QPC: R251M009 AR 24 Reg. No

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

Ph.D. (First Semester-Summer) Examinations, December – 2025

23SPPECS1012 – Advanced Data Structures

(CSE)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

Answer *ANY FIVE* Questions. **(14 x 5 = 70 Marks)** **Marks**

1.a. Define Dictionaries. Explain how dictionaries can be implemented using suitable data structures. 8

b. Define Hashing? Explain Hash Functions with suitable example? 6

2. Explain the concept of double hashing in open addressing. How does double hashing help in reducing clustering? What conditions must the second hash function satisfy to ensure efficient probing and avoid repeated collisions? 14

3.a. Describe the basic operations performed on a skip list. Explain how each operation—search, insertion, and deletion—is carried out using the layered structure of skip lists. 7

b. Differentiate between probabilistic and deterministic skip list. 7

4. Differentiate between probabilistic skip lists and deterministic skip lists. Explain their structural differences and performance characteristics. 14

5.a. Given a sequence of keys, explain in detail the algorithmic procedure for constructing a Binary Search Tree (BST). Then, using this procedure, construct the BST for the following set of values and illustrate the tree after each insertion step:45, 39, 75, 24, 42, 60, 87. 7

b. What is the balance factor in an AVL Tree? Explain in detail the various AVL tree operations (insertion, deletion, and rotations). Construct an AVL tree using an example and show how rotations are applied to maintain balance. 7

6.a. Is every AVL tree also a Red-Black tree? Provide a detailed justification for your answer by constructing suitable sample data, comparing the height properties of both trees, and demonstrating cases where an AVL tree cannot satisfy Red-Black tree constraints. 7

b. What are 2-3 trees how it works with data structures discuss with an example? 7

7. Explain the Longest Common Subsequence (LCS) problem in Dynamic Programming. Describe the recursive formulation, derive the DP table construction process, and compute the LCS for the strings “ABCDGH” and “AEDFHR” with all steps. 14

8.a. Explain the Brute Force Pattern Matching algorithm. Describe its working procedure with an example and analyze its time complexity in the best and worst cases. 7

b. Explain the concept of one-dimensional range searching in computational geometry. Describe suitable data structures used to perform efficient range queries and illustrate your answer with an example. 7

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