Hall Ticket Number:

Code No. : 14266 AS N/O

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. IV-Semester Advanced Suppl. Examinations, Aug./Sept.-2023

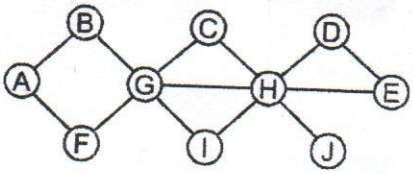
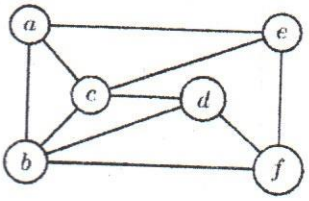
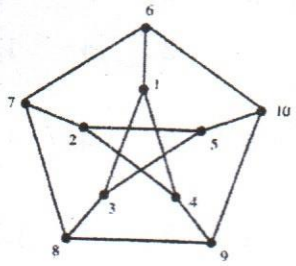
Design and Analysis of Algorithms

(Common to CSE & AIML)

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

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

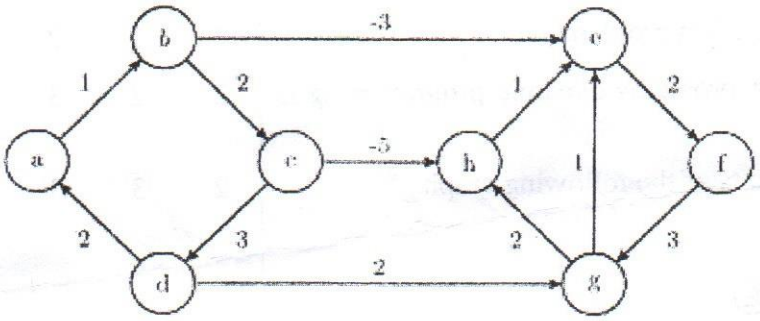
Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Prove or disprove the statement: $3^{n+3} = O(3^n)$.	2	3	1	1,2,3
2.	State master`s theorem.	2	1	1	1,2
3.	Give a recurrence for the running time of Strassen`s matrix multiplication algorithm to multiply two square matrices of order n, where $n = 2^k$, for some integer $k \geq 0$.	2	1	2	1,2
4.	Give two examples for optimization problems.	2	1	2	1,2
5.	For what type of optimization problems dynamic programming is more suitable?	2	2	3	1,2
6.	List out biconnected components of the following graph. 	2	3	3	1,2,3
7.	Determine chromatic number of the following graph. 	2	3	4	1,2,3
8.	Determine whether the following graph has a Hamiltonian cycle. 	2	3	4	1,2,3
9.	What is intractable problem? Give an example.	2	2	5	1,2
10.	Define set cover problem and give an example.	2	1	5	1,2

Contd... 2

	Part-B (5 × 8 = 40 Marks)				
11. a)	Define an algorithm. What are the criteria an algorithm must satisfy? Explain briefly.	5	1	1	1,2

b)	For an odd integer n, let T(n) be the number of times "*Self-motivation is the best form of motivation for oneself*" is printed in the following algorithm segment. Find T(n).
	for (i =1; $i \leq n$; i= i++) do
	for (j=1; $j \leq n$; j= j+2) do
	print" *Self-motivation is the best form of motivation for oneself*";
		3	1	1	1,2

12. a)	Derive a recurrence for the worst-case running time of binary search and represent it`s worst-case running time using theta notation.	3	3	2	1,2,3
b)	Solve the following instance of single-source shortest paths problem with vertex 'a' as source by applying a greedy algorithm.  	5	3	2	1,2,3
13. a)	Solve the following instance of 0/1 knapsack problem by applying your algorithm. Item No / Weight (Kg) / Profit (Rs) 1 / 2 / 4 2 / 6 / 3 3 / 7 / 2 4 / 3 / 4 Knapsack capacity (W) = 8 Kg	6	3	3	1,2,3
b)	What is longest common subsequence problem? Give an example.	2	2	3	1,2
14. a)	How many solutions does the 4-queens problem have? Justify your answer.	2	2	4	1,2
b)	Define Traveling Salesperson Problem (TSP). Explain briefly the main steps in a branch-and-bound solution to the TSP problem.	6	2	4	1,2
15. a)	Consider the following Clique Decision Problem (CDP). *Input* : An undirected graphs G (V, E) and an integer k. *Question*: Does there exist a clique of size at least k in G? Show that CDP is NP-hard by showing that CNF-Satisfiability problem reduces to CDP.	4	3	5	1,2,3

Contd... 3

	Define the following terms. i). Vertex cover ii) Matching iii) Maximal matching iv) Approximation ratio	4	2	5	1,2
16. a)	Give a formal definition of theta notation. Prove or disprove the following: $5n^2+8n-3=\Theta(n^2)$.	4	3	1	1,2,3
b)	Sort the keys 550, 550, 580, 530, 540, 530, 520 in non-decreasing order by applying quick sort.	4	3	2	1,2,3
17.	Answer any ***two*** of the following:				
a)	Define Binary Search Tree (BST). List out all possible BSTs possible with the keys 10, 20 and 30. Also state Optimal BST problem.	4	3	3	1,2,3
b)	Explain the general method of backtracking. Give two examples for problems with backtracking solution.	4	2	4	1,2
c)	Define the following complexity classes and give two examples for each. i). NP ii) NP-hard	4	2	5	1,2

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

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	34%
iii)	Blooms Taxonomy Level – 3 & 4	46%

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