PSG COLLEGE OF TECHNOLOGY

DEPARTMENT OF APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES

M.Sc (SS) – DESIGN AND ANALYSIS OF ALGORITHMS LAB

PROBLEM SHEET- IV

Divide and Conquer Approach

1. Let $A[0..n-1]$ be an array of n real numbers. A pair $(A[i], A[j])$ is said to be an ***inversion*** if these numbers are out of order, i.e., $i < j$ but $A[i] > A[j]$. Design an $O(n \log n)$ algorithm for counting the number of inversions.
2. You are given an integer N. Write a program to find a minimum number P such that $1 \le X \le P$, $\sum F(X) \ge N$ (where F(X)represents the number of times X can be divided by 5).
3. You are given a sequence A of length n and a number k. A number A[l] is special if there exists a contiguous subarray that contains exactly k numbers that are strictly greater than A[l] . The specialty of a sequence is the sum of special numbers that are available in the sequence. Your task is to determine the specialty of the provided sequence.
4. You are given an array **A** of length **N**. For any given integer **X**, you need to find an integer **Z** strictly greater than **X** such that **Z** is not present in the array **A**. You need to minimise the value of **Z**.
5. Given 2 x N pebbles of N different colors, where there exists exactly 2 pebbles of each color, you need to arrange these pebbles in some order on a table. You may consider the table as an infinite 2D plane. The pebbles need to be placed under some restrictions : You can place a pebble of color X, at a coordinate (X,Y) such that Y is not equal to X, and there exist 2 pebbles of color Y.

   In short consider you place a pebble of color i at co-ordinate (X,Y). Here, it is necessary that (i=X) and (i !=Y) there exist some other pebbles of color equal to Y.

   Now, you need to enclose this arrangement within a boundary, made by a ribbon. Considering that each unit of the ribbon costs M, you need to find the **minimum cost** in order to make a boundary which encloses any possible arrangement of the pebbles. The ribbon is sold only in units (not in further fractions).

   Input Format:

First line consists of an integer *T* denoting the number of test cases. The First line of each test case consists of two space separated integers denoting *N* and *M*.

The next line consists of *N* space separated integers, where the ith integer is A[i] and denotes that we have been given exactly *2* pebbles of color equal to A[i]. It is guaranteed that A[i] !=A[j] , if i!=j

Output Format:

Print the minimum cost as asked in the problem in a separate line for each test case.