Hall Ticket Number:

Code No. : 14667 AS N/O

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (I.T.) IV-Semester Advanced Suppl. Examinations, Aug./Sept.-2023

Design and Analysis of Algorithms

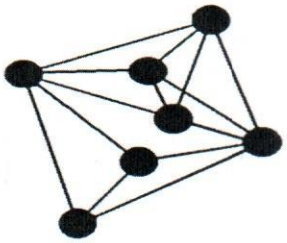
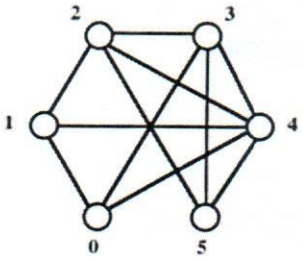
Time: **3 hours** Max. Marks: **60**

*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.	List out the characteristics of an algorithm and What is the significance of amortization.	2	1	1	1

2.	Compute the following code and calculate its time complexity.
	int fun(int a, int b){
	if(b<=0){
	return -1;
	}
	int res= a/b;
	return a-res*b;
	}
		2	3	1	2

3.	Analyze matrix multiplication algorithm and Stassen's matrix multiplication with respect to divide and conquer approach.	2	2	2	1
4.	What is Greedy Method? Write the control abstraction for greedy method.	2	1	2	1
5.	Determine the number of binary search trees possible with 3 distinct keys with an example.	2	2	3	1
6.	Describe reliability design problem.	2	1	3	1
7.	Distinguish between Back Tracking and Branch& Bound techniques	2	2	4	1
8.	Determine the minimum number of colors required to color the following graph. 	2	3	4	2
9.	Write the Non deterministic algorithm for sorting.	2	1	5	1
10.	Describe Clique Decision Problem and Determine the size of the maximum clique in the following graph and mention the nodes of the clique. 	2	2	5	1

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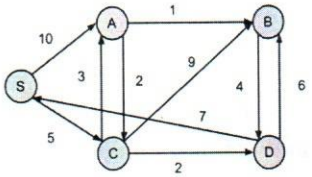
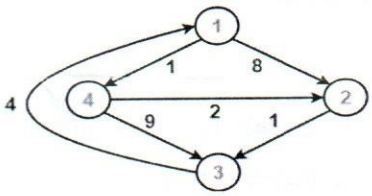
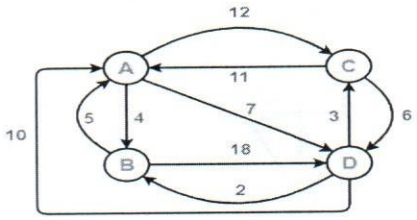
	Part-B (5 × 8 = 40 Marks)				
11. a)	Explain the asymptotic notations used for algorithm analysis with the help of graphs. Prove the following are correct. i)$12n^2+6n = O(n^3)$ ii) $10n^2 + 4n+2 = \Omega(n2)$ iii) $3n+2=\Theta(n)$	4	2	1	1
b)	i) Argue that the solution to recurrence $T(n)=T(n/3)+T(2n/3)+cn$, Where c is a constant, is $\Omega(nlogn)$ by appealing to a recursion tree. ii) Solve given recurrence relation using substitution method $T(n) = T(n/2)+ n$, where $T(1) = 1$.	4	3	1	2
12. a)	Write and demonstrate the Merge Sort divide-and-conquer algorithm on the array, a = 7, 2, 5, 8, 3, 1, 6, 4 and provide a divide-and-conquer recurrence that describes the number of steps required by the algorithm.	4	3	2	2
b)	Apply Dijkstra's algorithm to the following graph by considering vertex S as source. 	4	4	2	2
13. a)	Write Floyd Warshall's Algorithm and Solve all pairs shortest path problem for the given graph using Floyd Warshall's algorithm 	4	2	3	1
b)	Give an algorithm using dynamic programming to determine how many distinct ways there are to give a cents in change using any coins from among pennies, nickels, dimes, and quarters. For example, there are 6 ways to give 16 cents change: a dime, a nickel, and a penny; a dime and 6 pennies; 3 nickels and a penny; 2 nickels and 6 pennies; one nickel and 11 pennies; and 16 pennies. Demonstrate your solution by showing a step-by-step solution for 12 cents change.	4	3	3	2
14. a)	Explain how back tracking approach is used for solving the N-Queen's problem with an example	3	1	4	1
b)	Construct Solution State Space Tree and calculate optimal cost for the following Travelling Salesman Problem using LCBB. 	5	3	4	2

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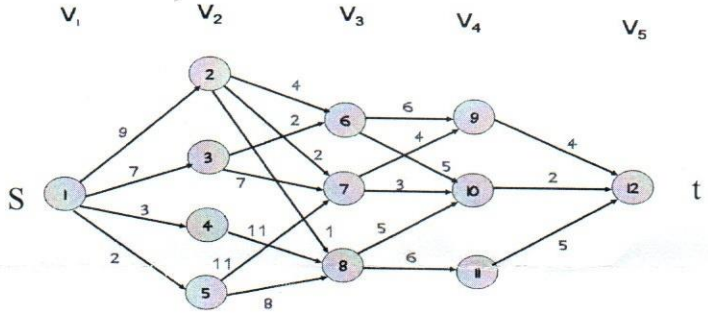
15. a)	Prove that CNF Satisfiability problem is directly proportional to clique decision problem	4	2	5	1
b)	Define Classes P, NP, NP-Hard, NP-complete problems. Give the relationship among them. Differentiate between NP-Hard and NP-complete.	4	1	5	1
16. a)	The *binomial coefficient*, written in text as n C k (read "n choose k"), is the number of combinations of n things taken k at a time. One definition of this is recursive: n C k = [(n-1) C (k-1)] + [(n-1) C k], if $0 < k < n$ 1, otherwise. Write a memoized recursive function that computes the binomial coefficient. What is a tight bound on the running time of your algorithm?	4	2	1	1
b)	Describe Master's theorem for all the cases and apply master's theorem to give tight asymptotic bounds for the following recurrences. i) $T(n) = 2T(n/2) + n \log n$ ii) $T(n) = 2T(n/4) + n^{0.51}$. iii) $T(n) = \sqrt{2}T(n/2) + \log n$ iv) $T(n) = 2^n T(n/2) + n^n$.	4	2	2	1
17.	Answer any ***two*** of the following:				
a)	Consider the following multistage graph and find the minimum cost path from s to t.	4	3	3	2
b)	Solve the following 0/1 knapsack problem using branch and bound.	4	3	4	2
c)	Prove that Node cover decision problem is NP Complete.	4	1	5	1



$n = 4,\ W = 16$

Item i	P_i	W_i
1	40	2
2	30	5
3	50	10
4	10	5

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

i)	Blooms Taxonomy Level – 1	23.75%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	41.25%

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