

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

M.Sc. (MACS)

Term-End Examination

June, 2017

01432

**MMTE-002 : DESIGN AND ANALYSIS OF
ALGORITHMS**

Time : 2 hours

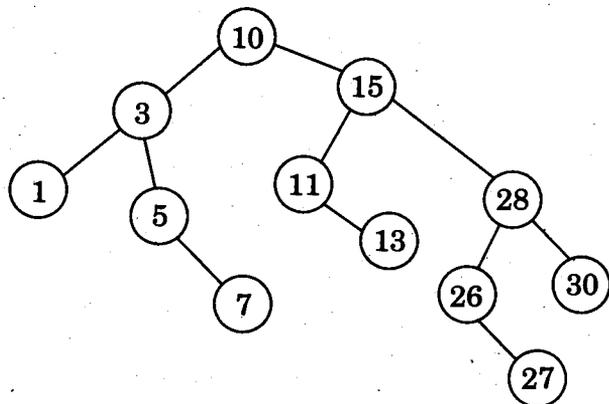
Maximum Marks : 50

Note : Question no. 6 is compulsory. Answer any four questions from the remaining questions.

1. (a) Sort the following numbers using the Quick Sort technique : 5

25, 11, 28, 09, 35

- (b) Delete the nodes 1, 5, 15 in this order, in the binary search tree below and show the tree you get at each stage : 5



2. (a) Sort the following numbers using the Radix Sort method : 3

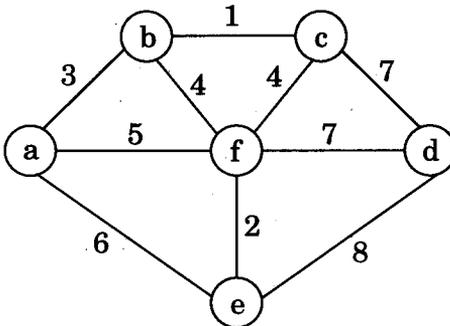
243, 121, 120, 240, 189, 173, 193

- (b) Construct the Huffman code for the set of frequencies in the table below : 5

| | | | | | | |
|-----------|---|---|---|----|----|---|
| Character | a | b | c | d | e | f |
| Frequency | 5 | 5 | 5 | 10 | 10 | 5 |

- (c) Write an algorithm to compute the LCM of two natural numbers using the GCD algorithm. 2

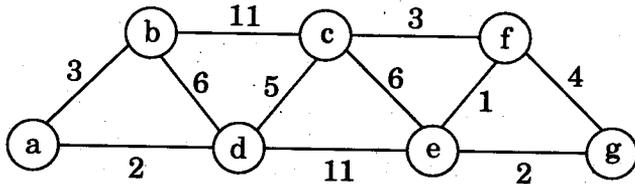
3. (a) Draw the minimum spanning tree for the following graph using Kruskal's algorithm and justify the choice of edge picked at each stage : 5



- (b) Find an optimal parenthesisation of a matrix chain product whose sequence of dimensions is (4, 3, 6, 8, 3, 5). 5



4. (a) Apply Dijkstra's Algorithm to find the shortest path between b and g in the following graph. Show all the steps in the execution of the algorithm. 5



- (b) Working modulo $q = 11$, find the positions of all the spurious hits encountered by the Rabin-Karp algorithm in the text $T = 3141592653589793$, when looking for the pattern $p = 26$. Further, which character of the text would you change to increase the number of spurious hits by one? Give reasons for your answer. 5

5. (a) Rank the following functions in increasing order of growth with justification : 3

$$n, \log^2 n, \log(n!)$$

- (b) What are the minimum and maximum number of elements in a heap of height h ? Give reasons for your answer. 4

- (c) At which points does the DFT procedure evaluate a polynomial of degree n , and why? 3

6. State whether the following statements are *True* or *False*. Give reasons for your answers. 5×2=10

- (a) $2^{2n} = O(2^n)$
 - (b) All the nodes in a B-tree must have the same number of keys.
 - (c) Insertion Sort is an example of a 'Divide and Conquer' algorithm.
 - (d) The DFS tree is independent of the order in which the adjacent edges are explored.
 - (e) $ax \equiv bx \pmod{m} \Rightarrow a \equiv b \pmod{m}$, where $a, b, x, m \in \mathbf{N}$.
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