

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code

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Fourth Semester B.E. Degree Examinations, September/October 2024

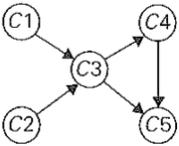
DESIGN AND ANALYSIS OF ALGORITHMS

(Common to CSE & AIML)

Duration: 3 hrs

Max. Marks: 100

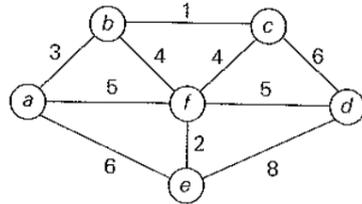
Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data, if any, may be suitably assumed.

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>							
MODULE – 1										
1.	a. Define algorithm. Discuss the properties of an algorithm with example.	06	(2 : 1 : 1.3.1)							
	b. Write an algorithm of Tower of Hanoi problem. Find its time complexity.	08	(2 : 1 : 1.3.1)							
	c. Explain the problem-solving technique with a neat flowchart.	06	(2 : 1 : 1.3.1)							
OR										
2.	a. Define asymptotic notations. How these are related to time complexity? Give example for each.	12	(2 : 1 : 1.3.1)							
	b. Write an algorithm to find the maximum element in an array of n elements. Find its time complexity.	08	(2 : 1 : 1.6.1)							
MODULE – 2										
3.	a. Write sequential search algorithm and find its time complexity.	08	(2 : 2 : 1.6.1)							
	b. Write selection sort algorithm and analyze the time complexity of algorithm.	08	(2 : 2 : 1.6.1)							
	c. Explain with example Johnson Trotter algorithm for generating permutations.	04	(3 : 3 : 1.3.1)							
OR										
4.	a. Apply the bubble sort method to sort the following set of elements in ascending order.	07	(2 : 2 : 1.3.1)							
	<table border="1" style="display: inline-table;"><tr><td>89</td><td>45</td><td>68</td><td>90</td><td>29</td><td>34</td><td>17</td></tr></table>	89	45	68	90	29	34	17		
89	45	68	90	29	34	17				
	b. Apply source removable method to obtain Topological sort for the given graph.	05	(3 : 2 : 1.3.1)							
										
	c. Write an algorithm for element uniqueness problem and derive its time complexity.	08	(2 : 2 : 1.6.1)							
MODULE – 3										
5.	a. Define binary search. Write a recursive algorithm to perform binary search with example.	08	(2 : 3 : 1.6.1)							
	b. Discuss quick sort algorithm and explain it with an example. Derive worst-case and average-case complexity.	12	(2 : 3 : 1.6.1)							
OR										
6.	a. Explain merge sort method with an example. Mention the worst-case time complexity.	06	(2 : 3 : 1.3.1)							

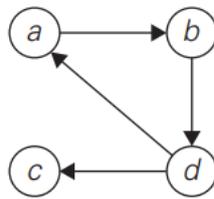
- b. Write an algorithm to find the maximum and minimum of n elements of an array using divide and conquer method. Find its time complexity. **08** (3 :3 : 1.3.1)
- c. Define heap. Write bottom-up heap construction algorithm. **06** (2 :3 : 1.6.1)

MODULE – 4

- 7. a. Differentiate between Prim’s and Kruskal’s algorithm. **04** (2 :4 : 1.3.1)
- b. Apply the Prim’s algorithm to obtain the minimum cost spanning tree for the given weighted graph. **08** (3 :4 : 1.3.1)



- c. Write an algorithm to find transitive closure of a given directed graph. **08** (2 :4 : 1.6.1)



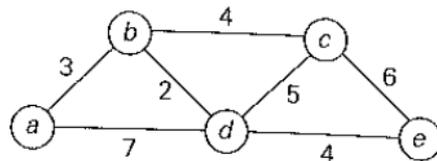
OR

- 8. a. Compare dynamic programming and greedy techniques. **04** (3 :4 : 1.3.1)
- b. Solve the given Knapsack problem using dynamic programming approach and find the optimal solution. **08** (2 :5 : 1.4.1)

ITEM	WEIGHT	PROFIT
1	2	12
2	1	10
3	3	20
4	2	15

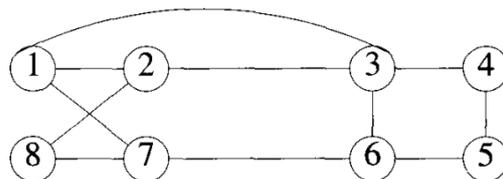
Capacity W=5

- c. Calculate the shortest distance and path from the vertex ‘a’ to vertex ‘e’ using Dijkstra’s algorithm. **08** (3 :4 : 1.3.1)



MODULE – 5

- 9. a. Solve 4-Queen problem to find all possible solutions with appropriate state space tree structure. **06** (3 :5 : 1.3.1)
- b. Apply backtracking approach to find Hamiltonian cycles in a given graph. **06** (3 :5 : 1.3.1)

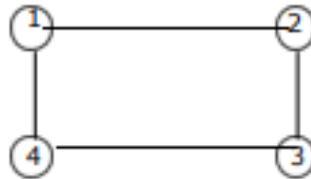


- c. Construct the state space tree for the following instance of job assignment problem using branch and bound method. **08** (3 :5 : 1.3.1)

$$C = \begin{matrix} & \text{job 1} & \text{job 2} & \text{job 3} & \text{job 4} \\ \begin{matrix} \text{person } a \\ \text{person } b \\ \text{person } c \\ \text{person } d \end{matrix} & \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \end{matrix}$$

OR

10. a. Apply backtracking approach to assign colour to the given graph. $M = 3$, {RED, GREEN, BLUE} **07** (3 :5 : 1.3.1)



Graph

- b. Solve the given instances of 0/1 Knapsack problem using branch and bound technique. **08** (3 :5 : 1.3.1)

Item	Weight	Value
1	4	\$40
2	7	\$42
3	5	\$25
4	3	\$12

The Knapsack's capacity W is 10.

- c. Explain the class of NP- hard and NP-complete problems. **05** (2 :5 : 1.3.1)

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