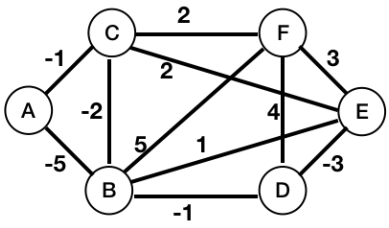
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

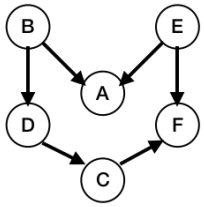
2nd SESSIONAL TEST QUESTION PAPER 2018–19 Even SEMESTER

USN										

Degree : B.E **Semester : IV**
Branch : Computer Science & Engineering **Subject Code : 17CS43**
Subject Title : Design and Analysis of Algorithms **Date : 2019-04-16**
Duration : 90 Minutes **Max Marks : 30**

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K Level	CO mapping
	PART-A			
1(a)	Use Divide and conquer approach and **construct** an algorithm to find k^{th} smallest element in the given sequence of n elements. Hint: Use the idea of quicksort except that only one sub-problem has to be solved. Identify which subsequence contains the k^{th} smallest element and use that subsequence to find the solution.	**5**	Applying	**CO2**
(b)	**Make use of** fractional knapsack algorithm to **build** a solution for the instance $n=7$, knapsack size $m=15$, profits $p_1=10$, $p_2=5$ $p_3=15$, $p_4=7$, $p_5=6$, $p_6=18$, $p_7=3$, and weights as $w_1=2$, $w_2=3$, $w_3=5$, $w_4=7$, $w_5=1$, $w_6=4$, $w_7=1$.	**5**	Applying	**CO2**
(c)	Consider that a country has coins in the denominations of Rs 14, 12, 5, and 1. **Show** an example value to prove that greedy algorithm always does not generate change with minimum number of coins.	**5**	Under-standing	**CO3**
	OR			
2(a)	**Analyze** time complexity for QuickSort in worst case. Hint: Define and explain the recurrence relation for worst case and solve the same.	**5**	Analyzing	**CO2**
(b)	Consider *Dijkstra's* algorithm to find the single source shortest path for a weighted graph. **Identify** the changes that you need to make in this algorithm to find a shortest path between given two vertices i.e. **develop** the algorithm for single-pair-shortest-paths problem.	**5**	Applying	**CO3**
(c)	**Apply** the algorithm developed in Q2(b) to find the shortest path from node F to node B. **Compare** the path thus found using this algorithm with actual shortest path and **explain** the difference. 	**5**	Applying, Analyzing	**CO3**
	PART-B			

3(a)	**Illustrate** the product P(x)*Q(x) computation manually using divide and conquer multiplication approach for following polynomials. $P(x) = 0+1x+2x^2+3x^3+\ldots+7x^7$ $Q(x) = 8+7x+6x^2+5x^3+\ldots+1x^7$	**5**	Under-standing	**CO2**
(b)	**Construct** a Minimum Cost Spanning Tree using Prim's algorithm for the graph shown in Q2(c) starting from node C as the root of the spanning tree. Please note that some edges have negative weights associated with them	**5**	Applying	**CO3**
(c)	**Analyze** the time complexity of *Prim's* algorithm using both *Adjacency Martrix* and *Adjacency List* representation.	**5**	Analyzing	**CO3**
	OR			
4(a)	For the graph below, Identify and **List** all possible topological sorting orders. 	**5**	Applying	**CO2**
(b)	**Analyze** the time complexity of Kruskal's algorithm using *Union-Find* with fixed cost of Union operation as $O(1)$ and varying cost of Find operation.	**5**	Analyzing	**CO3**
(c)	Consider the graph as shown in Q2(c), and **develop** Union Find trees to check for cycle formation when considering each edge for Minimum Cost Spanning Tree.	**5**	Applying	**CO3**