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 - THEORY EXAMINATION (2021 - 2022)

Subject: Data Structures and Algorithm Design

Time: 03:00 Hours Max. Marks: 100

General Instructions:

1. All questions are compulsory. It comprises of three Sections A, B and C.

- Section A - Question No- 1 is objective type question carrying 1 mark each & Question No- 2 is very short type questions carrying 2 marks each.
- Section B - Question No- 3 is Long answer type - I questions carrying 6 marks each.
- Section C - Question No- 4 to 8 are Long answer type - II questions carrying 10 marks each.
- 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. Let A be a two-dimensional array declared as follows: 1
A: array [1 … 10][1 … 15] of integer;
Assuming that each integer takes one memory location. The array is stored in row-major order and the first element of the array is stored at location 84, what is the address of the element A[i][j]? [CO1]

1. 15i + j + 84
2. 15j + i + 84
3. 10i + j + 89
4. None of These

1-b. The following sequence of operations is performed on a stack: PUSH (10), PUSH (20), POP, PUSH (10), PUSH (20), POP, POP, POP, PUSH (20), POP. The sequence of values popped out is: [CO1] 1

1. 20, 10, 20, 10, 20
2. 20, 20, 10, 10, 20
3. 10, 20, 20, 10, 20
4. 20, 20, 10, 20, 10

1-c. The algorithms like merge sort, quick sort and binary search are based on. [CO2] 1

1. Greedy algorithm
2. Divide and Conquer algorithm
3. Hash table

4. Parsing

1-d. What is the speciality about the inorder traversal of a binary search tree? [CO2] 1

1. It traverses in a non increasing order
2. It traverses in an increasing order
3. It traverses in a random fashion
4. It traverses based on priority of the node

1-e. Linear array are also called as [CO3] 1

1. Straight Line array
2. One dimensional array
3. vertical array
4. Horizontal array

1-f. What data structure would you mostly likely see in non recursive implementation of a recursive algorithm? [CO3] 1

1. Linked List
2. Stack
3. Queue
4. Tree

1-g. The no of external nodes in a full binary tree with n internal nodes [CO4] 1

1. n
2. n+1
3. 2n
4. 2n+1

1-h. Height of a binary tree is [CO4] 1

1. MAX(Height of left Subtree, Height of right subtree)+1
2. MAX(Height of left Subtree, Height of right subtree)
3. MAX(Height of left Subtree, Height of right subtree)-1
4. None of the above

1-i. What is the number of edges present in a complete graph having n vertices?[CO5] 1

1. (n*(n+1))/2
2. (n*(n-1))/2
3. n
4. Information given is insufficient

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

1. Multi Graph
2. Regular Graph
3. Simple Graph
4. Complete Graph

2. Attempt all parts:-

2-a. Can we declare array size as a negative number?[CO1] 2

2-b.	Write any two characteristics of Greedy Algorithm? [CO2]	2
2-c.	Differentiate array and linked list.[CO3]	2
2-d.	Mention various points of difference between complete binary tree and almost complete binary tree.[CO4]	2
2-e.	Name the different ways of representing a graph? [CO5]	2

SECTION B

30

3. Answer any five of the following:-

3-a.	Examine the algorithm for Insertion sort and sort the following array: 16,15,4,3,2,1.[CO1]	6
3-b.	Write an algorithm to convert Infix expression into postfix expression.[CO1]	6
3-c.	Mention some methods for choosing the pivot element in quick sort?[CO2]	6
3-d.	Sort the sequence 2,4,5,7,1,2,3,6 using Merge sort. Show all the required steps.[CO2]	6
3-e.	Develop an algorithm for a Linear search and Binary search.[CO3]	6
3-f.	Draw a binary Tree for the expression : A * B - (C + D) * (P /Q)[CO4]	6
3-g.	Discuss following with reference to graphs. (i) Directed graph (ii) Undirected graph (iii) Degree of vertex (iv)Null graph (v) Acyclic Graph [CO5]	6

SECTION C

50

4. Answer any one of the following:-

4-a.	Explain Array? Describe the storage structure of array. Also explain various types of array in detail.[CO1]	10
4-b.	List the applications of Stack. What is Recursion? Explain Recursion for find a factorial of number in detail.[CO1]	10

5. Answer any one of the following:-

5-a.	What is Backtracking? Draw the state – space tree for 4-queens problem.[CO2]	10
5-b.	What is Dynamic programming? Apply this technique to find all pairs shortest path in a graph.[CO2]	10

6. Answer any one of the following:-

6-a.	What is linked list ? Illustrate the use of linked lists to represent the polynomial.[CO3]	10
6-b.	Explain an algorithm to merge two sorted linked list into a single sorted list.[CO3]	10

7. Answer any one of the following:-

7-a.	Define an AVL tree. Obtain an AVL tree by inserting one integer at a time in the following sequence. 150, 155, 160, 115, 110, 140, 120, 145, 130, 147, 170, 180. Show all the steps.[CO4]	10
7-b.	What is a B-tree? Generate a B-tree of order 4 with the alphabets (letters) arrive in the sequence as follows : a, g, f, b, k, d, h, m, j, e, s, i, r, x, c ,l, n, t ,u, p [CO4].	10

8. Answer any one of the following:-

8-a.	Compare any two applications of Graph with your own example.[CO5]	10

8-b.	Develop an algorithm to compute the shortest path using Dijkstra’s algorithm. Validate the algorithm with suitable example.[CO5]	10