**PSG COLLEGE OF TECHNOLOGY, COIMBATORE-4**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**19I510 DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY**

**CA-1**

**CLASS: III B. Tech (IT) G1                                                                            SEM: V**  
**DURATION: 2 Hours                               MAX MARKS: 15**

1. **Given an array of integers. Find the Inversion Count in the array. Inversion Count: For an array, inversion count indicates how far (or close) the array is from being sorted. If array is already sorted then the inversion count is 0. If an array is sorted in the reverse order then the inversion count is the maximum. Formally, two elements a[i] and a[j] form an inversion if a[i] > a[j] and i < j.**

**Use Enhanced Merge Sort and show the Expected Time Complexity**

**Input Format**

The first line is an integer ‘N’ representing the number of elements in the array. The next line contains space-separated integers of array as per N

**Constraints**

1 ≤ N ≤ 5\*10^5

1 ≤ arr[i] ≤ 10^18

**Output Format**

Number of Inversions expected

**Sample Input**

5

2 4 1 3 5

**Sample Output**

3

1. **Noor is going fish farming. There are N types of fish. Each type of fish has size(S) and eating factor(E). A fish with eating factor of E, will eat all the fish of size ≤ E. Help Noor to select a set of fish such that the size of the set is maximized as well as they do not eat each other in an efficient manner. Sort the selected set of fish in maximized order in O(nlogn) and analyze the time complexity.**

**Input**

The first line contains an integers N. N is the number of types of fish. Each of the next N lines contains two integers S and E meaning the size and eating factor of a fish.

**Output**

For each test cases, print the integer, the maximum number of fish Noor can have in his pond and the sorted maximized size values in order.

**Constraints**

1 ≤ N ≤ 10^5

1 ≤ S,E ≤ 10^9

S > E

**Sample Input**

3

4 1

5 4

7 3

**Sample Output**

2

7

4

**Hint**: Noor can select the first and the third fish for this example.

1. **Micro has an array A having N strings made of lower case English alphabets. He is interested in finding out the length of the longest string that occurs as a substring among all the strings in A.**

Now as you know strings hate Micro, so he asked Monk for help. Monk helped him in identifying the substring in the string using **Linear time pattern searching Algorithm**.

**Input**:

First line consists of a single integer denoting N.

Each of the following N lines consists of a single string made of lower case English alphabets.

**Output**:

Print the length of the longest common substring among all strings in A.

**Constraints**

1 ≤ N ≤ 10^5

1 ≤ A[i] ≤ 10^6

**Sample Input**

3

abcd

bcd

cdab

**Sample Output**

2

**Hint**: String "cd" is the longest string that occurs as a substring in all the strings of array.

1. **Chef has an Array A of length N**

**Let F(A) denote the maximum frequency of any element in the Array A. Using hash list/table store the maximum frequency of the elements in the array A and Chef can perform the following operation at most once:**

1. Calculate F(A) for the elements in the array A
2. Replace the element with maximum frequency with a random integer ‘y’ and compute **minimum possible value of F(A)**

**Example:**

If A = [1,1,1,1,1], then F(A) = 5 since element 1 has the highest frequency = 5.

Replace ‘1’ **with a random integer ‘y’ such that minimizing F(A) value optimally at most once. For example, [**1,1,1,1,1]→[2,1,2,1,2]. **The value of minimized F(A) in this case is 3, which is the minimum possible.**

**Determine the minimum possible value of F(A) Chef can get by performing the given operation at most once.**

**Input Format**

The first line contains a single integer N denoting the length of array A.

The second line contains N space-separated integers denoting the array A.

Third line consists of random number ‘y’ to replace with.

**Output Format**

For each test case, output the minimum value of F(A) Chef can get if he performs the operation optimally.

**Constraints**

1 ≤ N ≤ 10^5

1 ≤ A[i] ≤ 10^6

1 ≤ y ≤ 10^5

**Sample Input:**

1 2 1 2

**Sample Output:**

2

**Sample Input:**

1 1 1 1 1

**Sample Output:**

3 when **[**1,1,1,1,1] is modified as [2,1,2,1,2] with a random integer 2

1. Little pig Benny has just taken a shower. Now she is going to buy some gifts for her relatives. But the problem is that Benny doesn't know how to reach to the gift shop. Her friend Mike has created a special set of instructions for her. A set of instructions is a string which consists of letters {'U', 'R', 'L', 'D', ‘S’, ‘T’, ‘J’, “U’}and any letters may repeat. Arrange these letters in order using **3-way Quick Sort.**

**Input format**

Single line contains string S.

**Output format**

Arrange the strings in order

**Constraints**

1 ≤ S ≤ 10^5

**Sample Input**

RRULDLTSJR

**Sample Output**

DJLLRRRSTU