विश्वजीवनामृतं ज्ञानम्

ABV- Indian Institute of Information Technology & Management, Gwalior

Design and Analysis of Algorithms (IT203)

Minor Examination (Session 2023–24)

Maximum Time: 1.5 Hours **Max Marks: 40**

Note: Answer all questions. All questions carry equal marks.

1. (a) Define and compare Big-O, Big-, and Big- notations with examples. (b) Arrange the following functions in increasing order of growth rate: $n, \log n, n^2, 2^n, n \log n$. (5 Marks)

2. Consider the recurrence $T(n) = 2T(n/2)+n$. (a) Solve it using the Master Theorem. (b) State the time complexity of Merge Sort and Quick Sort and justify briefly. (5 Marks)

3. (a) Explain linear search and binary search algorithms. Derive their best, worst, and average case complexities. (b) Apply binary search to find 55 in the sorted list: {10, 20, 30, 40, 50, 55, 60, 70}. Show steps. (5 Marks)

4. (a) Explain Divide and Conquer strategy with an example other than sorting. (b) Write the algorithm for Matrix Chain Multiplication problem. (5 Marks)

5. A professor wants to schedule lectures using the **Interval Scheduling Problem**. Given jobs with start and finish times: (1, 4), (3, 5), (0, 6), (5, 7), (8, 9), (5, 9), (6, 10), (8, 11). Apply the **Greedy Algorithm** to find the maximum set of non-overlapping intervals. Show step-by-step solution. (5 Marks)

6. (a) Explain briefly the differences between Greedy and Dynamic Programming approaches. (b) Give one real-world example each where Greedy works optimally and where it fails. (5 Marks)

7. Write short notes on any two: (a) NP-complete problems (b) Graph representations (Adjacency Matrix vs List) (c) Weighted Interval Scheduling (5 Marks)