Printed Page:- **Subject Code:- AMTCSE0101**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech

SEM: I - THEORY EXAMINATION (2022 - 2023)

Subject: Advanced Data Structures and Algorithms

Time: 3 Hours **Max. Marks: 70**

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 **15**

1. Attempt all parts:-

1-a. Consider the usual algorithm for determining whether a sequence of parentheses is balanced. The maximum number of parentheses that appear on the stack AT ANY ONE TIME when the algorithm analyzes: (()(())(())))? (CO1) 1

(a) 1

(b) 2

(c) 3

(d) 4

1-b. What is/are the disadvantages of implementing tree using normal arrays? (CO2) 1

(a) difficulty in knowing children nodes of a node

(b) difficult in finding the parent of a node

(c) have to know the maximum number of nodes possible before creation of trees

(d) difficult to implement

1-c. How many children does a binary tree have? (CO3) 1

(a) 2

(b) any number of children

(c) 0 or 1 or 2

(d) 0 or 1

1-d. List the worst case complexity of binary search using recursion? (CO4) 1

(a) O(n log n)

(b) O(log n)

(c) O(n)

(d) O(n2)

1-e. In what manner is a state-space tree for a backtracking algorithm constructed? (CO5) 1

(a) Depth-first search

(b) Breadth-first search

(c) Twice around the tree

(d) Nearest neighbour first

2. Attempt all parts:-

2.a. Design a Stack that supports retrieving the min element in O(1). (CO1) 2

2.b. Define Full Binary Tree. Write the maximum number of nodes in a full binary tree with depth 3. (CO2) 2

2.c. Define different ways of representing a graph? Represent the following graph using those ways. (CO3) 2

2.d. Differentiate between greedy method and dynamic programming. (CO4) 2

2.e. State the applications of backtracking. (CO5) 2

SECTION B **20**

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

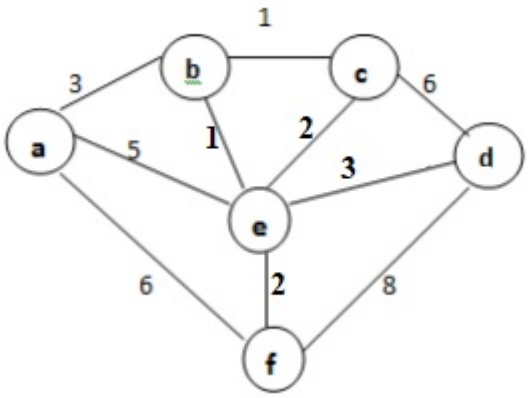
3-a. Write the applications of linked list. (CO1) 4

3-b. Convert the following infix expression into postfix form (A+B)*(C+D)*E^F (CO1) 4

3-c. What is a Binary Search Tree (BST)? Make a BST for the following sequence of numbers 45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48
Traverse the tree in Preorder, Inorder and postorder. (CO2) 4

3-d. Write the algorithm for insertion in the red-black tree. (CO2) 4

3.e. Using Prim's algorithm, determine minimum cost spanning tree for the weighted graph shown below. (CO3) 4



3.f. Write an algorithm for sorting the array. Perform best and worst case time complexity analysis with appropriate order notations. (CO4) 4

3.g. Discuss how deterministic algorithms are different from non-deterministic algorithms with examples. (CO5) 4

SECTION C **35**

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

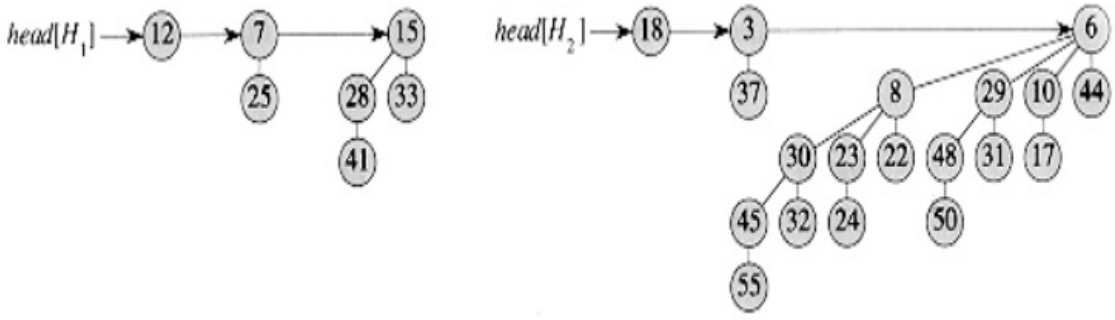
4-a. Write an algorithm to implement a stack of size N using an array. The elements in the stack are to be integers. The operations to be supported are PUSH, POP and DISPLAY. Take into account the exceptions of Stack overflow and underflow (CO1) 7

4-b. Convert the following infix expression into a postfix expression i) (((A/(B*C))+(D*E))-(A*C)) ii) A^B*C-D+E/F/(G+H) (CO1) 7

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

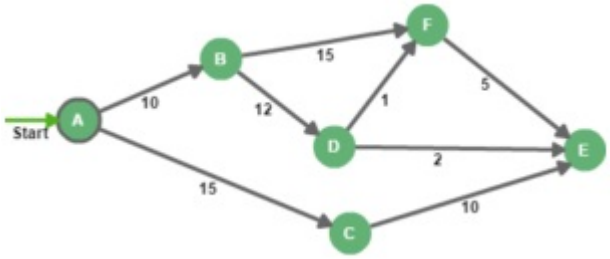
5-a. Construct AVL Tree for the following sequence of numbers- (CO2) 7
50 , 20 , 60 , 10 , 8 , 15 , 32 , 46 , 11 , 48

5-b. Write the algorithm for Binomial Heaps Union. Apply Binomial Heaps Union on these two binomial heaps: (CO2) 7



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

6-a. Explain Dijkstra's algorithm for finding the shortest path in a given graph. Find the single source shortest path for the following graph (CO3) 7



6-b. Explain the Floyd Warshall algorithm with example. (CO3) 7

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

7-a. Describe the Travelling salesman problem & discuss how to solve it using Dynamic Programming? (CO4) 7

7-b. Explain how will you construct optimal search tree with example. (CO4) 7

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

8-a. Explain P, NP, NP hard, and NP complete problems with examples. (CO5) 7

8-b. Discuss Amortized Analysis in detail with examples. (CO5) 7