

Note: Each question is of two marks. Attempt the questions in the given sequence.

1	There is an archive of those Hindi movies which have topped the charts in their respective years of release. Movies are of different length. Movies are not stored in any order. A file table gives the starting address and size of each movie. An expert team wants to analyze these films in the order of the length of the movies i.e. smallest movies first and so on. Due to poor state of the archive they want there should not be any movement of the data between different sectors, blocks or clusters of data. What mechanism do you suggest for sorting and type of data structure that should be adopted to fulfill the team's requirements such that the team is able to view the movies in order without any data movement with in different parts of the archive? Justify your answer.
2	In an army recruitment drive all eligible persons are standing in a queue and there looks no logical way to select one out of them. So the Army general uses the following trick to select one person out of the eligible persons. He gives every person a number in the order of their position in the queue like 1,2,3,4... Then he starts removing every odd person starting from the queue and the persons left are with the numbers 2,4,6,... Again he does the same thing and removes every alternate person starting from the front. Now he is left with persons numbered 4,8... Write an algorithm, given the number of persons in the queue, at which position you should stand so that you are chosen by the General, if he uses the above approach.
3	Find the time complexity of the following code in big oh notation in terms of n. An array A[i] contains sum of numbers from 1 to i in a particular index of the array. Array index is starting from 1. so array elements are 1,3,6,10,15,21,28.... Explain how you calculated the complexity. <pre> { int a,b; for i= 1 to n for j= 1 to A[i] for k= 1 to j { a=b+i; } } </pre>
4	Prove that at the time of insertion of new elements if the array is full than it is better option to double the array instead of extending it by a fix constant c.
5	You are interested in analyzing some hard-to-obtain data from two separate databases. Each database contains n numerical values – so there are 2n values total –and you may assume that no two values are the same. You'd like to determine the median of this set of 2n values, which we will define here to be the n-th smallest value. However, the only way you can access these values in through queries to the databases. In a single query, you can specify a value k to one of the two databases, and the chosen database will return the k-th smallest value that it contains. Since queries are expensive, you would like to compute the median using as few queries as possible. Give an algorithm that finds the median value using at most $O(\log n)$ queries.
6	a) Describe Extract-Min operation in Binomial Heaps b) Describe Extract Min operation in Fibonacci Heaps
7	a) What are the benefits of B Trees? Why these are preferred for various file systems. b) What is complexity of various data structure operations on B-Trees like insertion, deletion and search?
8	A tableaux is a matrix where each row and each column of the matrix is in increasing order. You are given a set of unique numbers in a n*n matrix. Task is to arrange the elements in such a way that every row and every column of the matrix is sorted in increasing order. If it is not possible for the given numbers then the algorithm should print that it is not possible to create such order, otherwise it should print the matrix with the desired order.
9	a) Explain any two cases of deletion in a Red Black Tree. Take the help of diagram. b) Explain and any two cases of insertion in a Red Black Tree. Take the help of diagram.
10	a) How you can split an AVL tree into two AVL trees. What will be the time complexity? b) How you can merge two AVL trees into an AVL tree. What will be the time complexity?