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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2025 - 2026)

Subject: Data Structures & 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:-

(1.1) Performance of algorithm is measured in terms of: (CO1, K1)

1

- (a) Time and Space
- (b) Compiler
- (c) Language
- (d) OS

(1.2) Which algorithm design technique guarantees global optimum? (CO1, K2)

1

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

(1.3) Which data structure follows LIFO principle? (CO2, K1)

1

- (a) Stack
- (b) Queue
- (c) Linked List
- (d) Array

(1.4) Deletion in a queue happens at? (CO2, K1)

1

- (a) Front
- (b) Rear
- (c) Top
- (d) Bottom

(1.5) A binary tree node has at most how many children? (CO3, K1)

1

- (a) 1 child

- (b) 2 children
(c) 3 children
(d) n children
- (1.6) B-tree is mainly used in: (CO3, K1) 1
(a) RAM
(b) Disk storage
(c) Stack
(d) Queue
- (1.7) Identify the linear data structure from the following options (CO4, K1) 1
(a) Array
(b) Tree
(c) Graph
(d) None
- (1.8) State the time complexity of searching an element in a sorted array using Binary Search. (CO4, K2) 1
(a) $O(n)$
(b) $O(\log n)$
(c) $O(n^2)$
(d) $O(1)$
- (1.9) Sequential file organization stores records in: (CO5, K1) 1
(a) Sequential order
(b) Random order
(c) Hashed order
(d) Indexed order
- (1.10) In hashing, collision occurs when: (CO5, K1) 1
(a) Keys are unique
(b) Two keys map to same location
(c) No key exists
(d) File is empty

2. Attempt all parts:-

- (2.1) $f(n) = 3n^3 + 2n^2 + 5n + 1$. Find (i) Big-O (ii) Big-Theta (iii) Big-Omega notation. (CO1, K3) 2
- (2.2) Convert the expression $A + B * C$ into Postfix notation. (CO2, K3) 2
- (2.3) What is balance factor? (CO3, K1) 2
- (2.4) Define the 'Pivot' element in Quick Sort. (CO4, K1) 2
- (2.5) Define indexed sequential file organization. (CO5, K1) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) Differentiate between primitive and non-primitive data types with examples. (CO1, 6

	K2)	
(3.2)	Explain trees and graphs as non-linear data structures and discuss their applications. (CO1, K2)	6
Answer any one of the following:-		
(3.3)	Write the steps to insert a node at the beginning of a singly linked list. (CO2, K3)	6
(3.4)	Explain why a doubly linked list requires more memory than a singly linked list. (CO2, K2)	6
Answer any one of the following:-		
(3.5)	Differentiate full, complete, and perfect binary tree. (CO3, K2)	6
(3.6)	Difference between B-tree and B+ tree. (CO3, K2)	6
Answer any one of the following:-		
(3.7)	Write a complete C function for Linear Search and explain its logic. (CO4, K3)	6
(3.8)	Show the steps of Insertion Sort for the list: 12, 11, 13, 5, 6. (CO4, K3)	6
Answer any one of the following:-		
(3.9)	Explain advantages and limitations of hashing. (CO5, K2)	6
(3.10)	Explain adjacency matrix representation with example. (CO5, K2)	6
<u>SECTION-C</u>		50
4. Answer any <u>one</u> of the following:-		
(4.1)	Explain the concept of growth of functions. Using graphs and mathematical reasoning, compare and arrange the following in increasing order of growth: $\log n$, $n^{1/2}$, n , $n \log n$, n^2 , 2^n . Justify each comparison. (CO1, K4)	10
(4.2)	Explain the role of data structures in problem solving. Choose one real-life problem (e.g., University Course Registration or Bank Management System) and describe the choice of data structure for storing and manipulating data efficiently. (CO1, K5)	10
5. Answer any <u>one</u> of the following:-		
(5.1)	Write a recursive function for calculating the factorial of a number. (CO2, K3)	10
(5.2)	Discuss the array representation of a Stack. Provide algorithms for push and pop. (CO2, K2)	10
6. Answer any <u>one</u> of the following:-		
(6.1)	Explain B-tree with insertion operation by taking suitable example. (CO3, K3)	10
(6.2)	Explain detailed comparison between BFS and DFS by taking suitable example. (CO3, K4)	10
7. Answer any <u>one</u> of the following:-		
(7.1)	Discuss hashing in detail, including various hash functions and hashing techniques. (CO4, K2)	10
(7.2)	Write a Program to implement Insertion sort in an Array. (CO4, K3)	10
8. Answer any <u>one</u> of the following:-		
(8.1)	Explain Kruskal algorithm with detailed example and complexity analysis. (CO5, K4)	10
(8.2)	Write a Program implement the minimum cost spanning tree. (CO5, K3)	10