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MMTE-002

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

Term-End Examination

June, 2022

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) Explain the concept of input size of an algorithm with an example. 2

   (b) Sort the following list of numbers using counting sort method : 5

   4 2 2 8 3 3 1

   Show all the steps.

(c) Rank the following function in the order of growth by finding an ordering f_1, f_2, f_3, f_4 of the functions satisfying $f_1 = O(f_2)$, $f_2 = O(f_3)$, $f_3 = O(f_4)$. The functions are $n!$, $3^n, e^n$. 3

2. (a) Construct the B-tree of degree 2 by inserting numbers from 1 to 10. Show all the steps. 5

(b) Illustrate the MERGE procedure of the MERGE-SORT algorithm for the following array : 5

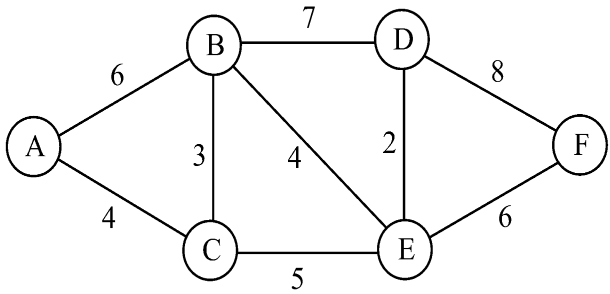
3	4	8	9	11	1	2	5	6	7	10

3. (a) The Huffman for the following set of frequencies :

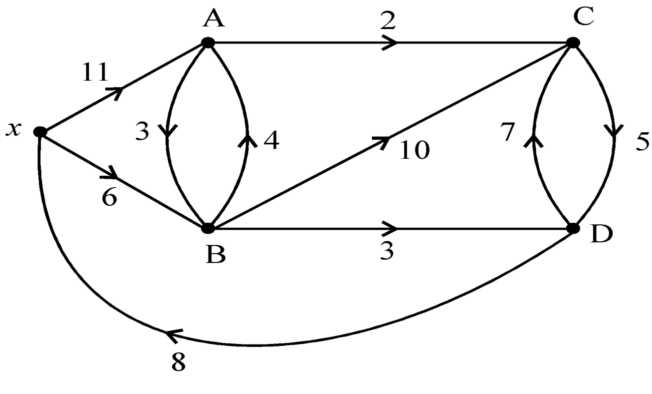
Character	A	B	C	D	E
Frequencies	5	6	6	11	20

Show all the steps. Also compute the number of data bits required to encode the data. 5

(b) Apply Kruskal's algorithm to find the minimum spanning tree of the following graph : 5



4. (a) Use the Dijkstra's algorithm to find the shortest distance from the vertex x to all the other vertices : 5



(b) Write an algorithm to delete an internal mode from a binary search tree. 5

5. (a) Find the optimal parethesization of a matrix chain product whose sequence of dimensions is (4, 6, 30, 8, 9). 5

(b) For the polynomials $g(x) = x^2 - 3x + 1$ and $h(x) = x^2 + x - 1$, obtain the point-value representation of using the points $\{1, -i, i, -i\}$. Use the representation to find the product of the polynomials g and h in the coefficient form. 5

6. Which of the following statements are true and which are false ? Justify your answer with a short proof or a counter-example : 2×5=10

(i) Every binary heap is complete.

(ii) The Dijkstra's algorithm will not terminate of 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 weights the minimal spanning tree given by the Kruskal's algorithm is unique.

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