOR OF TECHNOLOGY (CBCS - 2023)
B. Tech. Sem-III INFORMATION TECHNOLOGY : WINTER : 2024
SUBJECT: DISCRETE STRUCTURE & GRAPH THEORY

Day : Tuesday
Date : 03/12/2024

W-292-43-2024

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

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable **CALCULATOR** is allowed.
- 4) Assume suitable data if necessary.

Q.1 A survey was conducted among 1000 people. Of these 595 are graduates, 595 wear glasses and 550 like ice-cream, 395 of them are graduates who wear glasses, 350 of them are graduates who like ice-cream and 400 of them wear glasses and like ice-cream; 250 of them are graduates who wear glasses and do not like ice-cream. How many of them are graduates who do not wear glasses and do not like ice-cream? [10]

OR

Q.1 Evaluate the truth table for the following logical expression: [10]
 $(P \wedge \neg Q) \Rightarrow (R \vee \neg S)$
Where P, Q, R and S are propositions. Analyze the truth conditions under which the expression is true and false.

Q.2 Evaluate the correctness and efficiency of applying Warshall's algorithm to determine the transitive closure of a binary relation on a set of n elements. How does the algorithm scale with increasing n, and what alternative methods could be more efficient? [10]

OR

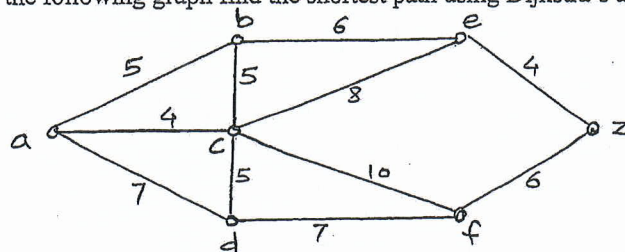
Q.2 Let R be a relation on the set $A = \{1, 2, 3\}$ given by $R = \{(1, 2), (2, 3)\}$. Compute the reflexive closure, symmetric closure and transitive closure of R. Discuss the closure properties and explain how each closure affects the original relation. [10]

Q.3 Suppose we print all five digit numbers on slips of paper with one number on each slip. Find how many minimum distinct slips one has to make up for all the five digits numbers. [10]

OR

Q.3 Evaluate the differences in outcomes between problems using permutations versus combinations. Analyze the scenario of seating arrangements versus group selection among 10 people. [10]

Q.4 For the following graph find the shortest path using Dijkstra's algorithm. [10]



P.T.O.

OR

Q.4 Define the factors of a graph and explain how the concept relates to the factorization of a graph. Analyze the conditions required for a graph to have a factor and provide examples of both 1-factors and 2-factors. [10]

Q.5 Analyze the performance of operations in a binary search tree (BST). For a given sequence of insertions, explain how the height of the tree changes and the impact on the efficiency of search, insertion and deletion operations. Provide examples of both balanced and unbalanced BSTs. [10]

OR

Q.5 For a weighted graph, apply Kruskal's algorithm to find the minimal spanning tree. Then, compare the result with the minimal spanning tree obtained using Prim's algorithm. Discuss the key differences between these two algorithms. [10]

Q.6 Define an algebraic system and explain the key properties that make up a semi-group, monoid and group. Provide an example of each structure and discuss the operations within the system. [10]

OR

Q.6 Prove that the set of positive integers under addition forms a monoid. Show that it satisfies the closure, identity and associativity properties. Discuss how this example contrasts with a semi-group. [10]

* * * *

031224-m-coe-mumbai