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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

SEM: III - THEORY EXAMINATION (2022 - 2023)

Subject: Data Structures

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. What is the time complexity of insertion sort & selection sort? (CO1) 1
- (a) $O(\log n)$, $O(n)$
- (b) $O(n \log n)$, $O(1)$
- (c) $O(n)$, $O(n^2)$
- (d) $O(n^2)$, $O(n^2)$
- 1-b. Given an array $arr = \{45, 77, 89, 90, 94, 99, 100\}$ and $key = 100$; What are the values of $arr[mid]$ generated in the first and second iterations of binary search? (CO1) 1
- (a) 90 and 99
- (b) 90 and 100
- (c) 89 and 94
- (d) 94 and 99
- 1-c. A data structure in which elements can be inserted or deleted at/from both ends but not in the middle is? (CO2) 1
- (a) Queue

- (b) Circular queue
- (c) Dequeue
- (d) Priority queue
- 1-d. If the MAX_SIZE is the size of the array used in the implementation of circular queue, array index starts with 0, front points to the first element in the queue, and rear points to the last element in the queue. Which of the following condition specify that circular queue is FULL? (CO2) 1
- (a) $\text{Front} = \text{rear} = -1$
- (b) $\text{Front} = (\text{rear} + 1) \% \text{MAX_SIZE}$
- (c) $\text{Rear} = \text{front} + 1$
- (d) $\text{Rear} = (\text{front} + 1) \% \text{MAX_SIZE}$
- 1-e. Which of the following is true regarding polynomial addition? (CO3) 1
- (a) exponents are added if coefficients are same
- (b) coefficients are added if exponents are same
- (c) only coefficients of all the nodes are added
- (d) exponents and coefficients of all nodes are added
- 1-f. Linked lists are not suitable for the implementation of _____ (CO3) 1
- (a) Binary search
- (b) Insertion sort
- (c) Radix sort
- (d) Polynomial manipulation
- 1-g. The preorder traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42. Which one of the following is the post-order traversal sequence of the same tree? (CO4) 1
- (a) 10, 20, 15, 23, 25, 35, 42, 39, 30
- (b) 15, 10, 25, 23, 20, 42, 35, 39, 30
- (c) 15, 20, 10, 23, 25, 42, 35, 39, 30
- (d) 15, 10, 23, 25, 20, 35, 42, 39, 30
- 1-h. Which of the following tree data structures is not a balanced binary tree? (CO4) 1
- (a) AVL tree
- (b) Red-black tree
- (c) Splay tree
- (d) B-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) 1
- (a) $v = e$
 - (b) $v = e+1$
 - (c) $v + 1 = e$
 - (d) $v = e-1$
- 1-j. What is the maximum number of edges present in a simple directed graph with 7 vertices if there exists no cycles in the graph? (CO5) 1
- (a) 21
 - (b) 7
 - (c) 6
 - (d) 49

2. Attempt all parts:-

- 2.a. What is hashing? (CO1) 2
- 2.b. Discuss infix, prefix and postfix expression. (CO2) 2
- 2.c. How many types of Linked List exist? (CO3) 2
- 2.d. What is Binary Search Tree? (CO4) 2
- 2.e. Differentiate between cyclic and acyclic graph. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

- 3-a. What is data structure. Explain its types in detail. (CO1) 6
- 3-b. A hash table contains 7 buckets and uses linear probing to solve collision. The key values are integers and the hash function used is $\text{key} \% 7$. Draw the table that, results after inserting in the given order the following values: 16, 8, 4, 13, 29, 11, 22. (CO1) 6
- 3-c. What will be the postfix expression for the infix expression $A + B * (C + D) / F + D * E$ is (CO2) 6
- 3-d. Write a Python code to find factorial of a number using recursion. (CO2) 6
- 3.e. Write a function in Python to reverse a singly linked list. (CO3) 6
- 3-f. Describe all Rotation in AVL tree. Construct AVL tree from the following nodes in given order: B, C, G, E, F, D, A. (CO4) 6
- 3.g. Discuss the various operations of a file. (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. What do you understand by divide and conquer algorithm? How this method is used in merge sort? Write a program in Python to implement merge sort. (CO1) 10

4-b. What do you mean by Hashing Collision Resolution Technique (CRT)? Explain any three CRTs with examples. (CO1) 10

5. Answer any one of the following:-

5-a. Write a program which performs insertion and deletion as per user choice in a DE queue. (CO2) 10

5-b. Write a menu driven program in python to implement the various operations on a linear queue. (CO2) 10

6. Answer any one of the following:-

6-a. What are doubly linked lists? Write a python program to create and display a doubly linked list. (CO3) 10

6-b. Write short note on circular linked lists. Write a function to insert a node at front and rear end in a circular linked list. Write down sequence of steps to be followed. (CO3) 10

7. Answer any one of the following:-

7-a. Define tree, binary tree, complete binary tree and full binary tree. Write algorithms or function to obtain traversals of a binary tree in preorder, post-order and in-order. (CO4) 10

7-b. What is a height balanced Tree? Why height balancing of Tree is required? Create an AVL Tree for the following elements: a, z, b, y, c, x, d, w, e, v, f (CO4) 10

8. Answer any one of the following:-

8-a. What is the difference between visiting a graph and traversing a graph? Explain any two algorithm to find minimum cost spanning tree. (CO5) 10

8-b. Use Warshall's algorithm to find all pair shortest path for the given graph. (CO5) 10

