# No. of Printed Pages : 3 <br> <br> M.Sc. (MATHEMATICS WITH APPLICATIONS <br> <br> M.Sc. (MATHEMATICS WITH APPLICATIONS <br> <br> IN COMPUTER SCIENCE) <br> <br> IN COMPUTER SCIENCE) <br> <br> M.Sc. (MACS) <br> <br> M.Sc. (MACS) <br> <br> Term-End Examination <br> <br> Term-End Examination <br> <br> December, 2015 <br> <br> December, 2015 <br> <br> MMTE-002 : DESIGN AND ANALYSIS OF <br> <br> MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS 

 ALGORITHMS}

MMTE-002

Time: 2 hours
Maximum Marks : 50
Note: Answer any five questions. Calculators are not allowed.

1. (a) Sort the following numbers using Quick sort algorithm :

$$
32,5,25,10,31,42,26
$$

(b) Define B-trees along with conditions. Give an example of a B -tree.
2. (a) Sort the following numbers using Heap sort algorithm :

$$
32,5,25,10,31,42,26
$$

(b) What is the time complexity of Build Max Heap ? Sort the following numbers using Radix sort algorithm :

$$
329,457,657,839,436,720,213,582
$$

What is the time complexity of Radix sort algorithm?
3. (a) What is an optimal Huffman Code for the following set of frequencies?

| Character | a | b | c | d | e | f |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Frequency | 45 | 13 | 12 | 16 | 9 | 5 |

How many total bits are required to encode
the set of characters?
(b) Write Kruskal's algorithm in pseudocode. Discuss its time complexity.
4. (a) Find an optimal parenthesisation of a matrix-chain product whose sequence of dimensions is $(5,10,3,12,5)$.
(b) How can you implement efficient FIND and UNION operations for disjoint sets?
5. (a) Illustrate all the steps of Rabin-Karp-Miller string matching algorithm for $P=26$, $\mathrm{T}=3141592653$ and $\mathrm{Q}=11$.
(b) For the following network flow, draw the residual network :


Find an augmenting path $p$ and use it to augment the flow along p. Draw the flow network of the augmented flow.
6. (a) Compute the DFT of the vector (1, 2, 3, 4). 6
(b) Let $g(n)=1^{3}+2^{3}+\ldots+n^{3}$. Show that $g(n)=\Theta\left(n^{4}\right)$ giving the constants.

