Printed Page:- 04 **Subject Code:- AMICSE0401**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech(Integrated)

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. Find MST of the given graph using Kruskal algorithm. (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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