Hall Ticket Number:

Code No. : 14626

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

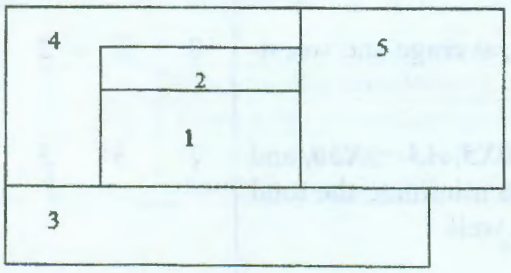
B.E. (I.T. : CBCS) IV-Semester Main Examinations, January-2021

Design and Analysis of Algorithms

Time: **2** hours Max. Marks: **60**

*Note: Answer any **NINE** questions from **Part-A** and any **THREE** from **Part-B***

Part-A (9 × 2 = 18 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Give the recurrence relation capturing the optimal execution time of the Towers of Hanoi problem with ***n*** discs.	2	2	1	2
2.	What are the steps involved in solving a recurrence relation using the substitution method?	2	1	1	1
3.	What is prefix opcodes in Huffman coding?	2	1	2	1
4.	Write down the recurrence relation for the following algorithms: (a) Binary Search (b) Merge Sort	2	1	2	2
5.	Compute Fibonacci series using dynamic programming.	2	4	3	3
6.	What is meant by principle of optimality?	2	2	3	1
7.	Define branch and bound problem.	2	1	4	1
8.	Convert the following map with regions numbered from 1-5 to a graph and perform graph coloring. 	2	3	4	3
9.	What is Satisfiability problem?	2	2	5	1
10.	Define P-class and NP-class of problems.	2	2	5	1
11.	What is an Algorithm? Give the characteristics of an Algorithm.	2	1	1	1
12.	List the general plan in divide and conquer algorithm.	2	1	2	2

Part-B (3 × 14 = 42 Marks)

13. a)	Apply the master method to determine the asymptotic behavior of the function T(n). (i) $T(n) = 2 \cdot T(n/4) + n^{0.51}$ (ii) $T(n) = \sqrt{2} \cdot T(n/2) + \log n$ (iii) $T(n) = 6 \cdot T(n/3) + n^2 \cdot \log n$ (iv) $T(n) = 3 \cdot T(n/3) + n/2$	8	3	1	2

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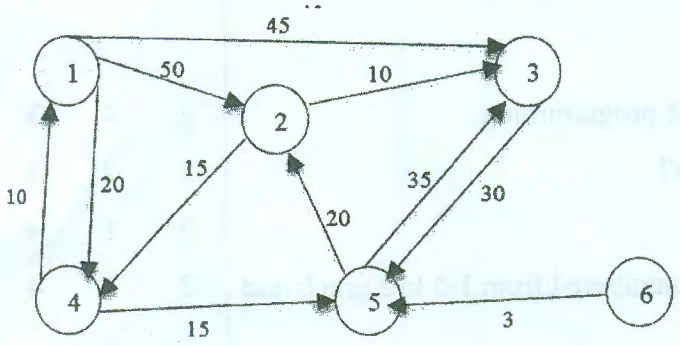
b)	For the given algorithm, calculate the time complexity using steps per execution method and recursive tree method.
	Algorithm RSum(a,n)
	// a is an array with elements, and n is the size of the array.
	{
	if(n<=0) then
	return 0.0;
	else
	return RSum(a,n-1) + a[n];
	}
		6	3	1	2

14. a)	Calculate the single source shortest path for the given directed graph using Dijikstra's algorithm by considering 1 as the source vertex.  	6	3	2	3
b)	Write an algorithm for Quick Sort. Also, analyze best, average and worst-case time complexity of Quick sort Algorithm.	8	2	2	2
15. a)	Given a chain of four matrices ***A1 = 10X100, A2 = 100X5, A3 =5X50,*** and ***A4=50X1***. Fully parenthesize the matrices in a way to minimize the total scalar operations. Also write the intermediate steps as well.	7	3	3	2
b)	Explain optimal binary search tree algorithm with example and analyze its efficiency	7	2	3	1
16. a)	Explain the Travelling salesman problem in Branch and bound with an example.	6	2	4	1
b)	Write backtracking algorithm for the ***n***-queens problem. Trace it with the help of 4-queens problem.	8	2	4	3
17. a)	Define the decision version of the vertex (or node) cover problem (VCDP). Show that VCDP is NP-complete by reducing it to another NP-Hard problem.	7	2	5	2
b)	What is *SAT* and 3-*SAT* problem? Prove that 3-*SAT* problem is np-complete.	7	1	5	2

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18. a)	Initially device an algorithm that arranges the array of elements in ascending order with time complexity $O(n^2)$. Then reduce time complexity to $O(nlogn)$ for the same set of array of elements.	7	4	1	3
b)	Solve the fractional knapsack problem in $O(n)$ time. Also, prove that the fractional knapsack problem has the greedy-choice property.	7	4	2	3
19.	Answer any ***two*** of the following:				
a)	Describe the Floyd - Warshall's algorithm with an example and analyze its efficiency.	7	2	3	2
b)	Solve the following instance of Knapsack problem by Branch and bound Algorithm with W=15 Kg.	7	3	4	2
c)	Prove that Clique Decision Problem is NP-complete.	7	2	5	2

Item	Weight(in Kg)	Profit
1	5	$40
2	7	$35
3	2	$18
4	4	$4
5	5	$10
6	1	$2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	60%
2	Knowledge on application and analysis (Level-3 & 4)	40%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable, subject to a maximum of 10%)	-

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