DAY-5 problem set. Date:- 22-07-2024

1. Implement the Binary Search using a loop and also using the concept of upper and lower bound.

2. Problem:

There is a street of length ‘X’ with 'X' slots numbered from 0 to 'X' (0,1,…, ’X’). Initially, there are no traffic lights in these slots. Later ‘N’ sets of traffic lights are added to the street one after another. The ‘POS’ array tells the position of the ‘i’th light.
Your task is to calculate the length of the longest passage without traffic lights after each addition.

For example:

Given:- ‘X’ = 5 and ‘N’ = 2.
‘POS’[] = 3, 4
The output will be 3 and 3.
Initially, there are no lights, and we install a light at position three; therefore, there is a segment between the 3 and 6.
Then we install a light at position four; therefore, the largest gap becomes between 0 to 3.

Input format :

The first line of input contains an integer ‘T’ denoting the number of test cases.
The first line of each test case contains two space-separated integers, 'X' and ‘N’, where ‘X’ is the length of the road and ‘N’ is the number of lights.
The next line contains ‘N’ space-separated integers denoting the position of the ith light.

Output format :
For each test case, print a single line containing a single integer denoting the maximum gap for every light we install.
The output of each test case will be printed in a separate line.

Constraints:

1 <= T <= 10
1 <= N <= 2000
1 <= X <= 10 ^ 8
1 <= POS[i] <= X

Where ‘T’ is the total number of test cases, ‘N’ is the number of lights we install, ‘X’ is the length of the road, and ‘POS[i]’ denotes the position of the 'i th' light.

Sample Input 1 :

2
5 2
3 4
6 3
4 5 1

Sample Output 1 :

3 3
4 4 3

Explanation of the Sample Input 1:

For the first test case :
The output will be 3 3.
Initially, there are no lights, and we install a light at position 3 therefore, there is a segment between the 3 and 6.
Then we install a light at position 4; therefore, the largest gap becomes between 0 to 3.

For the second test case :
The output will be 4 4 3.
Initially, there is no light. Then we install a light at position 4. Therefore the max gap becomes between 0 and 4.
Then we install a light at position 5, and the largest gap is still 0 to 4.
Then we install a light at position 1 then the largest gap is between 1 to 4, which is 3.

Sample Input 2 :

2
6 3
5 3 4
7 4
1 2 3 4

Sample Output 2 :

5 3 3

6 5 4 3

Problem no 3.

Prateek is a kindergarten teacher. He wants to give some candies to the children in his class. All the children stand in a line and each of them has a grade according to his or her performance in the class. Prateek wants to give at least one candy to each child. If two children are standing adjacent to each other, then the one with the higher rating must get more candies than the other. Prateek wants to minimize the total number of candies he must buy.

Given an array 'STUDENTS' of size 'N' that contains the grades for each student, your task is to find what is the minimum number of candies Prateek must buy so that he can distribute them among his students according to the criteria given above.
Example :

Given students' ratings : [5, 8, 1, 5, 9, 4].

He gives the students candy in the following minimal amounts : [1, 2, 1, 2, 3, 1]. He must buy a minimum of 10 candies.

Note :

1. If two students having the same grade are standing next to each other, they may receive the same number of candies.
2. Every student must get at least a candy

Input format :

The first line of input contains an integer 'T' representing the number of the test case. Then the test case follows.The first line of each test case contains an integer ‘N’ representing the number of students.The second line of each test case contains 'N' space-separated integers representing the grades of each student.

Output Format :

For each test case, print the minimum number of candies required.
Constraints :

1 <= T <= 10^2

1 <= N <= 10^4

1 <= STUDENTS[i] <= 10^5

Sample Input 1 :

3

2

1 5

3

1 3 4

3

1 2 2

Sample Output 1 :

3

6

4

Explanation For Sample Input 1 :

(i) Optimal distribution will be 1 2

(ii) Optimal distribution will be 1 2 3

(iii) Optimal distribution will be 1 2 1 because for children with equal grades one child can have less candies

Sample Input 2 :

3

1

100

5

1 5 3 4 6

6

1 9 1 3 2 4

Sample Output 2 :

1

9

9

Explanation For Sample Input 2 :

(i) Optimal distribution will be 1

(ii) Optimal distribution will be 1 2 1 2 3

(iii) Optimal distribution will be 1 2 1 2 1 2