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 (2023 - 2024)
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. Which of the following algorithm design technique is used in the quick sort algorithm? (CO3) 1

(a) Dynamic programming
(b) Backtracking
(c) Greedy method
(d) Divide-and-conquer

1-b. Which of the following asymptotic notation is used to provide lower bound constraints ? (CO1) 1

(a) O
(b) θ
(c) Ω
(d) o

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

(a) Insertion, Union
(b) Insertion, Deletion
(c) extract_min, insertion
(d) Union, delete

1-d. What is the best case height of a B-tree of order n and which has k keys? (CO2) 1

(a) log n (k+1) -1
(b) nk
(c) logk (n+1) – 1
(d) klogn

1-e. Best case time complexity of Merge Sort is (CO3) 1

(a) O(n lg n)
(b) O(n)
(c) O(n^2)
(d) O(lg n)

1-f. When will Bellman-Ford's algorithm fail ? (CO3) 1

(a) Graph has negative weighted cycle
(b) Graph has negative weighted edges
(c) Graph is sparse
(d) Graph is dense

1-g. Where is the n-queens problem implemented? (CO4) 1

(a) carom
(b) chess
(c) ludo
(d) cards

1-h. Travelling salesman problem is an example of which of the following ? (CO4) 1

(a) Dynamic Algorithm
(b) Greedy Algorithm
(c) Recursive Algorithm
(d) Divide and Conquer

1-i. What does NP stands for in complexity classes' theory? (CO5) 1

(a) Non polynomial
(b) Non-deterministic polynomial
(c) Both (a) and (b)
(d) None of the mentioned

1-j. If a problem A is NP-Complete, there exists (CO5) 1

(a) a non-deterministic polynomial time algorithm to solve A
(b) a deterministic polynomial time algorithm to solve A
(c) both of above
(d) None of above

2. Attempt all parts:-

2.a. Find the O notation of following function: - (CO1) 2

(1) $F(n)= 5n^3+n^2+6n+2$
(2) $F(n)=6n^2+3n+2$

2.b.	Explain inserting in Fibonacci heap with example. (CO2)	2
2.c.	Write a short note on Bellman Ford's Algorithm (CO3)	2
2.d.	Explain graph traversal algorithm. (CO4)	2
2.e.	Discuss some example of randomized algorithms . (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	What do you understand by stable and unstable sorting? Sort the following sequence { 25, 57, 48, 36, 12, 91, 86, 32} using Heap Sort. (CO1)	6
3-b.	Discuss about Counting sort algorithm and sort the following array { 1, 3 ,7 , 8, 1, 1, 3 } using counting sort . (CO1)	6
3-c.	Explain about RED-BLACK tree and write down it's properties .(CO2)	6
3-d.	Write the procedure which extract the minimum key node from binomial heap. (CO2)	6
3.e.	Implement Krushkal's algorithm also discuss an example and find MST of any graph using Kruskal's algorithm (CO3)	6
3.f.	Given two sequence say "ABCF" and "ACF" Find Longest Common Subsequence or LCS (CO4)	6
3.g.	(a) Consider the recurrences T (n) = 3 T (n/3) + cn, and T (n) = 5 T (n/4) + n2 where c is constant and n is the number of inputs. Find the asymptotic bounds. (CO1)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Solving the following function using recursion tree method or Substitution method : - T(n)=2T(n/3) + n when n>0 T(n)=1 when n=0 (CO1)	10
4-b.	Explain red-black tree. Show steps of inserting the keys 41, 38, 31, 12, 19, 8 into initially empty red-black tree. (CO2)	10

5. Answer any one of the following:-

5-a.	What is an optimization problem ? How greedy method can be used to solve the optimization problem ? (CO3)	10
5-b.	Insert following sequence of integers 10, 25,20, 35, 30, 55, 40, 45, 50, 55, 60, 75, 70, 65, 80, 85 and 90 in an initially empty B-Tree of m=4. Give the number of nodes splitting operation that take place . (CO2)	10

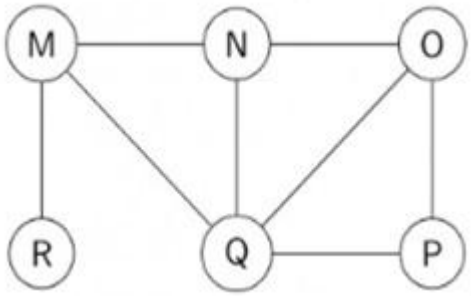
6. Answer any one of the following:-

6-a.	Describe and compare following algorithms to determine the minimum cost spanning tree : (i) Kruskal's algorithm (ii) Prim's algorithm . (CO3)	10
6-b.	What are data compression techniques? Write algorithm to implement Huffman code and analyze the algorithm step by step. Find the Huffman code for the character of given text file	10

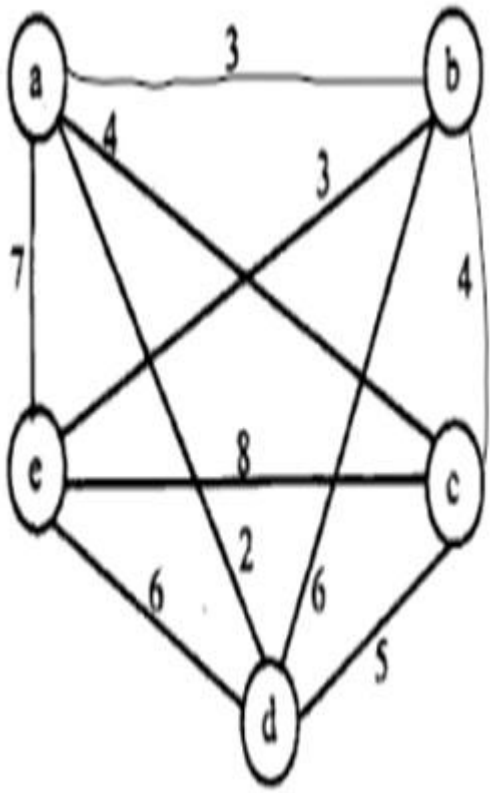
Character:
Frequency:<45, 25, 20, 10, 5, 15> (CO3)

7. Answer any one of the following:-

7-a. The Breadth First Search (BFS) algorithm has been implemented using the queue data structure. Which one of the following is a possible order of visiting the nodes in the graph below? (CO4) 10



7-b. Find the solution of following instance for TSP problem using Branch and Bound Algorithm. (CO4) 10



8. Answer any one of the following:-

8-a. What are the decision problems? How can you convert an optimization problem into decision problem? (CO5) 10

8-b. Implement an algorithm for Knapsack problem using NP-Hard Approach. (CO5) 10