Name:

Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

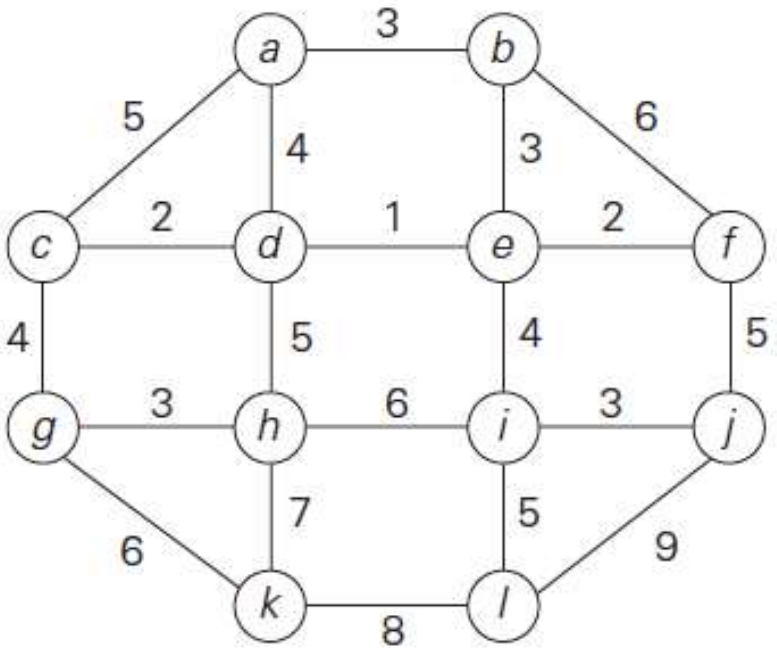
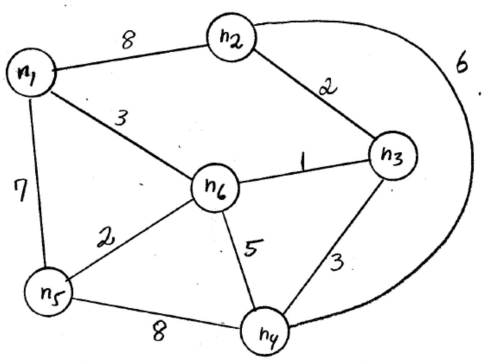
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

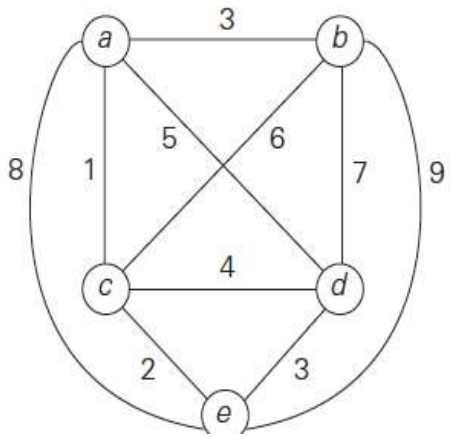
Course: Design and Analysis of Algorithms — **Semester: III**
Program: B.Tech(CSE+All) — **Time 03 hrs.**
Course Code: CSEG 2003 — **Max. Marks: 100**

Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Is it true that $2^{n+1} \leq O(2^n)$? Give a brief justification	**4**	**CO1**
Q 2	Suppose you are given the array A = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12], and you then perform the binary search algorithm find the number 8. Which numbers in the array A are compared against the number 8?	**4**	**CO2**
Q 3	Explain in brief the basic asymptotic efficiency classes.	**4**	**CO1**
Q 4	Discuss the effect of data structure on the time complexity of Prim's Algorithm.	**4**	**CO4**
Q 5	Briefly explain the concepts of P, NP and NP complete problems.	**4**	**CO5**
	SECTION B		
Q 6	Devise a divide-and-conquer algorithm for finding the position of the largest element in an array of n numbers.	**10**	**CO4**
Q 7	Let A[0..n − 1] be an array of n sortable elements. (For simplicity, you may assume that all the elements are distinct.) A pair (A[i], A[j]) is called an inversion if i < j and A[i]>A[j]. a) Determine, What arrays of size n have the largest number of inversions and what is this number? b) Demonstrate that the average-case number of key comparisons in insertion sort is $O(n^2)$	**4+6**	**CO3**
Q 8	Construct a Huffman code for the following data: Symbol | A | B | C | D | -- Frequency | 0.4 | 0.2 | 0.1 | 0.15 | 0.15 a) Encode ABACABAD using the code of question b) Decode 100010111001010 using the code of question OR Solve the following instances of the single-source shortest-paths problem with vertex ***a*** as the source:	**7+3**	**CO3**

			
Q 9	Consider the following graph  The number next to the edges denotes length of the edges. Determine shortest path between every pair of nodes.	**10**	**CO4**
SECTION-C			
Q 10	Explain Matrix chain multiplication problem Figure out an optimal parenthesization of a matrix-chain product whose sequence of dimensions is <30,35,15,5,10,20,25>.	**5+15**	**CO3**

Q 11	Apply the branch-and-bound algorithm to solve the traveling salesman problem for the following graph.  OR Solve the following Knapsack problem using branch and bound problem. Where Knapsack capacity W=16 Item | Weight | Value 1 | 10 | 100 2 | 7 | 63 3 | 8 | 56 4 | 4 | 12	**20**	**CO5**