BACHELOR OF TECHNOLOGY (CBCS) (2021-COURSE)
B. Tech. Sem - III COMPUTER SCIENCE & ENGINEERING : SUMMER : 2024
SUBJECT: DISCRETE MATHEMATICAL STRUCTURES

Day : Thursday
Date : 09/05/2024

S-25311-2024

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Assume suitable data **WHEREVER** necessary.
4) Draw neat labeled diagrams **WHEREVER** necessary.

Q.1 What are some fundamental methods of proofs used in mathematics to establish the truth of mathematical statement and theorems? Explain the following in detail with example. **(10)**

i. Direct Proof.
ii. Proof by Contradiction.
iii. Proof by Contrapositive.

OR

Q.1 List the Rules of Inference. Prove any five of the rules. **(10)**

Q.2 What is a set? Explain different operations on set. Also list the fundamental set identities. Prove De Morgan's Laws. **(10)**

OR

Q.2 Explain the Principle of Inclusion and Exclusion. Solve the following: **(10)**
Among 50 patients admitted to a hospital, 25 are diagnosed with pneumonia, 30 with bronchitis and 10 with both pneumonia and bronchitis. Determine:

i. The number of patients diagnosed with pneumonia or bronchitis.
ii. The number of patients not diagnosed with pneumonia or bronchitis.

Q.3 Consider the directed graph G with vertices V = {A, B, C, D } and edges E = {(A, B), (B, C), (C, D), (D, A)} **(10)**
Compute the Transitive Closure of the graph G using Warshall's algorithm.
Explain how the Transitive Closure matrix obtained from Warshall's algorithm represents the reachability information between pairs of vertices in the original graph G.

OR

Q.3 Define a relation and explain its properties. Explain different types of relations with suitable examples. **(10)**

Q.4 Define a function and related terminologies such as image, domain and co-domain with suitable examples. Explain different types of functions. Solve the following: **(10)**

i. Show that the function $f: R \rightarrow R$, given by $f(x)=2x$ is one-one and onto.
ii. If $f: R \rightarrow R$; $f(x)=2x + 7$ is a bijective function then find Inverse of f.

OR

Q.4 Define Homomorphism and Isomorphism. How do homomorphism and Isomorphism serve as fundamental concepts for studying and comparing Algebraic Structures? **(10)**

Q.5 Explain with example and suitable formulae what are Sum Rule and Product Rule. **(10)**
Solve the following:

i. In New Hampshire, license plates consisted of two letters followed by 3 digits. How many possible license plates are there?

ii. How many legal configurations are there in Towers of Hanoi with n rings?

OR

Q.5 Explain with example and suitable formulae what are Permutations and Combinations. Solve the following: **(10)**

i. How many ways are there to distribute four distinct balls evenly between two distinct boxes (two balls to go in each box)?

ii. How many permutations are there of 5 things taken 3 at a time?

Q.6 Explain what a planar graph is? Differentiate between Eulerian and Hamiltonian paths and circuits using suitable example. **(10)**

OR

Q.6 What is a Binary Tree? Explain its properties and any two applications of binary trees. **(10)**

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