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Subject Code:- ACSIOT0301

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2024 - 2025)

Subject: Data Structures and Algorithms Design

Time: 3 Hours

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

1. Attempt all parts:-

- JEC-2026 1-a. The best case for linear search is [CO1,K1]
 - O(nlogn) (a)
 - (b) O(logn)
 - (c) O(n)
 - (d) O(1)
- Pushing an element into stack already having five elements and stack size of 5, 1-b. 1 then stack becomes .[CO1,K1]
 - Overflow (a)
 - (b) Crash
 - Underflow (c)
 - User flow (d)
- The algorithms like merge sort, quick sort and binary search are based on : 1 1-c. [CO2,K1]
 - Greedy algorithm (a)
 - Divide and Conquer algorithm (b)
 - Hash table (c)
 - (d) Parsing

1-d. The sub-problems in the dynamic programming are solved..[CO2,K1]

Dependently (a)

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Max. Marks: 100

20

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- (b) Independently
- (c) Parallel
- (d) Concurrent
- 1-e. The following sequence of operations is performed on a stack: PUSH (10), PUSH 1 (20), POP, PUSH (10), PUSH (20), POP, POP, POP, PUSH (20), POP. The sequence of values popped out is: [CO3,K3]
 - (a) 20, 10, 20, 10, 20
 - (b) 20, 20, 10, 10, 20
 - (c) 10, 20, 20, 10, 20
 - (d) 20, 20, 10, 20, 10

1-f.

_____ data structure is mainly used for implementing the recursive 1 algorithm.[CO3,K1]

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- (a) Queue
- (b) Stack
- (c) Binary tree
- (d) Linked list
- 1-g. The no of external nodes in a full binary tree with n internal nodes [CO4,K1]
 - (a) n
 - (b) n+1
 - (c) 2n
 - (d) 2n+1
- 1-h. A complete binary tree with the property that the value at each node is at least as 1 large as the value of its children is known as:[CO4,k1]
 - (a) Binary Search Tree
 - (b) AVL Tree
 - (c) Completely Balance Tree
 - (d) Max-Heap
- 1-i.
 A connected planar graph having 6 vertices, 7 edges contains ______ 1

 regions.[CO5,K1]
 1
 - (a) 15
 - (b) 3
 - (c) 1
 - (d) 11

1-j. A graph with all vertices having equal degree is known as a _____.[CO5,k1] 1

- (a) Multi Graph
- (b) Regular Graph
- (c) Simple Graph
- (d) Complete Graph

2. Attemp	pt all parts:-	
2.a.	Write the various operations that can be performed on different Data Structures. [CO1,K1]	2
2.b.	Define Backtracking with example.[CO2,K1]	2
2.c.	Define singly linked list with neat diagram.[CO3,K1]	2
2.d.	Define complete trees with diagram.[CO4,K1]	2
2.e.	Difference between AVL tree and Binary search tree.[CO5,K2]	2
<u>SECTIO</u>	<u>N-B</u>	30
3. Answe	r any <u>five</u> of the following:-	
3-a.	Write an algorithm to sort a list using bubble sort with one example.[CO1,K1]	6
3-b.	Explain asymptotic notations with example .[CO1,K2]	6
3-c.	Explain quick sort algorithm with the help of an example.[CO2,K2]	6
3-d.	Among the merge sort and quick sort which sorting technique is the best in worst case. Apply the best one among these algorithms to sort the list : E,X,A,M,P,L,E in the alphabetic order. [CO2,K3]	6
3.e.	Evaluate the postfix expression using stack 2 3 9 * +2 3 ^ - 6 2 / + Show the content of each and every steps [CO3,K3]	6
3.f.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example. [CO4,K2]	6
3.g.	Write algorithm for Breadth First Search. [CO5,K1]	6
<u>SECTIO</u>	<u>N-C</u>	50
4. Answe	er any <u>one</u> of the following:-	
4-a.	Write and explain non-recursive algorithm for binary search.[CO1,K1]	10
4-b.	Given an array arr[110][115] with base value 100 and the size of each element is 1 Byte in memory find the address of arr[8][6] with the help of column-major order. [CO1,K3]	10
5. Answe	ar any <u>one</u> of the following:-	
5-a.	Explain how the merge sort can be viewed as a recursive application of the Divide and conquer methodology. Suggest a pseudo code for merge sort and analyze its complexities. Trace its application to the following data set 5,2,4,7,1,3,2,6.[CO2,K2]	10
5-b.	What is Backtracking? Draw the state – space tree for 4-queens problem.[CO2]	10
6. Answe	r any <u>one</u> of the following:-	
6-a.	Define circular Queue. Write an algorithm to insert an element in circular queue?.[CO3,K1]	10
6-b.	Convert the following infix expression into postfix expression using stack.[CO3,K3]	10
	$A^{*}(B+D)/E-F^{*}(G+H/K).$	

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

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7-a.	Define the hight balanced Tree. Why height balanced tree is required ? Create an AVL tree for the following elements : [CO4, k3] a, z, b, y, c, x, d, w, e, v, f	10
7-b.	Define extended binary tree, full binary tree, strictly binary tree and complete binary tree with example.[CO4,K1]	10
8. Answe	er any <u>one</u> of the following:-	
8-a.	 Write a short note on : (a) Vertex (b) Edge (c) Closed Path (d) Cycle (e) Complete graph [CO5, K1] 	10
8-b.	Write the prim's algorithm for minimum spanning tree. Also give an example.[CO5,K1]	10

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