M.Sc. 1st Semester Examination, 2024

COMPUTER SCIENCE

(Analysis of Algorithm)

PAPER—COS-101

Full Marks : 50

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

Answer any **four** questions :   2 × 4

1. Determine the time complexity of the Heapsort algorithm and explain why it is efficient.

2. Define tail recursion and explain its significance with an example.

3. How does the divide-and-conquer approach work in the Merge Sort algorithm ?

4. Explain the significance of the overlapping subproblems property in dynamic programming with an example.

5. What is the main difference between BFS and DFS in terms of their traversal methods ?

6. Define NP-complete problems and give an example.

GROUP – B

Answer any **four** questions : 4 × 4

7. Derive the time complexity of the binary search algorithm and explain its significance in sorted data.

8. Write down the algorithm to solve Tower of Hanoi problem using recursive approach.

9. Write the recurrence relation for Quick Sort algorithm and solve it to determine the time complexity in the best and worst cases.

10. Describe the Branch and Bound technique used in solving the 15-puzzle problem.

11. Explain the UNION-FIND algorithm with union by rank and path compression.

12. Briefly discuss Prim's algorithm for finding minimum spanning tree with a suitable example.

GROUP – C

Answer any **two** questions :   8×2

13. Give four matrices A1, A2, A3 and A4 with dimensions 2×3, 3×4, 4×5 and 5×2 respec-

tively. Determine the optimal parenthesization of these matrices to minimize the number of scalar multiplications. Show the steps of your computation and the final result.

14. Given the two strings X="ABCDGH" and Y="AEDFHR". Find the length of the Longest Common Subsequence (LCS) between X and Y using dynamic programming approach. Additionally, identify the LCS itself by constructing the LCS table and backtracking.

15. Explain the Diffie-Hellman algorithm with a suitable example.

16. Consider the following weighted graph with four vertices :

(*Continued*)
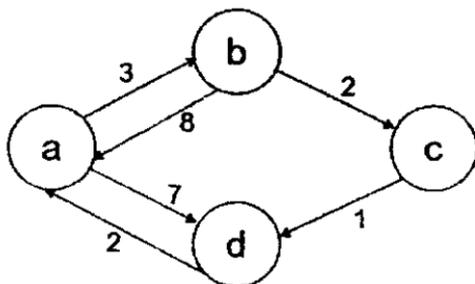
Use the Floyd-Warshall algorithm to compute the shortest path between all pairs of vertices using dynamic programming approach.

[Internal Assessment — 10 Marks]