Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

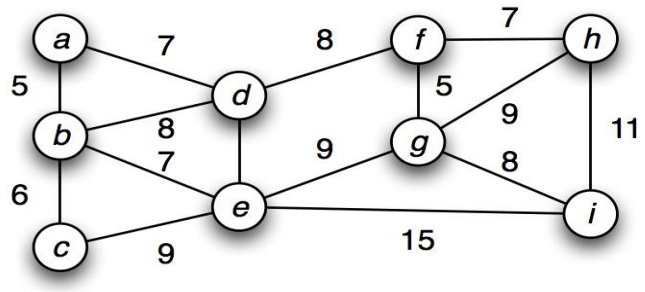
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, January 2021

Course: Algorithm Design and Analysis — **Semester: I**
Program: M.Tech CSE — **Time : 03 hrs.**
Course Code: CSEG7001 — **Max. Marks: 100**
No. of pages : 3

Instruction: Attempt all questions. Internal choice is given, where ever applicable.

SECTION A

S. No.		Marks	CO
Q 1	a) Define the asymptotic notations used for best case, average case and worst case analysis of algorithms (3M) b) Devise a brute force algorithm to find out the maximum element of an array. (2M)	**5**	**CO1**
Q 2	Solve the following recurrence equations $T(n) = 3T(n/2) + n^2$ $T(n) = 2T(n/2) + n \log n$	**5**	**CO1**
Q 3	Four matrices M1, M2, M3 and M4 of dimensions pxq, qxr, rxs and sxt respectively can be multiplied is several ways with different number of total scalar multiplications. For example, when multiplied as ((M1 X M2) X (M3 X M4)), the total number of multiplications is pqr + rst + prt. When multiplied as (((M1 X M2) X M3) X M4), the total number of scalar multiplications is pqr + prs + pst. If p = 10, q = 100, r = 20, s = 5 and t = 80, then the number of scalar multiplications needed is (A) 248000 (B) 44000 (C) 19000 (D) 25000	**5**	**CO3**

Q 4	Computer MST using Prim's algorithm and show the constructed path.  	**5**	**CO2**
Q 5	For merging two unsorted list of size p and q into sorted list of size (p + q). The time complexity in terms of number of comparisons is: (A) O(log p + log q) (B) O(p log p) + O(q log q) (C) O(p + q) (D) None	**5**	**CO1**
Q 6	If one uses straight two-way merge sort algorithm to sort the following elements in ascending order *20, 47, 15, 8, 9, 4, 40, 30, 12, 17* then the order of these elements after the second pass of the algorithm is _____:	**5**	**CO2**
	SECTION B		
Q 1	Consider two strings A = "abacc" and B = "abacaca". Let x be the length of the longest common subsequence (not necessarily contiguous) between A and B and let y be the number of such longest common subsequences between A and B. Then calculate the value of x + y .	**10**	**CO3**
Q 2	Devise an algorithm to remove the duplicates from the array in O(1) space complexity.	**10**	**CO2**
Q 3	A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency: character Frequency a 25 b 29 c 22 d 23 e 26 f 35 Each character in input message takes 1 byte. If the compression technique used is Huffman Coding, how many bits will be saved in the message?	**10**	**CO2**
Q 4	let G = (V, E) where V = {1, 2, 3, 4} and E = {(1, 2),(2, 3),(2, 4),(3, 4)} and suppose that k = 3, devise an algorithm such that adjacent nodes get different colors.	**10**	**CO3**

Q 5	Explain the P, NP, NP-hard, NP-complete classes? Give relationship between them?	**10**	**CO4**
	SECTION-C		
Q 1	Let T be a text of length n, and let P be a pattern of length m. Describe an O(n+m) time method for finding the longest prefix of P that is a substring of T. **(OR)** Consider the travelling salesperson problem given by following cost matrix $\begin{bmatrix} 0 & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix}$ Obtain the optimum tour using dynamic reduction method. Draw a portion of state space tree using LCBB	**20**	**CO3**