Computer Science - Previous Year Questions

Semester: Spring 2023 | Subject: Data Structures

Time: 3 hours | Maximum Marks: 100

Q1. [20 marks] Define and explain the following:

a) What is the time complexity of searching in a binary search tree?
Answer: O(log n) for balanced BST, O(n) for skewed BST

b) Explain the difference between stack and queue.
Answer: Stack follows LIFO, Queue follows FIFO principle

Q2. [25 marks] Algorithm Analysis

Write an algorithm to reverse a linked list and analyze its
time and space complexity.

Solution approach:
â¢ Use three pointers: prev, current, next
â¢ Time complexity: O(n)
â¢ Space complexity: O(1)

Q3. [30 marks] Tree Problems

a) Implement inorder traversal of binary tree
b) Find height of binary tree
c) Check if tree is balanced

Q4. [25 marks] Graph Algorithms

Given an undirected graph, implement BFS and DFS traversal.

Explain when to use each algorithm.

BFS Applications:

â¢ Shortest path in unweighted graph

â¢ Level order traversal

â¢ Connected components

DFS Applications:

â¢ Topological sorting

â¢ Cycle detection

â¢ Path finding

Q5. [Bonus - 10 marks] Dynamic Programming

Solve the 0/1 Knapsack problem using dynamic programming.

Given: weights = [1, 3, 4, 5], values = [1, 4, 5, 7], W = 7

Approach:

â¢ Create 2D DP table

â¢ dp[i][w] = maximum value with first i items and weight w

â¢ Recurrence: dp[i][w] = max(dp[i-1][w], dp[i-1][w-wi] + vi)

Answer Key: Maximum value = 9 (items with weights 3,4)