International Coding Hub Labor Day 2020

ICH Administration

September 6, 2020

§1 Binary Substring

Given a binary string (consists of 1's and 0's) of length at most 10^8, find the number of substrings that start and end with 0. A substring is defined as a contiguous sequence of two or more characters within a string. Output the number of substrings that start and end with 0.

Sample Input

```
011010
```

Sample Output

```
3
```

Explanation

The substrings are `011010`, `0110` and `010`

§2 String Comparison

Given two strings n, m find the length of the shortest substring of n which contains all the unique characters of m. If no such substring exists, print `N/A`

Input Format

Two strings, n followed by m

Constraints

n, m may contain only lowercase and uppercase English letters (no spaces).
$1 \leq |n| < 400$
$1 \leq |m| < 30$

Sample Input 1

```
helloworldHeLo
hold
```

Sample Output 1

```
10
```

Explanation 1

The shortest valid substring in n is `helloworld`, which contains every unique character from `hold`.

Sample Input 2

```
wookie
woookie
```

Sample Output 2

```
6
```

Explanation 2

If we let the substring of n be n itself, all of the unique characters in m are contained in that substring.

§3 Powerful Subarray

Given an array t, you must find the length of array s, the shortest powerful subarray. An array s is powerful if it has at least 2 elements and the number of occurrences of some element x in s is greater than the number of occurrences of any other element in s.

For example, `[3, 1, 3]`, `[11, 11, 4, 5]`, and `[1, 2, 3, 4, 5, 4]` are all powerful arrays with x-values of $3, 11$, and 4, respectively.
However, `[3, 2, 1]` and `[1, 11, 11, 13, 13]` are not powerful arrays.

A subarray of s is defined as a contiguous part of array t.

Input Format

The first line contains a single integer n, the length of array t. The second line contains the elements of array t, separated by spaces.

Output Format

A single integer, the length of s, the shortest powerful subarray of t. Print `-1` if there is no such subarray.

Constraints

$1 \leq n \leq 2 \cdot 10^5$
$1 \leq t_i \leq n$, where t_i is an element in array t

Sample Input

```
7
4 2 2 4 3 3 4
```

Sample Output

```
2
```

§4 Mouse

A mouse is at the top left square of an $n \times m$ rectangular grid (n rows, m columns). The mouse wants to reach the bottom right square because there is cheese there, which it wants to eat. The mouse moves one unit down, or one unit right at a time.

However, there are k mousetraps placed in some squares of the grid (at most 1 per square), which the mouse wants to avoid at all costs. The mouse wants to know how many distinct paths there are from the starting square to the cheese such that no square with a mousetrap is crossed.

Input Format

The first line contains n, m, k. The next k lines each contain two integers a_i, b_i, denoting the row and column locations (respectively) of the ith mousetrap.

Output Format

An integer denoting the number of ways for the mouse to safely go from $(1, 1)$ to (n, m). As the answer might be quite large, output it modulo $10^9 + 7$

Constraints

$2 \leq n, m \leq 10^3$
$0 \leq k \leq (n \cdot m)$
(a_i, b_i) is a unit square inside the grid.

Note that it's possible for mousetraps to be located in the starting and/or ending points (a mousetrap can be in the same square as the cheese). In these cases, it's impossible to for the mouse to reach the cheese safely so the answer is 0.

Sample Input

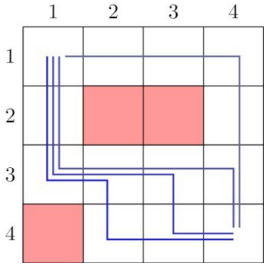
```
4 4 3
2 2
2 3
4 1
```

Sample Output

```
4
```

Explanation

The red squares denote mousetraps.



§5 Teams

There are some teams staying at a hotel just before a competition. The n rooms of the hotel are arranged in a long line with exactly 1 person in each room. Each room has an x-coordinate, denoting the location of it.

A meeting needs to be held urgently, with at least one representative from each team. However, after the arduous journey to the hotel, everyone is feeling tired and lazy. Hence, the people who attend the meeting have to be in a "compact" area of the hotel, so they can talk in the corridor outside their rooms.

Specifically, you need to find a contiguous range of rooms such that the distance between the leftmost and rightmost rooms is minimized, and there is at least one representative from each team in that range of rooms.

Input Format

Line 1: An integer n, denoting the number of participants in the competition.
Line 2...$n+1$: For each participant: the x coordinate of their room, and their team ID (which team they're a member of)

§5.1 Constraints

$1 \leq n \leq 100,000$
$1 \leq x$, team ID's $\leq 1,000,000,000$

Sample Input

```
6
25 7
26 1
15 1
22 3
20 1
30 1
```

Sample Output

```
4
```

Explanation

The range from $x = 22$ to $x = 26$ contains at least one of each type of team ID from the larger group (all the participants).