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

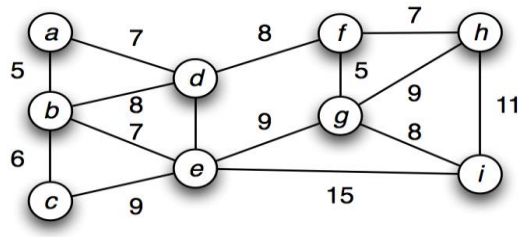
Course: Algorithm Design and Analysis
Program: M.Tech CSE
Course Code: CSE7001
No. of pages : 2

Semester: I
Time : 03 hrs.
Max. Marks: 100

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

SECTION A

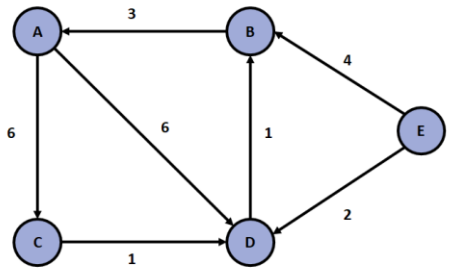
(5Qx 4M = 20 Marks)

Q. No.		Marks	CO
1	Explain the P, NP, NP-hard, NP-complete classes.	4	CO4
2	Obtain the asymptotic upper bound using recursion tree for $T(n)= 2T(n/2)+n^2$	4	CO1
3	An array $A(n)$ contains n elements of the same value that means $A[1] = A[2] = A[3] = ... = A[n] = x$. Calculate the complexity of sorting $A(n)$ using quick sort?	4	CO1
4	Compute the MST using Prim's strategy for the following graph 	4	CO2
5	Why you need approximation algorithms?	4	CO4

SECTION B

(4Qx10M = 40 Marks)

6	Let A[0...n - 1] be an array of n distinct positive integers in unsorted arrangement. If i < j and A[i] > A[j] then the pair (i, j) is called an inversion of A. Given n and an array A, devise O(n log n) algorithm to find the number of inversions of A.	10	CO3
7	Draw the state space tree for 4 queen's problem (OR) Let m=31 and w= {7,11,13,24} draw a portions of state space tree using algorithm sum_subset(). Clearly show the solutions obtained.	10	CO3

8	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.	10	CO4
9	(a) What is overlapping sub problems explain it through an example 5 Marks (b) Compute/Prove the following time complexity equations 5 Marks i) $5N^3+106n^2$ is $\Theta(n^2)$ ii) 3^{n+1} is $O(3^n)$	10	CO2
	SECTION-C **(2Qx 20M= 40 Marks)**		
10	Compute All Pairs Shortest Path for the following graph 	20	CO3
11	You are given two sorted arrays of lengths m and n. give a O(log m + log n) time algorithm for computing the k-th smallest element in the union of the two arrays. Keep in mind that the elements may be repeated. **(OR)** 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.	20	CO4