

10 JUL 2025 (M)

NCU/FRM/2.6/ACAD/027

	Question paper for Major Test 2025	Review Date:
	School of Engineering & Technology	Session: Jan-Jun 2025
	Programme Name: BCA Course Name: Analysis and Design of Algorithm Course Code: BCL 206 Semester: Even, 4th Semester	Maximum Marks: 100 Duration: 3 hrs
	Sheet 1 of 3	

Note:

- All the questions are compulsory.
- Marks and COs are indicated against the questions.
- Scientific Calculators permitted.

CO1: 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.

CO2: Describe the concept of Divide and Conquer approach and demonstrate its working on various problems. Also determine the complexity of these algorithms.

CO3: Apply greedy and dynamic programming to solve different problems and compare the two approaches. Analyze the complexity of these problems

CO4: Illustrate the backtracking technique to solve different problems and discuss their complexities.

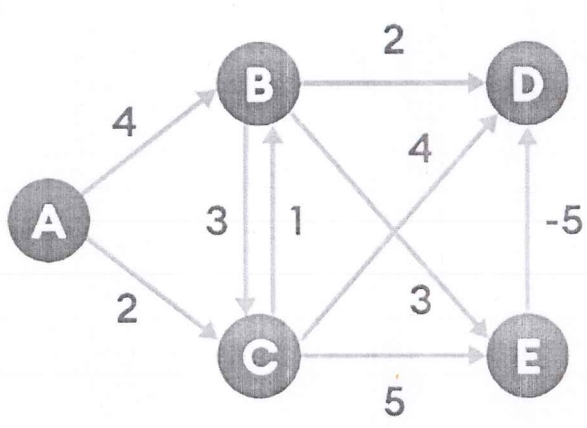
CO5: Identify the need for Branch and bound approach. Apply this technique on some problems & evaluate the performance of these algorithms.

SECTION A (30 marks)

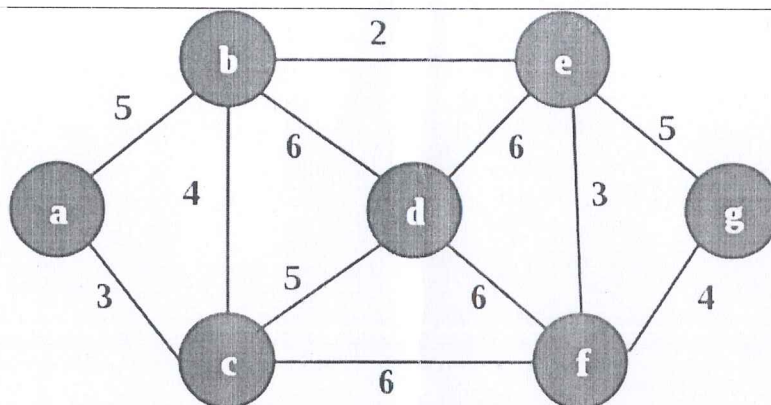
Q. No.	Question	Marks	CO's
Q1.	Solve the recurrence relation using the recursion tree method. $T(n) = 2T(n/2) + n$	6	CO1
Q2.	Is there any proof to decide if Greedy approach will produce the best solution? Explain	6	CO3
Q3.	Let G be a weighted undirected graph with distinct positive edge weights. If every edge weight is increased by same value, will the minimum cost spanning tree and shortest path between any pair of vertices change. Justify your answer.	6	CO3
Q4.	What is state space tree? What are the different ways of searching an answer node in a state space tree explain with example?	6	CO4
Q5.	Analyze how different pivot selection strategies affect the time complexity and overall performance of the Quick Sort algorithm.	6	CO2

Issued by:	Approved by:
Date:	Date:

SECTION B (50 marks)

SECTION B (50 marks)																		
Q6.	You are given $n = 4$ items with the following weights and values for a 0/1 Knapsack Problem. The capacity of the knapsack is $W = 7$. Solve using Dynamic Programming. <table> <tr> <th>Item</th> <th>Weight</th> <th>Value</th> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>4</td> <td>5</td> <td>7</td> </tr> </table>	Item	Weight	Value	1	1	1	2	3	4	3	4	5	4	5	7	10	CO3
Item	Weight	Value																
1	1	1																
2	3	4																
3	4	5																
4	5	7																
Q7.	How backtracking can be used to solve N-queen's problem. Show	10	CO4															
Q8	Consider the following graph. What is the minimum cost to travel from node A to node E using Bellman Ford Algorithm? 	10	CO2															
Q9	Given an undirected graph with vertices $\{A,B,C,D,E\}$ and edges: $\{(A,B),(A,C),(B,C),(B,D),(C,D),(C,E)\} \setminus \{(A,B), (A,C), (B,C), (B,D), (C,D), (C,E)\} \setminus \{(A,B),(A,C),(B,C),(B,D),(C,D),(C,E)\}$ 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.	10	CO4															
Q10	Find the minimum spanning tree and its cost using Prim's Algorithm for the given graph	10	CO3															

Issued by:	Approved by:
Date:	Date:



SECTION C (15-20% marks)

Q11 Given the following cost matrix, solve the **Traveling Salesman Problem** using the **Branch and Bound technique**.

From/To	A	B	C	D
A	∞	10	15	20
B	10	∞	35	25
C	15	35	∞	30
D	20	25	30	∞

5*4=20

CO5

- Perform **row and column reductions** on the initial cost matrix.
- Draw the **state-space tree** for the first two levels
- Select the next promising node based on minimum bound.
Apply further reduction if required and update the bound.
- Discuss how **Branch and Bound** reduces search space in this problem.
What is the worst-case time complexity for solving TSP using B&B?

Issued by:

Date:

Approved by:

Date: