



B.M.S COLLEGE OF ENGINEERING, BANGALORE-19

Computer Science & Engineering

INTERNALS-2

Course Code : 19CS4PCADA

Course Title : Analysis and Design of Algorithms

Semester : 4

Maximum Marks: 40

Date: 31-05-2020

Faculty Handling the Course:

Namratha M, Saritha A N, Anthara Roy Choudhury

Instructions: Internal choice provided in Part C.

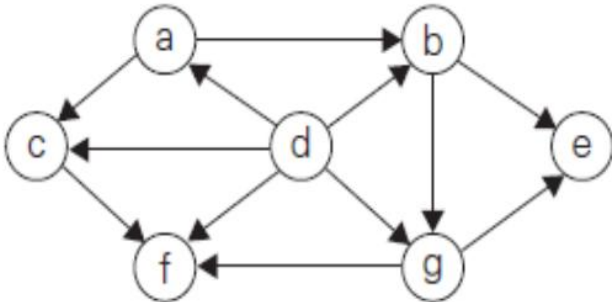
PART-A

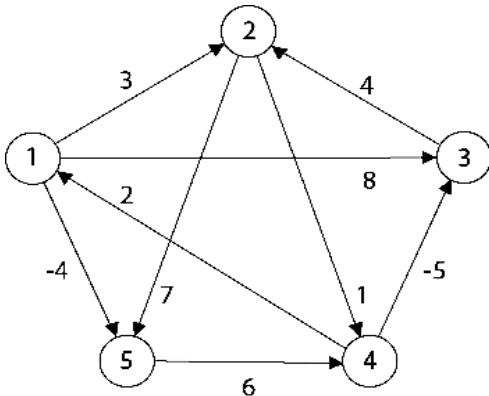
Total 5 Marks (No Choice)

No.	Question	Marks
1	<p>Apply Master's theorem to solve the following recurrence relations:</p> <p>(i) $T(n) = 4T(n/2) + n^2$</p> <p>(ii) $T(n) = 9T(n/3) + n$</p> <p>(iii) $T(n) = 2T(n/2) + n^2$</p>	5

PART-B

Total 15 Marks (No Choice)

No.	Question	Marks																		
2 a)	<p>Solve Knapsack Problem using Bottom-up Dynamic Programming (compute memoization table) for the following instance. Assume knapsack capacity as 10.</p> <table><tr><td>item</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>profit</td><td>30</td><td>20</td><td>40</td><td>70</td><td>60</td></tr><tr><td>weight</td><td>4</td><td>1</td><td>2</td><td>5</td><td>3</td></tr></table>	item	1	2	3	4	5	profit	30	20	40	70	60	weight	4	1	2	5	3	5
item	1	2	3	4	5															
profit	30	20	40	70	60															
weight	4	1	2	5	3															
2 b)	<p>Apply the source-removal algorithm to solve the topological sorting problem for the following digraph. Show all intermediate steps.</p> 	5																		

2 c)	<p>Compute the shortest distances using Flyod's algorithm. Show the adjacency matrix after every iteration.</p> 	
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PART- C

Total 20 Marks

No.	Question	Marks
3 a)	<p>Given a fence with n posts and k colors, find out the number of ways of painting the fence such that at most 2 adjacent posts have the same color. Design an algorithm for the above scenario.</p> <p>Examples:</p> <p>Input : n = 2 k = 4</p> <p>Output : 16</p> <p>We have 4 colors and 2 posts.</p> <p>Ways when both posts have same color : 4</p> <p>Ways when both posts have diff color :</p> <p>$4 * (\text{choices for 1st post}) * 3(\text{choices for 2nd post}) = 12$</p> <p>Input : n = 3 k = 2</p> <p>Output : 6</p>	10
	OR	

3 b)	<p>Given n friends, each one can remain single or can be paired up with some other friend. Each friend can be paired only once. Find out the total number of ways in which friends can remain single or can be paired up.</p> <p>Examples :</p> <p>Input : n = 3</p> <p>Output : 4</p> <p>Explanation</p> <p>{1}, {2}, {3} : all single</p> <p>{1}, {2, 3} : 2 and 3 paired but 1 is single.</p> <p>{1, 2}, {3} : 1 and 2 are paired but 3 is single.</p> <p>{1, 3}, {2} : 1 and 3 are paired but 2 is single.</p> <p>Note that {1, 2} and {2, 1} are considered same.</p>	10
4a)	<p>Given two integers m & n, design an algorithm to find the number of possible sequences of length n such that each of the next element is greater than or equal to twice of the previous element but less than or equal to m.</p> <p>Examples :</p> <p>Input : m = 10, n = 4</p> <p>Output : 4</p> <p>There should be n elements and value of last element should be at-most m.</p> <p>The sequences are {1, 2, 4, 8}, {1, 2, 4, 9}, {1, 2, 4, 10}, {1, 2, 5, 10}</p> <p>Input : m = 5, n = 2</p> <p>Output : 6</p> <p>The sequences are {1, 2}, {1, 3}, {1, 4}, {1, 5}, {2, 4}, {2, 5}</p>	10
	OR	
4b)	<p>Given an array and k, design an algorithm to find the minimum operations needed to make GCD of the array equal or multiple of k. Here an operation means either increment or decrements an array element by 1.</p> <p>Examples:</p> <p>Input : a = { 4, 5, 6 }, k = 5</p> <p>Output: 2</p> <p>Explanation: We can increase 4 by 1 so that it becomes 5 and decrease 6 by 1 so that it becomes 5. Hence minimum operation will be 2.</p>	10