Printed Page:-04 Subject Code:- ACSE0501

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024 - 2025)

Subject: Design and Analysis of Algorithms

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. Using asymptotic analysis, we can very well conclude the scenario of an algorithm. (CO1),K4 1

(a) best case

(b) average case

(c) worst case

(d) best case, average case, and worst case

1-b. Solve The recurrence relation $T(n) = mT(n/2)+an^2$ is satisfied by. (CO1),K3 1

(a) $T(n) = O(n^m)$

(b) $T(n) = O(n + \log m)$

(c) $T(n) = O(n \log m)$

(d) $T(n) = O(m \log n)$

1-c. Choose the option with function having same complexity for a fibonacci heap. (CO2),K3 1

(a) Insertion, Union

(b) Insertion, Deletion

(c) extract_min, insertion

(d) Union, delete

1-d. A Binomial tree B_k Contains. (CO2),K2 1

(a) 2^k nodes

.

(b) Height k

(c) Exactly $^{K}C_{I}$ nodes

(d) All of these

1-e. Find Time complexity of Fractional Knapsack problem is. (CO3),K1 1

(a) O(n)

(b) O(lg n)

(c) O(2 n)

(d) O(n lg n)

1-f. Solve Single-Source shortest path problem using. (CO3),K3 1

(a) Kruskal's Algorithm

(b) Prim's Algorithm

(c) Dijkstra's Algorithm

(d) Flyod-Warshal Algorithm

1-g. Find in dynamic programming, the technique of storing the previously calculated values is called (CO4),K1 1

(a) Saving value property

(b) Storing value property

(c) Memoization

(d) Mapping

1-h. The running time of Floyd-Warshall algorithm is. (CO4),K4 1

(a) $\theta(n)$

(b) $\theta(1)$

(c) $\theta(n^3)$

(d) $\theta(nlogn)$

1-i. Rabin and Karp Algorithm is (CO5),K4 1

(a) String Matching Algorithm

(b) Shortest Path Algorithm

(c) Minimum spanning tree Algorithm

(d) Approximation Algorithm

1-j. Find the Basic principle in Rabin Karp algorithm. (CO5) ,K1 1

(a) Hashing

(b) Sorting

(c) Augmenting

(d) Dynamic Programming

2. Attempt all parts:-

2.a. differentiate between an Algorithm and a Program .(CO1),K4 2

2.b. Explain how to search element in a B-tree. (CO2),K2 2

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2.c.	Explain Fibonacci Heap? Discuss the applications of Fibonacci Heap. (CO3),K2	2
2.d.	Discuss n-Queen Problem. (CO4),K2	2
2.e.	Define theory of completeness. (CO5), K1	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Implement merge Sort algorithm and sort the following sequence { 23,11, 5, 15, 68, 31, 4,17} using merge sort. (CO1), K3	6
3-b.	Solve the Ω- notation for the following functions: (CO1),K3 a) $5n^3+n^2+3n+2$ b) $3n+6n^2+3n$ c) $4*2^n+3n$	6
3-c.	Discuss the advantages of Red Black Tree over Binary Search Tree?. Write down the properties of Red-Black tree.(CO2), K2	6
3-d.	Design the B-tree for following keys into empty B-tree:- 40,35,22,90,12,45,58,78,67,60 and t=3 (CO2),K6	6
3.e.	Implement Prim's algorithm. Take an example and find MST of any graph using Prim's algorithm.(CO3),K3	6
3.f.	Give the formulation of modified knapsack problem using branch and bound and find the optimal solution using least cost branch and bound with n=4, m=15, (p1…p4) = (15 15 17 23), (w1…w4) = (3 5 6 9). (CO4),K5	6
3.g.	Let w={5,7,10,12,15,18,20} and m=35.Compute all possible subset of w whose sum is equivalent to m. Draw the portion of state space tree for this problem. (CO4),K5	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Solution of the following recurrence relation: (CO1),K3 A) $T(n) = 8T(n/2)+3n^3$ B) $T(n) = 100T(n/99)+\log(n!)$ is $T(n) = \theta(n\log n)$ C) $T(n) = 4T(n/2)+n^2$	10
4-b.	Illustrate the operation of HEAP-SORT on the array A=(5,13,2,25,7,17,20,8,4) with the help of algorithm implementation.(CO1),K4	10

5. Answer any one of the following:-

5-a.	Explain deletion algorithm in red black tree in detail. Write down it's complexity (CO2),K2	10
5-b.	Explain the Properties of Binomial Heap. Write an algorithm to perform uniting two binomial Heaps. And also to find the Minimum Key (CO2), K2	10

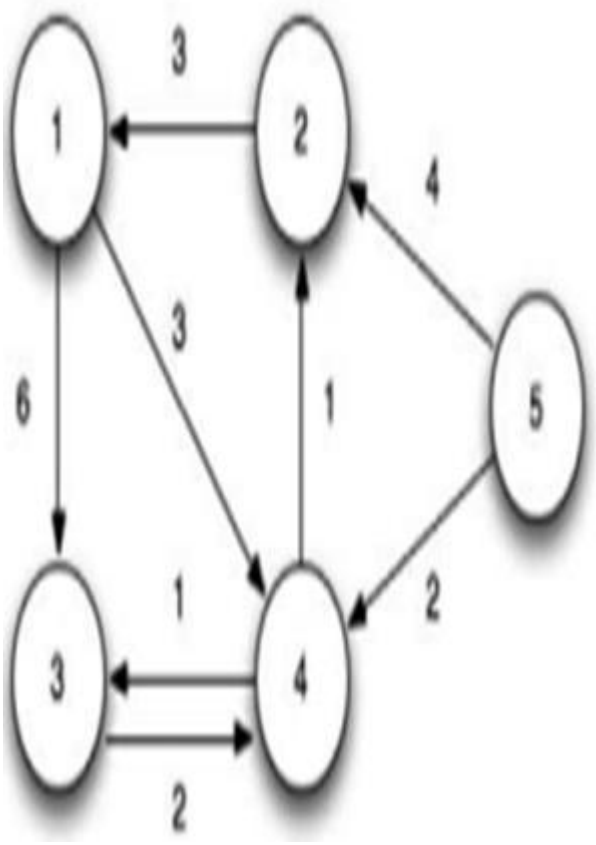
6. Answer any one of the following:-

6-a.	Implement Quicksort algorithm. Step by Step sort the following sequence in increasing order using Quicksort algorithm <1,2,3,4,5,6,7,8>. Analyze the algorithm for best-case time complexity.(CO3),K3	10

6-b. Explain Strassen matrix multiplication along with an example? Why and when do we prefer it over normal matrix multiplication. (CO3),K2 — 10

7. Answer any <u>one</u> of the following:-

7-a. Define Floyd Warshall Algorithm for all pair shortest path and Solve on above graph: (CO4),K3 — 10



7-b. Explain 0/1 knapsack problem? Solve the given instance using Dynamic Programming and write the algorithm also, knapsack capacity=8 profit<1,6,18,22,28> weight<1,2,5,6,7>. (CO4),K3 — 10

8. Answer any <u>one</u> of the following:-

8-a. (a) Define approximation algorithms? Why and where they are useful? (CO5),K1
(b) Explain the approximation algorithm for vertex cover and set cover problem. (CO5),K2 — 10

8-b. Discuss the Knuth-Morris-Pratt algorithm for pattern matching also write its time complexity. (CO5),K2 — 10