

Dr. Babasaheb Ambedkar Open University
Term End Examination February – 2026

Course	: BSCIT	Date	: 24/02/2026
Subject Code	: BSCIT-404	Time	: 11:30am to 01:45pm
Subject Name	: Introduction to Algorithms	Duration	: 02.15 Hours
		Max. Marks	: 70

Section A

Answer the following (Attempt any three) (30)

1. Define Asymptotic Notations (Big-O, Omega, and Theta). Explain their importance in analyzing the worst-case and average-case time complexity of algorithms.
2. Explain the Divide and Conquer strategy. Discuss the working of Merge Sort or Quick Sort and analyze its time complexity using recurrence relations.
3. What is Dynamic Programming? Explain the Principle of Optimality and solve the 0/1 Knapsack problem using the dynamic programming approach.
4. Describe Dijkstra's Algorithm for finding the shortest path in a weighted graph. Provide a step-by-step example with a graph diagram.
5. Define the classes P, NP, NP-Hard, and NP-Complete. Explain the significance of polynomial-time reducibility in complexity theory.

Section B

Answer the following (Attempt any four) (20)

1. Explain the Greedy Approach. How does it differ from Dynamic Programming?
2. Discuss the Breadth-First Search (BFS) and Depth-First Search (DFS) traversal techniques for graphs.
3. What is a Minimum Spanning Tree (MST)? Briefly explain Prim's or Kruskal's algorithm.
4. Explain the concept of Backtracking using the N-Queens problem as an example.
5. What are Recurrence Relations? Explain the Master Theorem for solving recurrences.
6. Describe the Binary Search algorithm and explain why the input list must be sorted.

Section C

Part – A (Multiple Choice Questions) (10)

- 1 Which notation is used to represent the upper bound of an algorithm's running time?
A. Ω (Omega) B. Θ (Theta)
C. O (Big-O) D. o (Little-o)
- 2 The time complexity of Binary Search in the worst case is:
A. $O(n)$ B. $O(\log n)$
C. $O(n \log n)$ D. $O(1)$
- 3 Which strategy does Quick Sort use?
A. Greedy B. Dynamic Programming
C. Divide and Conquer D. Backtracking
- 4 Kruskal's algorithm is used to find:
A. Shortest Path B. Hamiltonian Cycle
C. Minimum Spanning Tree D. Maximum Flow
- 5 Fractional Knapsack problem is solved using which approach?
A. Greedy B. Dynamic Programming
C. Backtracking D. Brute Force

- 6 What is the space complexity of an adjacency matrix for a graph with V vertices?
A. $O(V)$ B. $O(E)$
C. $O(V^2)$ D. $O(V+E)$
- 7 A problem is said to be NP-Complete if it is in NP and is also _____.
A. P B. Solvable in linear time
C. NP-Hard D. Symmetrical
- 8 Which data structure is typically used to implement BFS?
A. Stack B. Queue
C. Tree D. Priority Queue
- 9 The 'Master Theorem' is used to solve:
A. Sorting problems B. Recurrence relations
C. Graph coloring D. Shortest paths
- 10 In Dynamic Programming, storing the results of subproblems to avoid redundant work is called:
A. Recursion B. Hashing
C. Memoization D. Backtracking

Part – B (Do as Directed)

(10)

State whether the following statements are true or false

- 1 Merge Sort is an in-place sorting algorithm.
- 2 Big-O notation provides the best-case complexity of an algorithm.
- 3 Dijkstra's algorithm can work correctly even with negative edge weights.
- 4 Every NP-Complete problem is also NP-Hard.
- 5 The Greedy approach always yields the globally optimal solution for every problem.
- 6 Dynamic Programming is generally faster than simple recursion for problems with overlapping subproblems.
- 7 A Spanning Tree of a graph must include all the vertices of the original graph.
- 8 The time complexity of Bubble Sort in the worst case is $O(n^2)$.
- 9 P is a subset of the NP class.
- 10 DFS uses a Queue as its primary data structure for traversal.
