No. of Printed Pages : 3 M00705 **MMTE-002**

M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)
M.Sc. (MACS)

Term-End Examination,

December 2019

MMTE-002 :DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 Hours] *[Maximum Marks : 50*

Note : (i) Question No. 6 is compulsory.

(ii) Answer any Four questions from Question No. 1 to 5.

(iii) Calculators are not allowed.

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1. a) Sort the following numbers using Counting sort
3, 6, 4, 1, 3, 4, 1, 4.
Show all the steps involved. 5

b) i) Construct a Binary search tree showing all the steps involved by inserting the following sequence of numbers in the order it is given.
10, 12, 5, 4, 20, 8, 7

ii) Further, explain step by step, how you will delete the node with key 5.
5

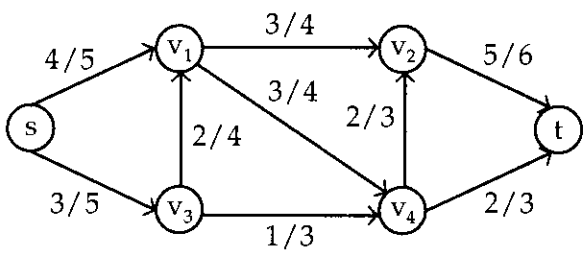
2. a) Construct a Max-heap tree for the following numbers
15, 19, 10, 7, 17, 16
show all the steps involved. 5

b) Find an optimal parenthesization of a matrix chain product whose sequence of dimensions is given by {4, 6, 30, 8, 9} 5

3. a) Construct the Huffman tree for the following data: 5

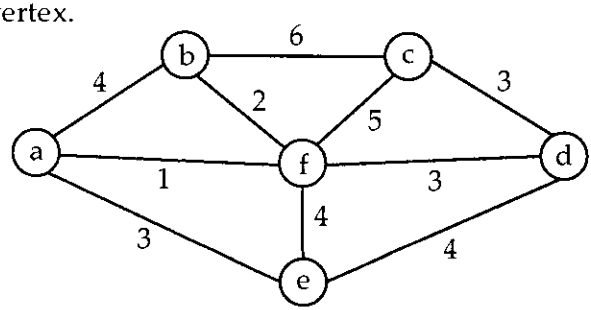
Character	A	B	C	D	E	F
Probability	0.2	0.15	0.10	0.30	0.12	0.13

b) For the following Network flow, draw the residual network.



Find an augmenting path P, and use it to augment the flow. 5

4. a) Find the minimum spanning tree for the following graph using Prim's algorithm with a as the root vertex. 5



b) Illustrate all the steps of the Robin-Karp-Miller string matching algorithm for P = 1312, Q = 9, T = 27072251312167. Indicate all the spurious matches. 5

5. a) Let $f:\mathbb{N}\to\mathbb{R}, g:\mathbb{N}\to\mathbb{R}$, be such that $f(n) \geq 0$, $g(n) \geq 0$ for all $n \in \mathbb{N}$. Explain the following notations, giving one example of each; with justification. 5

i) $f(n) = O(g(n))$

ii) $f(n) = \Theta(g(n))$

b) Compute the DFT of the vector (1, –1, 1, 2). 5

6. Which of the following statements are True, and which are False? Justify your answer with a short proof or a counter example. 10

i) Every binary heap is complete

ii) The Dijkstra algorithm will never terminate if there is an edge of negative weight in the graph.

iii) For solving the 0 - 1 Knapsack problem, the greedy method is the most efficient.

iv) If the edges of a connected graph have distinct weight the minimal spanning tree given by the Kruskal's algorithm is unique.

v) The insertion sort algorithm will take the same time to sort any two sequences of the same length.

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