Q. Code:238690

Reg. No. | | | | | | | | | | | | | |

B.E./ B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

CS22403 – DESIGN AND ANALYSIS OF ALGORITHMS

(Computer Science and Engineering)

(Regulation 2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Analyze the running time of algorithms using asymptotic analysis.	**4**
CO 2	Apply the divide-and-conquer techniques and analyze the running time of the algorithms in real-world problems.	**3**
CO 3	Apply the dynamic programming and greedy paradigms and analyze the running time of the algorithms using those techniques.	**3**
CO 4	Employ iterative improvement and computational geometry methods to solve engineering problems.	**3**
CO 5	Describe the limitations of algorithm power and methods to cope with the limitations of algorithm power for various problems	**2**

PART- A (20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Write an algorithm to compute the greatest common divisor of two numbers.	**1**	**3**
2.	Define best, worst and average case time complexity.	**1**	**2**
3.	Write the recursive Fibonacci algorithm and its recurrence relation.	**1**	**3**
4.	Discuss the steps in mathematical analysis for non-recursive algorithms.	**1**	**2**
5.	Give the general strategy of Divide and Conquer method.	**2**	**2**
6.	What is closest-pair problem?	**2**	**2**
7.	Derive the complexity of binary search algorithm.	**2**	**3**
8.	Find the order of growth for solutions of the following recurrences. a. T (n) = 4T (n/2) + n, T (1) = 1 b. T (n) = 4T (n/2) + n^2, T (1) = 1	**2**	**3**
9.	What does dynamic programming have in common with divide-and-conquer? What is a principal difference between them?	**3**	**2**
10.	Does Prim's algorithm always work correctly on graphs with negative edge weights?	**3**	**2**
11.	Write pseudocode of the Huffman-tree construction algorithm.	**3**	**3**

12.	Write pseudocode of the bottom-up dynamic programming algorithm for the knapsack problem.	**3**	**3**	
13.	What do you mean by 'perfect matching' in bipartite graphs?	**4**	**2**	
14.	Define the iterative improvement technique.	**4**	**2**	
15.	State the principle of duality.	**4**	**2**	
16.	What is a residual network in the context of flow networks?	**4**	**2**	
17.	When is a problem said to be NP hard?	**5**	**2**	
18.	Differentiate feasible solution and optimal solution.	**5**	**2**	
19.	State the Hamiltonian circuit problem.	**5**	**2**	
20.	What are tractable and non-tractable problems?	**5**	**2**	

PART- B (5x 10=50Marks)

			Marks	CO	RBT LEVEL
21. (a)	**(i)**	Write an algorithm for determining the uniqueness of an array. Determine the time complexity of your algorithm.	**(5)**	**1**	**3**
	(ii)	Solve the following instance of the 0/1 knapsack problem given the knapsack capacity in W=5 using brute force.	**(5)**	**1**	**3**

Items	Weight	Value
1	4	10
2	3	20
3	2	15
4	5	25

(OR)

(b)	Define Big Oh notation, Big Omega and Big Theta notation. Depict the same graphically and explain.	**(10)**	**1**	**3**
22. (a)	Solve the following recurrence relations using backward substitution.	**(10)**	**2**	**3**

$T(n) = T(n/3) + c, T(1) = 1$

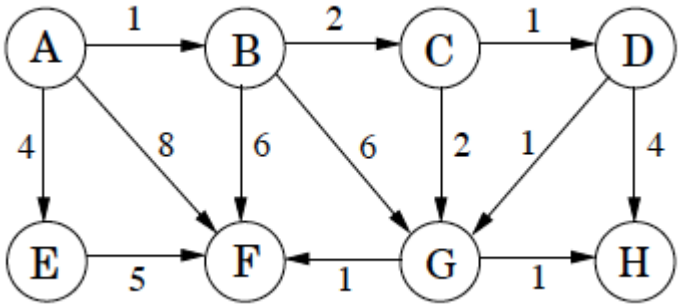
$T(n) = T(n-1) + n^4, T(0) = 0$

(OR)

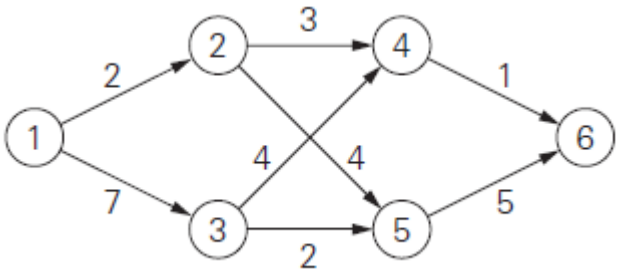
(b)	17, 9, 22, 31, 7, 12, 10, 21, 13, 29, 18, 20,11.	**(10)**	**2**	**3**

Sort the given numbers using Quick Sort with the first element as the pivot element. Write a pseudocode and calculate the time complexity.

23. (a)	Consider the strings "BHHUBBC" and "HYUYBZBC".	**(10)**	**3**	**3**
	i) What is the length of the longest common subsequence?			
	ii) Find the longest common subsequence for the above using dynamic programming strategy.			
	iii) Write an algorithm and find time complexity for the same.			
	(OR)			
(b)	Find the shortest path from node 'A' to all other nodes using Dijkstra's algorithm. Write a pseudocode and the time complexity.	**(10)**	**3**	**3**



24. (a)	Apply the shortest-augmenting path algorithm to find a maximum flow and a minimum cut in the following network.	**(10)**	**4**	**3**



(OR)

(b)	Use the simplex method to solve the linear programming problem. Maximize z = 3x + 5y Subject to x + y <= 8 x + 3y <= 12 x >= 0, y >= 0	**(10)**	**4**	**3**
25. (a)	The 5-queens puzzle is the problem of placing 5 queens on an n x n	**(10)**	**5**	**3**

chessboard such that no two queens attack each other.

i) Construct a complete state space tree for a 5-queens puzzle

ii) Write an algorithm and the time complexity for the same.

(OR)

(b)	Solve the following instance of knapsack problem by constructing state space tree using branch and bound algorithms. Knapsack Capacity W=60.	**(10)**	**5**	**3**

Item	Weight	Profit
1	5	$30
2	10	$40
3	15	$45
4	22	$77
5	25	$90

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Consider the following short text:	**(10)**	**2**	**5**

Source text S = Eyes never seen near lake

We want to encode a source text using Huffman coding.

a) Find frequency of each character.

b) Construct the Huffman tree based on the frequencies of characters in the source text S.

c) Create a variable length code table to encode all the source text S characters using Huffman's algorithm.

d) What will be the length of the encoded text?

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