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Printed Page:-4 **Subject Code:- BCSE0401/BCSEH0401**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: IV - THEORY EXAMINATION (2025 - 2026)
Subject: Data Structures and Algorithms-II

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:-

(1.1) In a BST, which traversal yields nodes in ascending order? (CO1, K1) 1

(a) Preorder
(b) Postorder
(c) Inorder
(d) Level Order

(1.2) Which operation is the most complex in a BST? (CO1,K1) 1

(a) Insertion
(b) Searching
(c) Deletion
(d) Traversal

(1.3) What is the maximum number of edges in a bipartite graph having 10 vertices? (CO2, K1) 1

(a) 24
(b) b21
(c) 25
(d) 16

(1.4) 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?CO2, K2 1

(a) v=e
(b) v = e+1
(c) v + 1 = e
(d) v = e-1

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(1.5) Which of the following is not a part of the dynamic programming approach for 0/1 Knapsack? (CO3, K1) 1

(a) Initialization with zero values
(b) Choice diagram with include/exclude options
(c) Recursive relation with overlapping subproblems
(d) Greedy selection of items with highest value/weight ratio

(1.6) Given the following code for solving the 0/1 Knapsack problem using Dynamic Programming, what does the value of dp[i][w] represent? 1

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int knapsack(int W, int wt[], int val[], int n) {
int dp[n+1][W+1];
for (int i = 0; i <= n; i++) {
for (int w = 0; w <= W; w++) {
if (i == 0 || w == 0)
dp[i][w] = 0;
else if (wt[i-1] <= w)
dp[i][w] = max(val[i-1] + dp[i-1][w-wt[i-1]], dp[i-1][w]);
else
dp[i][w] = dp[i-1][w];
}
}
return dp[n][W];
}
```

What does dp[i][w] represent in the code above? (CO3,K1)

(a) The maximum value achievable with exactly i items and w weight
(b) The total number of items that can be packed with weight w
(c) The maximum value achievable with the first i items and a maximum weight of w
(d) The total weight of the first i items that can be packed with a maximum weight of w

(1.7) Which data structure is commonly used in Branch and Bound? (CO4,K1) 1

(a) Stack
(b) Queue
(c) Priority Queue
(d) Hash Table

(1.8) Which method finds optimal solutions faster, on average? (CO4, K1) 1

(a) Brute Force
(b) Greedy
(c) Backtracking
(d) Branch and Bound

(1.9) A B-tree of order 4 and of height 3 will have a maximum of _____ keys (CO5, K1) 1

(a) 255
(b) 63
(c) 127
(d) 188

(1.10) Which of these operations have same complexities? CO5, K1 1

(a) Insertion, find_min
(b) Find_min, union
(c) Union, Insertion
(d) Deletion, Find _max

2. Attempt all parts:-

(2.1)	Define a threaded binary tree. How does it help in traversal without recursion? (CO1, K2)	2
(2.2)	Define Activity node graph.CO2, K2	2
(2.3)	Identify the purpose of the DP table in the Longest Common Sub sequence problem.(CO3,K2)	2
(2.4)	Define backtracking and provide an example of its application.(CO4,K1)	2
(2.5)	Define the operations in B-tree (CO5,K1)	2

SECTION-B 30

Answer any one of the following:-

(3.1)	Discuss the advantages of threaded binary trees compared to traditional binary trees. Highlight their efficiency in terms of space and traversal. (CO1,K2)	6
(3.2)	Construct a Binary Search Tree (BST) by inserting the following sequence of elements one by one. Show the tree after each insertion and draw the final BST. Elements: 50, 30, 70, 20, 40, 60, 80 (CO1, K3)	6

Answer any one of the following:-

(3.3)	Explain Dijkstra's algorithm with an example?CO2, K2	6
(3.4)	Explain Graph. Explain matrix and linked list representation of a graph. Also give the application of Graph. (CO2, K2)	6

Answer any one of the following:-

(3.5)	Explain the Matrix Chain Multiplication problem and discuss the dynamic programming approach to solve it. Show that this approach optimize the number of scalar multiplications? (CO3, K3)	6
(3.6)	Explain the Resource Allocation Problem in the context of optimization. Describe how resources are assigned to competing activities under constraints to maximize profit or minimize cost. Also mention one real-life example where this problem is applied. (CO3, K3)	6

Answer any one of the following:-

(3.7)	Discuss the key features of backtracking algorithms and how they help solve problems with constraints. (CO4,K2)	6
(3.8)	Explain the steps involved in solving the n-Queens problem using backtracking and the importance of the base case. (CO4, K2)	6

Answer any one of the following:-

(3.9)	Explain the algorithm to delete a given element in a binomial Heap. Give an example for the same CO5, K1	6
(3.10)	List and explain all the operations performed in a Binomial Heap. Describe how operations such as union/merge and decrease-key are performed in a binomial heap. (CO5, K2)	6

SECTION-C 50

4. Answer any one of the following:-

(4.1) Explain AVL Tree. Insert the sequence [20, 10, 30, 25, 40, 22] into an AVL tree. Show rotations after each insertion.[CO1,K3] 10

OR

Explain the applications of Binary Search Tree. Insert the following elements into a BST in order: 50, 30, 20, 40, 70, 60, 80. Draw the tree after each insertion. (CO1, K3)

(4.2) Write the Psedue Code for searching and inserting a node in BST. Explain with the help of example. (CO1, K3) 10

5. Answer any one of the following:-

(5.1) Give Floyd War shall algorithm to find the shortest path for all pairs of vertices in a graph . Give the complexity of the algorithm.CO2, K2 10

(5.2) Explain the difference between Depth First Search (DFS) and Breadth First Search (BFS). Give a situtation where DFS is better than BFS.CO2, K2 10

6. Answer any one of the following:-

(6.1) Discuss various techniques used to solve the Longest Common Subsequence problem. Illustrate how recursion, memorization, and tabulation differ in their approach, and support your explanation with suitable pseudocode and complexity analysis. (CO3, K4) 10

(6.2) Consider the following sequence of matrices: 10
Matrix A1: 5 × 10
Matrix A2: 10 × 15
Matrix A3: 15 × 20
Using dynamic programming, determine the optimal way to multiply these matrices and calculate the number of scalar multiplications. (CO3,K3)

7. Answer any one of the following:-

(7.1) Explain the concept of graph colouring, focusing on different algorithms for solving it and their complexities.(CO4,K2) 10

(7.2) Discuss the structure and solution of the Hamiltonian cycle problem, explaining the methods for finding a solution.(CO4,K2) 10

8. Answer any one of the following:-

(8.1) Define B-Tree and write down it's properties and explain properties of a B-Tree of order m and discuss its advantages for disk storage. (CO5,K2) 10

(8.2) Discuss various properties of Binomial tree and perform search operation with suitable example. CO5, K3 10