

Paper Code: COE-208
Time: 1:30 Hours

Title of the subject: Algorithm Design and Analysis
Max. Marks: 25

Note: Answer all questions. Write pseudo code for all algorithms asked.
Assume suitable missing data, if any.

1. Solve following recurrences (use any method)

(i) $T(n) = 2T(n/2) + n \log n$

(ii) $T(n) = 3T(n/4) + n \log n$

(iii) $T(n) = 5T(n/3) + n \log n$

(2+2+2=6)

2. You are given a sorted array of n elements which has been circularly shifted. For example, {35, 42, 5, 12, 23, 26} is a sorted array that has been circularly shifted by 2 positions. Give an $O(\log n)$ time algorithm to find the largest element in a circularly shifted array. (The number of positions through which it has been shifted is unknown to you.) (5)

3. Write algorithm for Huffman coding and apply it on following data:

Char	a	b	c	d	e	f	g	h	i
Frequency	5	1	3	21	5	9	3	6	8

Also compute average code size.

(5)

4. Bob loves foreign languages and wants to plan his course schedule to take the following nine language courses: LA15, LA16, LA22, LA31, LA32, LA126, LA127, LA141 and LA169.

The course prerequisites are: LA15: None, LA16: LA15, LA22: None, LA31: LA15, LA32: LA16 & LA31, LA126: LA22 & LA32, LA127: LA16, LA141: LA22 & LA16, LA169: LA32. Using Graphs, find a sequence of courses that allows Bob to satisfy all the prerequisites. Use proper algorithm to solve this problem. Also write the algorithm used. (5)

5. Given a sorted array of distinct integers, some of which may be negative, give an algorithm to find an index i such that $1 \leq i \leq n$ and $A[i] = i$ provided such an index exists. If there are many such indices, the algorithm can return any one of them. (4)