18 MAY 2026 (M)

24BCA023

NCU/FRM/2.6/ACAD/027

THE NORTHCAP UNIVERSITY	Question paper for Major Test School of Engineering & Technology Programme Name: BCA Course Name: Analysis and Design of Algorithms Course Code: BCL206 Semester: Even, 4th Sem*	Review Date: Session: Jan-Jul 2026 Maximum Marks: 100 Duration: 3 hrs Sheet 1 of 2

Note:

1. All the questions are compulsory.
2. Marks and COs are indicated against the questions.
3. Use of calculator is not allowed.

CO 1: Define the basic asymptotic notations and apply them to determine the complexity of algorithms using different methods to solve recurrence relations. Analyze a given code to calculate the time and space complexity.

CO 2: Describe the concept of Divide and Conquer approach and demonstrate its working on various problems. Also determine the complexity of these algorithms.

CO 3: Apply greedy and dynamic programming to solve different problems and compare the two approaches. Analyze the complexity of these problems

CO 4: Illustrate the backtracking technique to solve different problems and discuss their complexities.

CO 5: Identify the need for Branch and bound approach. Apply this technique on some problems & evaluate the performance of these algorithms.

SECTION A (30 marks)

Q. No.	Question	Marks	CO's
Q1.	Analyze how different pivot selection strategies affect the time complexity and overall performance of the Quick Sort algorithm.	6	CO2
Q2.	What is a state space tree? What are the different ways of searching an answer node in a state space tree? Explain with example.	6	CO3
Q3.	Compare the Greedy approach and Dynamic Programming in terms of strategy, efficiency, and optimality. Which approach guarantees an optimal solution? Justify your answer with a suitable example.	6	CO3
Q4.	Explain the use of Divide and Conquer Technique for Binary Search Method. What is the complexity of Binary Search Method? Explain it with example.	6	CO2
Q5.	Explain Backtracking Method. What is N-Queens Problem? Give solution of 4-Queens Problem using Backtracking Method.	6	CO4
	SECTION B (45 marks)		
Q6.	Apply Merge Sort on the array: 38,27,43,3,9,82,10 Show all steps and determine its time complexity.	9	CO2

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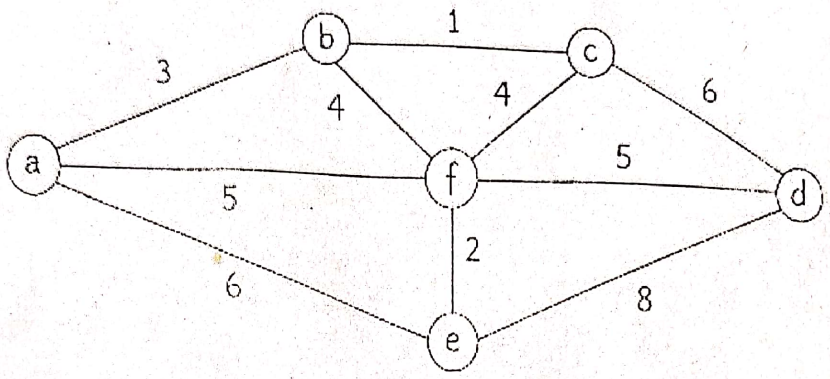
Q7. Solve the Fractional Knapsack Problem: — 9 — CO3

Item	Profit	Weight
1	60	10
2	100	20
3	120	30

If the total Knapsack capacity is 50 Kg then find the maximum profit.

Q8. Find out the Minimum Spanning Tree (MST) using Kruskal's Algorithm for the given graph and find minimum cost. — 9 — CO3



Q9. Given an undirected graph with vertices {A, B, C, D, E} and edges: — 9 — CO4

{(A,B), (A,C), (B,C), (B,D), (C,D), (C,E)}

Apply the Graph Coloring algorithm using backtracking to determine the minimum number of colors required such that no two adjacent vertices share the same color.

Q10. Explain the working principle of Selection Sort and perform a detailed analysis of its time complexity. Derive the exact number of comparisons and swaps performed in the worst case and in the average case. Based on your derivation, determine the asymptotic time complexity and comment on whether the input order affects its performance. — 9 — CO2

SECTION C (25 marks)

Q11. Given set: {2, 4, 6, 10} and target sum = 16 — 15 — CO4

Find all subsets whose sum equals 16 using backtracking approach.

Q12. A salesman needs to visit four cities A, B, C, and D exactly once and return to the starting city A. The distances between the cities are given below: — 10 — CO5

Vertex	A	B	C	D
A	∞	10	15	20
B	10	∞	35	25
C	15	35	∞	30
D	20	25	30	∞

Find the optimal tour and its minimum cost using complete enumeration.

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