Hall Ticket Number:

Code No. : 14615 N/O

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (I.T.: CBCS) IV-Semester Main & Backlog Examinations, May-2019

Design and Analysis of Algorithms

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Q. No	Stem of the Question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	What is the difference between time and space complexity. Also describe asymptotic notations used for describing the complexity?	2	1	1	1

2.	What is the time complexity of the program given below:
	`void fun(int n){`
	`int i,j,k,count=0;`
	`for(i=n/2;i<=n;i++)`
	`for(j=1;j+n/2<=n;j++)`
	`for(k=1;k<=n;k=k*2)`
	`count++;`
	`}`
	Solve the same by using any one of the method of your choice.
		2	2	1	2

3.	Write down the recurrence relation for following algorithms: i) Binary Search ii) Merge Sort	2	2	2	2
4.	Analyze matrix multiplication algorithm among iterative, divide and conquer and Stassen's matrix multiplication.	2	4	2	2
5.	What are the properties of dynamic programming?	2	2	3	2
6.	Write down the algorithm for Relax procedure in Bellman-ford algorithm.	2	2	3	2
7.	Draw a graph with a cycle but with no Hamiltonian cycle.	2	2	4	3
8.	What is explicit and implicit constraints in backtracking?	2	2	4	1
9.	Draw a DAG for the expression (a+b)*(a+b-c) and check whether it is a leaf-one DAG or not.	2	2	5	3
10.	What is polynomial time verification of an algorithm?	2	2	5	2
	Part-B (5 × 8 = 40 Marks)				
11.a)	Describe the Master's theorem for all the cases. Solve the following recurrence relations by using Master's theorem. i) $T(n) = 4T(n/2)+n$ ii) $T(n) = 2T(n/2)+n\log n$	4	2	1	1
b)	i) Solve given recurrence relation using substitution method $T(n) = T(n/2)+ n$, where $T(1) = 1$. ii) Solve given recurrence relation using recursion tree method $T(n) = 4T(n/3) + n^2$, where $T(1) =1$	4	3	1	2

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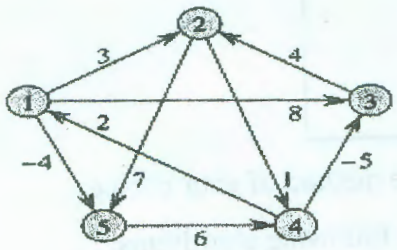
12.a)	Let us consider a mobile customer care with n customers to be served in the queue. For simplicity assume that the service time required by each customer is known in advance and it is w_i minutes for customer **i**. So if, for example, the customers are served in order of increasing **i**, then the i^{th} customer has to wait: $\sum_{j=1}^{n-1} w_j$ minutes. The total waiting time of all customers can be given as $\sum_{i=1}^{n} \sum_{j-1}^{n-1} w_j$. Give the greedy solution to serve the customers so that the total waiting time can be reduced?	4	4	2	3
b)	The characters **A** to **H** have the following set of frequencies **Characters:** A B C D E F G H **Frequency:** 1 1 2 3 5 8 13 21 Use Huffman technique to build the Huffman code tree for the above characters and find the sequence of characters corresponding to the following code. **110111100111010**	4	2	2	2
13.a)	Write Floyd – Warshall algorithm for computing All Pairs Shortest Paths (APSP) problem and explain working of Floyd - Warshall algorithm for the following graph. 	4	2	3	2
b)	A sequence is a palindrome if it reads the same whether we read it left to right or right to left. For example A, C, G, G, G, G, C, A. Given a sequence of length n, devise a dynamic programming algorithm to output the length of the longest palindrome subsequence and give its complexity. For example, the string A, G, C, T, C, B, M, A, A, C, T, G, G, A, M has many palindromes as subsequences, for instance: A, G, T, C, M, C, T, G, A has length 9.	4	5	3	3
14.a)	Reduce the given map to an equivalent graph having constraint that no two regions can be of same color. Device an algorithm for graph coloring and calculate its complexity. 	4	3	4	2

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b)	Following cost matrix is defined for a travelling salesman problem. Obtain reduced cost matrix and state space tree generated by branch and bound method. Label each node with cost estimate. Give its complexity. $\begin{pmatrix} 0 & 20 & 30 & 10 & 11 \\ 15 & 0 & 16 & 4 & 2 \\ 3 & 5 & 0 & 2 & 4 \\ 19 & 6 & 18 & 0 & 3 \\ 16 & 4 & 7 & 16 & 0 \end{pmatrix}$	4	2	4	2
15.a)	Write a non-deterministic algorithm for 0/1 knapsack and give its complexity? Compare its complexity with dynamic programming 0/1 knapsack.	4	2	5	3
b)	Define Clique? Prove that clique decision problem is NP-complete by reducing it from 2-SAT.	4	3	5	2
16.a)	Design an efficient recursive algorithm for the following and calculate its time and space complexity. Given an array of size N consisting of integers. For a given element M, find and return the occurrence of element M in the array, if it is exists in it otherwise return false.	4	4	1	3
b)	Suppose we have ***k*** sorted arrays each of length ***n***. We would like to merge the ***k***-sorted arrays to get a single array whose elements are sorted. Give an algorithm that runs in time *O(nk log k)*.	4	4	2	3
17.	Answer any ***two*** of the following				
a)	Write down recursive 0/1 knapsack algorithm. Explain with the help of an example.	4	2	3	2
b)	Devise a recursive backtracking algorithm for n-queens problem and trace the algorithm for 4-Queens problem. Calculate its complexity.	4	2	4	2
c)	Differentiate between i) Deterministic and Non deterministic. ii) Optimization problem and Decision Problem.	4	2	5	1

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)	62.5%
2	Knowledge on application and analysis (Level-3 & 4)	32.5%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	5%