

CSCI2100B Assignment 2

Due: March 23, 2022

1 Submission

The submission guidelines are the same as assignment 1, except the new link for testing (<https://vjudge.net/contest/482988>).

The assignment will be graded based on the number of accepted test cases as well as the content of the submitted pdf file.

2 Problem 1

2.1 Statement

You are given a list of students numbered 1 to n . Student i is initially located at the i -th position of the list. A $swap(i)$ operation is to swap student i with the student to the left of him/her. There will be m swap operations, and you need to process them in order and give the left-most position and the right-most position of each student during this process.

Below is an example with 3 students and three operations of $swap(2)$, $swap(2)$ and $swap(3)$.

1-2-3 (initial state)

2-1-3 (after $swap(2)$)

2-1-3 (after $swap(2)$, no effect because there is no student to the left of student 2)

2-3-1 (after ($swap(3)$))

You are supposed to output:

1 3 (the left-most position and the right-most position of student 1)

1 2

2 3

The left-most position of student 1 is 1 in the initial state.

The right-most position of student 1 is 3 from the state after $swap(3)$.

2.2 Input

Two numbers n and m in the first line, and m numbers denoting swap operations in the second line ($1 \leq n \leq 10^5, 1 \leq m \leq 4 \cdot 10^5$).

2.3 Output

n pairs of integers.

2.4 Example

Input:

10 6
7 3 5 7 3 6

Output:

1 2
2 3
1 3
4 7
4 5
6 7
5 7
8 8
9 9
10 10

3 Problem 2

3.1 Statement

You are given an array of n elements. The i -th element has an integer value a_i and a type number b_i ($b_i \in \{0, 1\}$). The only operation allowed is to swap two elements of different types. Your task is to answer whether a given array can be sorted in non-decreasing order of a_i only using the aforementioned swap operation.

3.2 Input

A number T ($1 \leq T \leq 500$) denoting the number of test cases in the first line. Each test case is given in the following format:

n
 $a_1 a_2 \dots a_n$
 $b_1 b_2 \dots b_n$
($1 \leq n \leq 500$, $1 \leq a_i \leq 10^5$, $b_i \in \{0, 1\}$)

3.3 Output

T lines, each of which is either "Yes" or "No".

3.4 Example

Input:

```
3
4
2 2 4 8
1 1 1 1
3
5 15 4
0 0 0
4
20 10 100 50
1 0 0 1
```

Output:

Yes

No

Yes

(There are no legal swaps in the first two test cases, so the answers depend on their original arrays. The third case is "Yes" because you can swap $20 \leftrightarrow 10$ and $100 \leftrightarrow 50$.)

4 Problem 3

4.1 Statement

Given n strings, each of which consists of m **uppercase** letters, your task is to sort them in ascending order according to the following comparison method.

If the first position that string a and string b differs is i , then a is smaller than b iff

1. i is odd and $a_i < b_i$, or
2. i is even and $a_i > b_i$.

The comparison of a_i and b_i follows $A < B < C < D < \dots < Z$.

An example: $AC < AB < AA < BC < BB < BA$.

4.2 Input

Two numbers in the first line: n and m ($1 \leq n \cdot m \leq 10^6$).

The following n lines gives n strings that are **pairwise distinct**.

4.3 Output

The indices of the strings after sorting.

4.4 Example

Input:

5 4

AAAA

AABB

AABC

ABAA

BACC

Output:

4 1 3 2 5

(*ABAA* < *AAAA* < *AABC* < *AABB* < *BACC*)

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