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

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

Course: Design and Analysis of Algorithms **Semester: IV**
Program: B.TECH CS with CCVT, GG, BAO, and IFM **Time: 03 hrs.**
Course Code: CSEG 2003 **Max. Marks: 100**

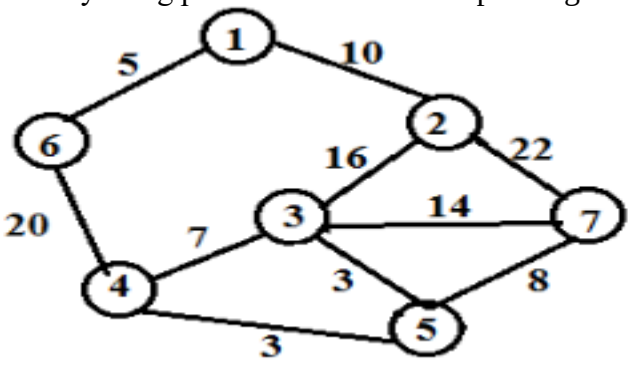
SECTION A

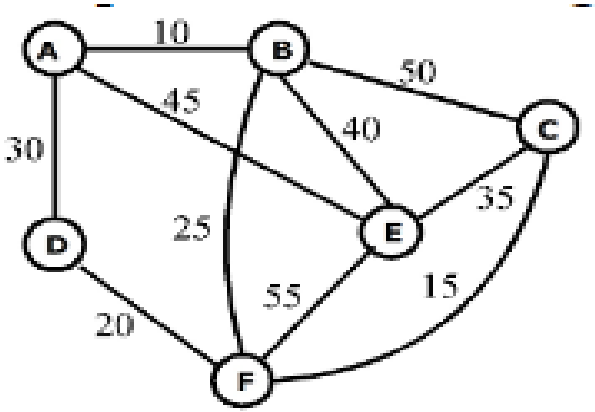
Instruction: complete the statement or select the correct answer(s)

S. No.		Marks	CO
Q 1	i. An analysis of the algorithm, the approximate relationship between the size of the job and the amount of work required to do is expressed by using_____ a. Central tendency b. Order of Storage. c. Order of execution d. Order of magnitude ii. which of the following is incorrect a. $100\,n\log n = O(\frac{n\log n}{100})$ b. $2^n \neq O(n^k)$ c. $\sqrt{\log n} = O(\log\log n)$ d. if $0 < x < y$ *then* $n^x = O(n^y)$	5	CO1
Q 2	i. which sorting algorithm needs the minimum number of swaps a. Bubble sort b. Quicksort c. Merge sort d. selection sort ii. apply the 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 second pass of the algorithm is a. 8,9,15,20,47,4,12,17,30,40 b. 15,20,47,4,8,9,12,30,40,17 c. 4,8,9,15,20,47,12,17,30,40 d. 8,15,20,47,4,9,30,40,12,17	5	CO2
Q 3	i. Let G be a weighted connected undirected graph with distinct positive edge weights. If every edge weight is increased by the same value, then which of the following statements is/are **TRUE** P: Minimum spanning tree of G does not change Q: Shortest path between any pair of vertices does not change a. P only b. Q only c. Both P and Q d. None ii. The complexity of Kruskal's s algorithm for finding the minimum spanning tree of an undirected graph containing m vertices and n edges if the edges are sorted is…… a. O(n log m) b. O(nm) c. O(m log n) d. O(mn)	5	CO3
Q 4	i. The time complexity of computing transitive closure of binary relation on a set of 'n' elements is a. $O(n)$ b. $O(n\log n)$ c. $O(n^3)$ d. $O(n^2)$	5	CO4

	ii. The maximum number of comparisons needed to sort 8 items using radix sort with 5 digits octal number. a. 40 b. 64 c.320 d. 400		
Q 5	i. Choose the correct answer for the following statements: A. The theory of NP-completeness provides a method of obtaining a polynomial-time for NP algorithms B. All NP-complete problems are NP-Hard. a. A is true B is false b. A is false B is true c. both are true d. both are false ii. A problem L is NP-complete iff L is NP-hard a. $L \approx NP$ b. $L \varepsilon NP$ c. $L \alpha NP$ d. $L = NP$	**5**	**CO5**
Q 6	i. The knapsack problem belongs to _____ domain of the problem a. NP-complete b. sorting c. optimization d. Linear solution ii. Which of the following can traverse the state space tree only in a DFS manner? a. branch and bound b. dynamic programming c. backtracking d. greedy algorithm	**5**	**CO5**
SECTION B **Instruction : Write short/brief notes**			

Q 7	a. Solve the recurrence relation using recursion tree $T(n) = 2T(\sqrt{n}) + 1 \; and \; T(1) = 1$
	b. Compute the time complexity of the following function where $n > 0$
	int recursive(int n) {
	if (n==1) return 1;
	else return (recursive(n-1)+recursive(n-1));
	}
		10	**CO1**

Q 8	Derive the recurrence relations of Best, worst, and Average-case time complexities of the Quicksort algorithm.	**10**	**CO2**
Q 9	Find the optimal solution by using prim's minimum cost spanning of the following graph.  	**10**	**CO3**
Q 10	Find all possible subsets of the sum to m. Let w= {5, 7, 10, 12, 15, 18, 20} and m=35 and draw the state space tree that is generated.	**10**	**CO4**

Q 11	Give the formulation of knapsack problem using branch and bound through find the optimal solution using least-cost branch and bound with n=4,m=15,(p1…p4)=(15,15,17,23),(w1….w4)=(3,5,6,9) or Explain the P, NP, NP-Hard, and NP-complete classes and give the relation between them.	**10**	**CO5**
SECTION C **Instruction: Write a long answer.**			
Q 12	Apply the matrix chain multiplication for A1=5X4, A2=4X6, A3=6X2, A4=2X7. P1=5, P2=4, P3=6, P4=2, P5=7. Design the algorithms for optimal parenthesization and matrix chain multiplication through analyzing the space and time complexity. or Apply the all pair shortest path problem for the following graph and design the algorithm for computing cost and path through analyzing the time complexity. 	**20**	**CO4**