2055
B.E. (Computer Science and Engineering)
Fourth Semester
CS-401: Analysis and Design of Algorithms

Time allowed: 3 Hours   Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

x-x-x

Q1. a) Solve the recurrence relation $T(n)=2*T(n/2)+n$ using the recursion tree method.   10

b) Why is Merge Sort preferred over Quick Sort for linked lists?

c) Why does the greedy approach fail for the 0/1 Knapsack problem but work for the fractional Knapsack problem?

d) State time complexity of the N-Queens problem using backtracking.

e) List any two main properties of problems that can be solved using Dynamic Programming.

Section-A

Q2. a) Solve the recurrence relation $T(n)=3T(n/2)+n^2$ using the Master's theorem. Explain each step clearly.   5

b) Explain different representations of graphs. Compare their advantages and disadvantages with respect to space and time complexity.   5

Q3. a) Given an array [12,11,13,5,6,7], show the step-by-step execution of Merge Sort. Work out its complexity also.   5

b) Explain how Strassen's matrix multiplication reduces the time complexity compared to the standard matrix multiplication algorithm. Derive its recurrence relation.   5

Q4. a) Differentiate between the 0/1 Knapsack Problem and the Fractional Knapsack Problem. Why does the greedy strategy work for the fractional case but not for the 0/1 case?   5

b) Explain the difference between Prim's and Kruskal's algorithms for finding a Minimum Spanning Tree (MST). Under what conditions is one preferred over the other? Compare time and space complexities of both.   5

P.T.O.

Section-B

Q5. a) Explain Floyd-Warshall's Algorithm for finding the shortest paths between all pairs of vertices in a   5
weighted graph. How does it differ from Dijkstra's algorithm?

    b) For the given sequences "ABCBDAB" and "BDCAB", construct the LCS table and determine the length
of the longest common subsequence. Also, reconstruct the actual LCS.   5

Q6. a) Illustrate the Sum of Subsets problem with a step-by-step solution using backtracking.   4

    b) Explain the Graph Coloring problem and how backtracking is used to solve it. Give an example with   6
3 colors.

Q7. a) Discuss the significance of Approximation Algorithms in solving NP-complete problems.   5

    b) Differentiate between P, NP, NP-complete, and NP-hard problems with proper examples.   5

x-x-x