Printed Page:- 04 **Subject Code:- ACSE0401 /ACSEH0301**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION - (2024 - 2025)

Subject: Design and Analysis of Algorithm

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. The Θ notation in asymptotic evaluation represents – (CO1,K1) 1

(a) Worst Case
(b) Average Case
(c) Best Case
(d) Null Case

1-b. ___ of an algorithm is the amount of time required for it to execute(CO1,K1) 1

(a) Time complexity
(b) Space complexity
(c) Compiling time
(d) Best case

1-c. In B-tree maximum no of keys are _____if order 4 and of height 3 . (CO2,K3) 1

(a) 255
(b) 63
(c) 127
(d) 188

1-d. The best case height of a B-tree of order n and which has k keys is: (CO2,K1) 1

(a) log n (k+1) -1
(b) nk

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(c) logk (n+1) – 1

(d) klogn

1-e. Time complexity of Depth First Search algorithm is: (CO3, K1) 1

(a) O(V lg E)

(b) O(E+V)

(c) O(lg V)

(d) O(E lg E)

1-f. We can solve Single-Source shortest path problem using (CO3,K1) 1

(a) Kruskal's Algorithm

(b) Prim's Algorithm

(c) Dijkstra's Algorithm

(d) Flyod-Warshal Algorithm

1-g. _____methods can be used to solve the longest common subsequence problem. (CO4,K1) 1

(a) Recursion

(b) Dynamic programming

(c) Both recursion and dynamic programming

(d) Greedy algorithm

1-h. The n-queens problem implemented in : (CO4,K1) 1

(a) carom

(b) chess

(c) ludo

(d) cards

1-i. Travelling Salesman Problem belongs to: (CO5,K1) 1

(a) NP-Complete Problem

(b) NP-Hard Problem

(c) NP-soft Problem

(d) None of them

1-j. The sum and composition of two polynomials are always polynomials (CO,K1) 1

(a) TRUE

(b) FALSE

(c) None

(d) Sometimes

2. Attempt all parts:-

2.a. Write down the characteristics of algorithm. (CO1,K1) 2

2.b. Define RED- BLACK tree.(CO2,K1) 2

2.c. Differentiate between single source shortest path and all pair shortest path problem. (CO3,K3) 2

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2.d.	Differentiate between Backtracking and Banch and Bound.(CO4,k3)	2
2.e.	Define NP- hard problem . (CO5,K1)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Explain asymptotic notations with example.(CO1,K2)	6
3-b.	Sort the following elements using Shell sort algorithms and specify its complexity. < 60, 20, 50, 10, 70, 90, 40, 30>. (CO1, K3)	6
3-c.	Insert the following keys into empty B-tree: 86, 23, 91, 4, 67, 18, 32, 54, 46, 96, 45 with degree t=2 and delete 18, 23 from it. (CO2,K3)	6
3-d.	Define B-Tree and write down it's properties.(CO2,K1)	6
3.e.	Use Merge sort to sort the given array in non-decreasing order <18,19,11,13,12,14,17,15>.(CO3,K3)	6
3.f.	Explain the Graph Coloring Problem with example . (CO4,K2)	6
3.g.	Explain NP-hard.Demonstrate approximation algorithm for NP hard problem. (CO5,K2)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Solve the recurrence relation using Iteration Substitution method. (CO1, K3) T(n)=1 n=0 T(n)=T(n-1)+1 n>0	10
4-b.	Write the algorithm of Counting sort? Sort the following elements using Counting sort algorithm < 8, 4, 4, 2, 6, 9, 9, 2, 9> (CO1,K3)	10

5. Answer any one of the following:-

5-a.	Write algorithm for extracting minimum element in a fibonacci heap. Also give example? (CO2,K1)	10
5-b.	Write algorithm for union of two binomial heaps. Also write its complexity. (CO2,K1)	10

6. Answer any one of the following:-

6-a.	Write Quicksort algorithm. Also show Step by Step sort the following sequence in increasing order using Quicksort algorithm <11,21,31,41,51,61,71,81>. (CO3,K3)	10
6-b.	Write Kruskal algorithm to find minimum spanning tree and analyze its time complexity. Explain with example. (CO3,K1)	10

7. Answer any one of the following:-

7-a.	Consider the sum-of-subset problem, n = 4, Sum = 13, and w1 = 3, w2 = 4, w3 = 5 and w4 = 6. Find a solution to the problem using backtracking. Show the state-space tree leading to the solution. (CO4)	10
7-b.	Solve the instance of 0/1 knapsack problem using dynamic Programming : n = 4, M = 25, (P1, P2, P3 P4) = (10, 12, 14, 16), (W1, W2, W3, W4) = (9, 8, 12, 14) .(CO4,K3)	10

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

8-a.	Define the following problems related to NPC: (CO5,K1) (i) Vertex Cover (ii) Clique (iii) SAT and its variants	10
8-b.	Explain the KMP String matching algorithm for finding the pattern on a text and analyze the algorithm. (CO5,K2)	10

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