Hall Ticket Number:

Code No. : 14647

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

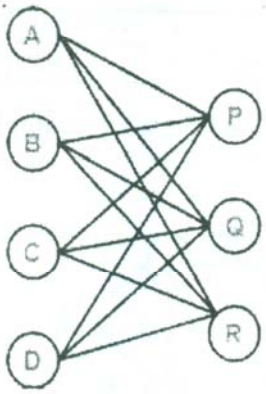
B.E. (I.T.) IV-Semester Main & Backlog Examinations, July-2022

Design and Analysis of Algorithms

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

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

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define the terms Best case, Worst case and Average case time complexities.	2	1	1	1
2.	What is the *Order* (Big-O) of the variable *count* in terms of *n* after the following algorithm-fragment is executed? (1) count = 0; (2) for i = 1 through n do (3) for p = 1 through 3 do (4) for k = 1 through i do (5) count = count +1; (6) end for loops;	2	3	1	2
3.	Distinguish between divide& conquer and greedy method	2	1	2	1
4.	State Master's Theorem for the case $a=b^k$. Apply Master's Theorem for solving the following recurrence equation. **$T(n)=2T(n/2)+n/\log n$**	2	1	2	1
5.	Write Floyd Warshall's Algorithm and its time complexity.	2	2	3	2
6.	Formulate a Reliability Design problem.	2	1	3	1
7.	Define Chromatic number and determine the minimum number of colors required to properly color the following graph. 	2	3	4	2
8.	Describe explicit and implicit constraints with an example.	2	1	4	1
9.	Define P, NP , NP-Hard and NP-complete problems.	2	1	5	1

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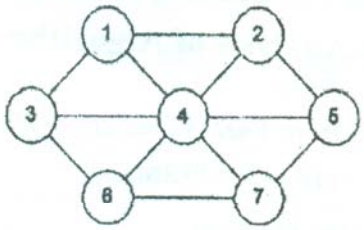
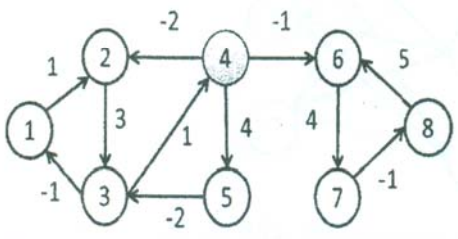
10.	Define clique and determine the size of the maximum clique in the following graph.  	2	3	5	2
	Part-B (5 × 8 = 40 Marks)				
11. a)	Solve the following recurrence equation using Recurrence Tree Method and Substitution Method. **a)T(n) = 3T(n/4) + an ^{2}** **b) T(n)= T(n-1)+n if n>1** **1 if n= 1**	4	2	1	2
b)	Given two lists, L1 of length n and L2 of length m. We say that L2 is a subsequence of L1 if we can remove elements from L1 to produce L2. This means that there exists indices $i_1 <$.....$< i_m$ such that L1[i_j] = L2[j] for each j. Design an algorithm that detects if L2 is a subsequence of L1 and outputs the indices i_1,....., i_m if L2 is a subsequence of L1.	4	3	1	2
12. a)	Formulate Fractional Knapsack Problem. Write Greedy Algorithm for fractional Knapsack Problem. Find the optimal solution for the following fractional Knapsack problem. n=4, m = 60, W={40, 10, 20, 24} and P={280, 100, 120, 120}.	3	3	2	2
b)	Develop a Huffman coding over the following node-frequency pairs by dry running the Greedy Huffman algorithm. The intermediate forest from each iteration must be shown. Encode a string "DEED" into binary code and Decode binary code as "1111110011101111101" into string. Letter: Z, K, M, C, U, D, L, E Frequency: 2, 7, 24, 32, 37, 42, 42, 120	5	3	2	2
13. a)	Apply BellmanFord Algorithm for the following graph by considering node 4 as source.  	3	3	3	3
b)	Construct an optimal binary search tree for the following instance where n = 4 A(1 :4) = (APPLE, DELL,HP,LENOVA) P(1:4) = (2,2,3,1) Q (0:4)=(2,3,1,1,1)	5	3	3	2

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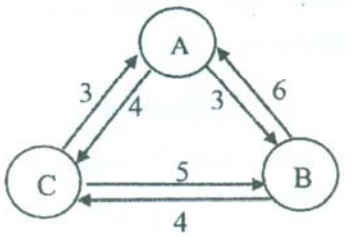
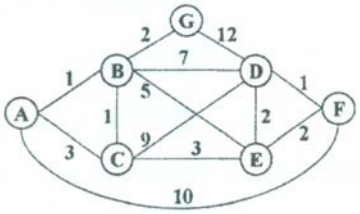
14. a)	State N Queens Problem. Write the backtracking algorithm for solving N Queens problem. Draw the solution state space tree for 4 Queens problem.	4	2	4	1
b)	Solve Travelling Salesman problem for the following graph using Branch and Bound Technique. 	4	3	4	2
15. a)	List and define the functions of Nondeterministic Algorithm. Write a non-deterministic sorting algorithm and analyze time complexity.	4	2	5	1
b)	Prove that CNF-Satisfiability is directly proportional to Clique Decision Problem	4	1	5	1
16. a)	Consider the following array [10, 5, 3, 9, 22, 24, 28, 27, 12] and Device algorithms which can sort the above elements in ascending order with a time complexity of $O(n^2)$ and O(nlogn).	4	2	1	2
b)	A weighted graph indicating (non-negative) distance of roads between adjacent towns is given. A town planner wishes to identify the shortest set of roads to connect the towns. Present an algorithm, along with its complexity, that will enable the town planner to determine this and find the shortest path between these towns. 	4	3	2	3
17.	Answer any ***two*** of the following:				
a)	Find an optimal paranthesization of a matrix-chain product whose sequence of dimensions is 4x10,10x3,3x12,12x20,20x7.	4	3	3	2
b)	Find an optimal solution to the following 0/1 Knapsack Problem by considering the instance weights (W1,W2,W3) = (2,3,4), profits (p1,p2,p3) = (11,12,15) and capacity m = 6 using Least cost branch and bound(LCBB) approach.	4	2	4	3
c)	Prove that Node cover decision problem is NP Complete.	4	2	5	1

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

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	32.50%
iii)	Blooms Taxonomy Level – 3 & 4	47.50%

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