No. of Printed Pages : 4 **MMTE-002**

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

Term-End Examination

June, 2023

MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 Hours *Maximum Marks : 50*

Note : *Answer any* ***four*** *questions from Question Nos.* ***1*** *to* ***5****. Question No.* ***6*** *is compulsory.*

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1. (a) Define and explain the Big-O, Big-Ω and Big-Θ notations with examples. 6

   (b) Explain the string matching problem with an example. 2

   (c) Explain the Longest Common Subsequence problem with an example. 2

2. (a) Illustrate the working of the function PARTITION of the quick sort algorithm using the array : 5

   < 24, 75, 26, 15, 67, 54, 31, 49 >

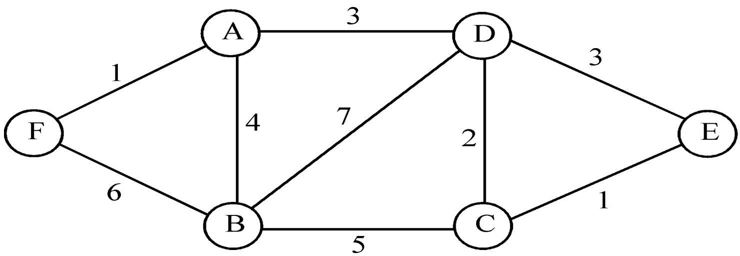
(b) Illustrate all the steps of Rabin-Karp-Miller string algorithm for the pattern P = 1312, modulus Q = 9 and the string 2702251312167. Indicate all the spurious matches. 5

3. (a) Construct the Huffman code tree for the set of frequencies in the table below : 5

Character	Frequency
A	5
B	1
C	6
D	3
E	4

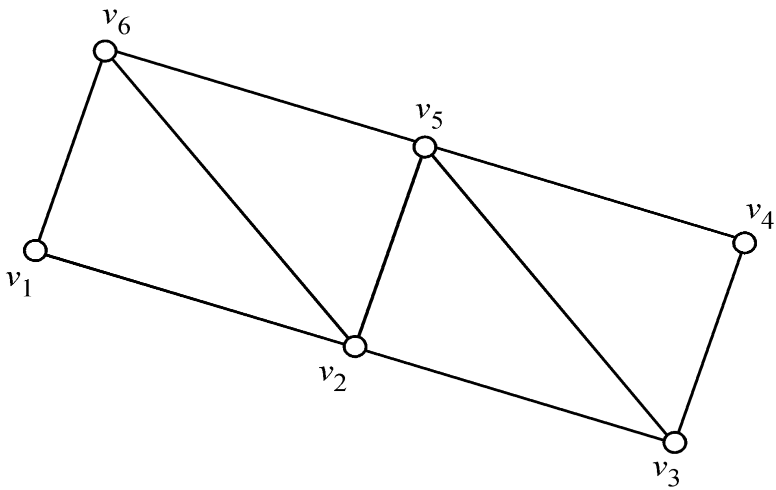
(b) Find an optimal parenthesisation of the matrix chain product whose sequence of dimensions is 10, 25, 10, 5, 17. 5

4. (a) Find the minimum spanning tree for the following graph using Kruskal's algorithm : 5



(b) Let $a = 352$, $b = 671$. Find s and t such that $as + bt = \gcd(a, b)$. Show the steps of the algorithm. 5

5. (a) Explain the breadth first search algorithm using the graph given below with v_1 as the source vertex :



For each stage of the algorithm give :

(i) $d(v), \pi(v)$ for each vertex, where $d(v)$ is the distance from the source to the vertex v and $\pi(v)$ is the predecessor of v.

(ii) White and gray vertices

(iii) Vertices in the queue

Also, give the breadth search tree. 7

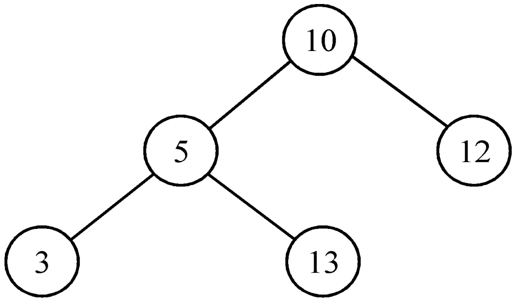
(b) Check whether the following array represents a max-heap. If not run the MAX-HEAPIFY algorithm to convert it into a max-heap : 3

6, 20, 18, 15, 17, 11, 12, 13

6. Which of the following statements are true and which are false ? Justify your answer with short proof or a counter-example : 10

(a) An array in ascending order in a max-heap.

(b) The following tree is a binary search tree :



(c) The Longest Common Subsequence problem always has a unique solution.

(d) If the weights of the edges of a graph are distinct, the graph has a unique minimal spanning tree.

(e) A polynomial $p(x)$ of degree n can be evaluated at a point x_0 in O (n) time.