C4-R3: ALGORITHM ANALYSIS AND DESIGN

NOTE:

1.	Answer question 1 and any FOUR questions from 2 to 7.
2.	Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 100**

1.

a) Define the time complexity and space complexity of an algorithm. Differentiate between average case, best case and worst case time complexities.

b) Trace QUICK-SORT (A) on the array A = [4 0 4 3 8 3 2]. What is the name of the algorithm design principle on which QUICK-SORT is based?

c) B-Tree with Minimum Degree 2 in given below. Insert key '5' again in the tree.
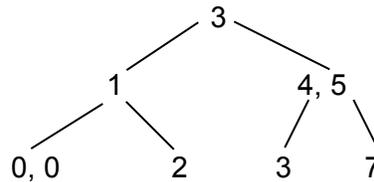
d) What is the Greedy approach? Does it always give Optimal Solution? Give two examples in which Greedy algorithm gives optimal solution.

e) Write a recursive algorithm for Binary Search. What is the time complexity of the algorithm? What is the size of each partition?

f) What is Amortized Analysis? How does it differ from Asymptotic Analysis? What are the methods to perform Amortized Analysis?

g) List the steps for the development of a Dynamic Programming algorithm and explain each of them briefly.

(7x4)

2.

a) Solve the following Recurrence using Recursive Tree Method:
$$T(n/3)+T(2n/3)+n$$

b) Find an asymptotic upper bound on the summation:
$$\sum_{k=0}^{\lfloor lg\,n \rfloor} \left\lceil \frac{n}{2^k} \right\rceil$$

c) Describe a convex Hull problem. What are the different methods that compute convex Hull? Write any one algorithm.

(6+6+6)

3.

a) Write a Greedy Algorithm for Activity Selection Problem and find its time complexity.

b) Define 0/1 Knapsack Problem. Solve the following given instance Using Greedy Approach. Is this solution Optimal? Capacity of Knapsack is 50.

Item	Weight	Value	Value/Weight
1	10	60	6
2	20	100	5
3	30	120	4

c)   What is Minimum Spanning Tree? Find the Minimum Spanning Tree for the given graph using Prim's Algorithm.
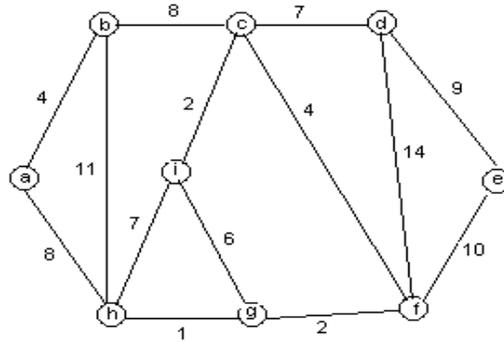
(6+6+6)

4.
a)   Explain working of Heap Sort with a suitable example.
b)   Explain P-RAM Model. Which are the most popular P-RAM Models?
c)   Write any one parallel algorithm for sorting.

(6+6+6)

5.
a)   Write a Dynamic Programming algorithm for matrix chain multiplication and find time and space complexity of the algorithm.
b)   Write Floyd-Warshall Algorithm for finding All Pairs of Shortest Path.
c)   Determine Longest Common Subsequence of two sequences:
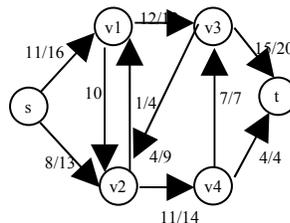   X: abcdace   Y: badcabe

(6+6+6)

6.
a)   Write an algorithm for incrementing 8-bit binary counter. Using Aggregate analysis, find the Amortized Cost.
b)   Define Approximation Algorithm. Write approximation algorithm for vertex cover problem.
c)   Define P, NP and NP-Complete Problems.

(6+6+6)

7.
a)   What is the basic idea behind String Matching? Which are the two popular algorithms for String Matching? Write Rabin-Karp Algorithm for String Matching.
b)   Define a Flow Network. What is the goal of the Flow Network? What are the properties of a Flow Network? Prepare Residual Network for the following Flow Network.

(9+9)