Sub Code: CST010 **ROLL NO……..……..**

ODD SEMESTER EXAMINATION, 2024 – 25

IIIrd Year (Vth Sem) B.Tech.: CS&E/ CS&E(Data Science)/AI&ML/IT

DESIGN & ANALYSIS OF ALGORITHMS

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any two parts of the following. (10x2= 20) a) (i) Discuss in brief Asymptotic Analysis with best, average & worst-case complexities. (5 marks) (ii) Show that the worst-case running time of the quick-sort algorithm is $\Theta(n^2)$. (5 marks) b) What is heap? Explain. Illustrate the performance of the heap sort algorithm on the following input sequence: 2, 5, 16, 4, 10, 23, 39, 18, 26, 15 (10 marks) c) Using merge-sort algorithm to sort the following elements: 15,10,5,20,25,30,40,45. Also show that the running time of the merge-sort algorithm on the n-element sequence is Θ(nlogn). (10 marks)
Q 2.	Answer any two parts of the following. (10x2= 20) a) (i) What is activity selection problem? Write a greedy approach to solve Activity Selection problem. (5 marks) (ii) What is difference between dynamic and greedy approach? Explain knapsack problem. (5 marks) b) What is the sum of subsets problem? Let w={5,7,10,12,15,18,20} and m=35. Find all possible subsets of w that sum to m using recursive backtracking algorithm for it. Draw the portion of the state-space tree that is generated. (10 marks) c) What is dynamic programming? Find the order of parenthesization for the optimal chain multiplication of the following matrices: A1 = 15*5 A2 = 5*10 A3 = 10*20 A4 = 20*25 (10 marks)
Q 3.	Answer any two parts of the following. (10x2= 20) a) (i) What are single source shortest paths? Write down Dijkstra's algorithm for it. (5 marks) (ii) What is Fibonacci Heap? Discuss the application of Fibonacci Heap. (5 marks) b) Write and explain the Kruskal algorithm to find the minimum spanning tree of a graph with suitable example. (10 marks) c) Write the properties of binomial tree. Draw a binomial heap whose keys are elements of A = (7,2,4,17,1,11,6,8,15,10,20). (10 marks)
Q 4.	Answer any two parts of the following. (10x2= 20) a) (i) Explain Satisfiability problem. (5 marks) (ii)Write and explain the Cooks theorem. (5 marks) b) What is non-deterministic algorithm. Prove that the Travelling Salesman Problem is NP-Complete. (10 marks) c) Discuss in detail about the class P, NP, NP-hard and NP-complete problems. Show the

	relationship between them.	(10 marks)
Q 5.	Answer any two parts of the following.	(10x2= 20)
	a) (i) Explore set cover problem using approximation algorithm.	(5 marks)
	(ii) What are Distributed Hash Tables? Explain the characteristics of Distributed Hash Tables.	(5 marks)
	b) Define approximation algorithms. What is approximation ratio? Approximate the travelling salesman problem with triangle inequality.	(10 marks)
	c) What is randomized algorithm? Write advantage and disadvantage of randomized algorithm. Also explain the types of randomized algorithm.	(10 marks)

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