Printed Page:- **Subject Code**:- **ACSIOT0301**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - CARRY OVER THEORY EXAMINATION - APRIL 2023

Subject: Data Structures and Algorithms Design

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 these best describes an array?[CO1] 1

(a) A data structure that shows a hierarchical behavior

(b) Container of objects of similar types

(c) Arrays are immutable once initialised

(d) Array is not a data structure

1-b. When the user tries to delete the element from the empty stack then the condition is said to be a ____.[CO1] 1

(a) Underflow

(b) Garbage collection

(c) Overflow

(d) None of the above

1-c. Which of the following is/are property/properties of a dynamic programming problem?[CO2] 1

(a) Optimal substructure

(b) Overlapping subproblems

(c) Both optimal substructure and overlapping subproblems

(d) Greedy approach

1-d. Time complexity of Activity selection problem is [CO2] 1

(a) O(lg n)

(b) O(n lg n)

(c) O(n)

(d) O(2 n)

1-e. Consider the following stack implemented using stack.#define SIZE 11 [CO3] 1

```
struct STACK
{
int arr[SIZE];
int top=-1;
}
```

(a) 8

(b) 9

(c) 11

(d) 10

1-f. To represent hierarchical relationship between elements, which data structure is suitable?[CO3] 1

(a) Dequeue

(b) Prioriy

(c) Tree

(d) Graph

1-g. Which of the following is a true about Binary Trees?[CO4] 1

(a) Every binary tree is either complete or full.

(b) Every complete binary tree is also a full binary tree.

(c) Every full binary tree is also a complete binary tree.

(d) None of the above

1-h. In a max-heap, element with the greatest key is always in the which node?[CO4] 1

(a) Leaf node

(b) First node of left sub tree

(c) root node

(d) First node of right sub tree

1-i.	For a given graph G having v vertices and e edges which is connected and has no cycles, which of the following statements is true?[CO5] (a) v=e (b) v = e+1 (c) v + 1 = e (d) v = e-1	1
1-j.	Which of the following statements for a simple graph is correct?[CO5] (a) Every path is a trail (b) Every trail is a path (c) Every trail is a path as well as every path is a trail (d) Path and trail have no relation	1

2. Attempt all parts:-

2.a.	Explain what is a recursive algorithm?[CO1]	2
2.b.	List out Disadvantages of Divide and Conquer Algorithm.[CO2]	2
2.c.	Explain how a circular queue can be implemented using arrays.[CO3]	2
2.d.	Write the advantages of threaded binary tree.[CO4]	2
2.e.	The number of elements in the adjacency matrix of a graph having 7 vertices is?[CO5]	2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a.	Describe the storage structure of Array. Also Explain Various types of Array in details.[CO1]	6
3-b.	Explain Row and column major order in details.[CO1]	6
3-c.	Define sorting.How the Merge sort is done with the array?[CO2]	6
3-d.	"Worst case of Quicksort occurs when array is already sorted", Support or Contradict this statement using suitable explaination.[CO2]	6
3.e.	Explain with necessary algorithms, the Implementation of stack using linked list.[CO3]	6
3.f.	List out the steps involved in deleting a node from a binary search tree.[CO4]	6
3.g.	What do you understand by minimum cost of a graph? What is its use? [CO5]	6

SECTION C **50**

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

4-a.	Apply insertion sort and sort the following elements 16,15,4,13,2,1.[CO1]	10

4-b.	Explain the working of linear search technique with one example.[CO1]	10

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

5-a.	Elaborate how backtracking technique can be used to solve the n-queens problem. Explain with an example.[CO2]	10
5-b.	There are 'n' different activity are given with their starting and ending time.Select minimum number of activity to solve by a single person. i)- Sort the activity with their ending time. ii)-Find compatible activity and add to list. Activity: A1, A2, A3, A4, A5, A6, A7, A8, A9 Starting time: 1, 2, 4, 1, 5, 8, 9, 11, 13 Finish time: 3, 5, 7, 8, 9, 10, 11, 14, 16 . [CO2]	10

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

6-a.	Write an algorithm to insert and delete a node from doubly linked list. Illustrate with an example.[CO3]	10
6-b.	Write an algorithm for insertion and deletion of elements for a queue. Use a Boolean variable to distinguish between a queue being empty or full.[CO3]	10

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

7-a.	Write a short note on: i)B- Tree ii) Heap Tree iii)Extended Binary Tree iv) AVL Tree [CO4]	10
7-b.	Explain Binary Search tree and analyze the algorithms of BST using suitable example.[CO4]	10

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

8-a.	Implement Dijkstra's algorithm. Analyse it space and time complexity using both array and minheap. [CO5]	10
8-b.	How the graph can be represented in memory? Explain with suitable example.[CO5]	10