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Printed Page:-4 **Subject Code:- CMICSE0201**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
M.Tech Integrated
SEM: II - THEORY EXAMINATION (2025 - 2026)
Subject: Data Structures and Algorithm-I

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) Time complexity is a measure of: [CO1][K3] 1

(a) Memory used
(b) Number of instructions
(c) Execution time
(d) Number of inputs

(1.2) Recursive function with depth n has space complexity: [CO1][K2] 1

(a) O(1)
(b) O(log n)
(c) O(n)
(d) O(n2)

(1.3) Identify the linear data structure from the following options (CO2, K1) 1

(a) Array
(b) Tree
(c) Graph
(d) None

(1.4) Identify the technique that resolves collisions by storing elements in a linked list at the hash index. (CO2, K2) 1

(a) Linear Probing
(b) Quadratic Probing
(c) Chaining
(d) Double Hashing

(1.5) A doubly linked list has: (CO3, K1) 1

(a) One pointer in each node
(b) Three pointers in each node
(c) No pointers in nodes
(d) Two pointers in each node

(1.6) Time complexity to add a node in circular linked list (CO3, K1) 1

(a) O(n)
(b) O(1)
(c) O(log n)
(d) $O(n^2)$

(1.7) Convert infix expression (A+B)*(C−D) into postfix form. (K3, CO4) 1

(a) AB+CD−*
(b) AB+CD−
(c) ABCD+−
(d) AB+CD*−

(1.8) State condition for full circular queue of size n using front and rear. (K3, CO4) 1

(a) rear=n
(b) rear+1=front
(c) front=rear
(d) front=0

(1.9) Identify the fundamental mechanism used in Divide and Conquer. (CO5, K1) 1

(a) Breaking a problem into overlapping subproblems.
(b) Breaking a problem into smaller, independent subproblems and combining their results.
(c) Choosing the best local option at each step.
(d) Iteratively improving a solution until it is optimal.

(1.10) Identify the category to which Merge Sort belongs. (CO5, K1) 1

(a) Internal sorting
(b) External sorting
(c) Divide and Conquer sorting
(d) None of the above

2. Attempt all parts:-

(2.1) Discuss the difference between worst-case and best-case complexity?.[CO1][K1] 2

(2.2) Describe the formula for address calculation in 1D array. (CO2, K2) 2

(2.3) Define the primary difference between arrays and linked lists. (CO3, K1) 2

(2.4) Write the difference in access pattern between stack and queue using a single example. (K2, CO4) 2

(2.5) State the reason Fractional Knapsack allows partial selection of items. (CO5, K2) 2

SECTION-B 30

Answer any one of the following:-

(3.1)	Distinguish between Psuedocode and Algorithm with an real life example. [CO1][K4]	6
(3.2)	Define theoretical analysis and experimental analysis of algorithms. Explain with examples.[CO1][K1]	6

Answer any one of the following:-

(3.3)	Discuss the implementation of a 1D array and its address calculation with an example. (CO2, K2)	6
(3.4)	Show the steps of Insertion Sort for the list: 12, 11, 13, 5, 6. (CO2, K3)	6

Answer any one of the following:-

(3.5)	Discuss how a doubly linked list differs from a singly linked list. Give a suitable example(CO3, K2)	6
(3.6)	Write the algorithm with example to insert a node at the beginning of a doubly linked list. (CO3, K3)	6

Answer any one of the following:-

(3.7)	Explain how a stack can be implemented using arrays. Write the algorithm for push and pop operations.(K3, CO4)	6
(3.8)	Demonstrate merging of two sorted queues [2, 6, 8] and [1, 3, 7] maintaining sorted order. (K3, CO4)	6

Answer any one of the following:-

(3.9)	Describe the greedy method for filling multiple knapsacks in the Fractional Knapsack problem. (CO5,K2)	6
(3.10)	Construct a Huffman Encoding tree for characters with frequencies A=5, B=9, C=12, D=13, E=16, F=45. (CO5,K3)	6

SECTION-C 50

4. Answer any one of the following:-

(4.1)	Compare the growth rates of the following functions and justify your answer mathematically: f1(n)=n, f2(n)=nlogn, f3(n)=n2, f4(n)=2n, f5(n)=n! (a) Determine which function grows fastest and which grows slowest. (b) Express using Big-O notation. [CO1][K1]	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][K2]	10

5. Answer any one of the following:-

(5.1)	Design a complete menu-driven C program to perform insertion, deletion, and searching in a 1D array. (CO2, K3)	10
(5.2)	Define collision in hashing and illustrate Linear Probing, Quadratic Probing, and Chaining with an example. (CO2, K3)	10

6. Answer any one of the following:-

(6.1)	Describe the structure of a node in a polynomial linked list with example. (CO3, K2)	10
(6.2)	A company stores employee ID numbers in a hash table of size 10 for quick searching. The hash function used is h(key) = key mod 10, and collisions are	10

handled by linear probing. Insert the employee IDs 23, 43, 13, 27, 37, 33, 14, 24, 54, 64 into the table and show the final arrangement. (CO3, K2)

7. Answer any one of the following:-

(7.1) Differentiate between infix, postfix, and prefix expressions and illustrate their evaluation order with examples. (K2, CO4) 10

(7.2) Generate Fibonacci series using recursion, presenting the program and tracing the complete recursion tree for n = 6. (K3, CO4) 10

8. Answer any one of the following:-

(8.1) Solve the Task Scheduling problem for deadlines [2, 1, 2, 1] and profits [100, 19, 27, 25]. (CO5,K3) 10

(8.2) Perform Quick Sort on the array [12, 11, 13, 5, 6, 7] with detailed steps. (CO5,K3) 10