Lista AA 2022 #8

A. Lorry

2 seconds, 64 megabytes

A group of tourists is going to kayak and catamaran tour. A rented lorry has arrived to the boat depot to take kayaks and catamarans to the point of departure. It's known that all kayaks are of the same size (and each of them occupies the space of 1 cubic metre), and all catamarans are of the same size, but two times bigger than kayaks (and occupy the space of 2 cubic metres).

Each waterborne vehicle has a particular carrying capacity, and it should be noted that waterborne vehicles that look the same can have different carrying capacities. Knowing the truck body volume and the list of waterborne vehicles in the boat depot (for each one its type and carrying capacity are known), find out such set of vehicles that can be taken in the lorry, and that has the maximum total carrying capacity. The truck body volume of the lorry can be used effectively, that is to say you can always put into the lorry a waterborne vehicle that occupies the space not exceeding the free space left in the truck body.

Input

The first line contains a pair of integer numbers n and v ($1 \le n \le 10^5$; $1 \le v \le 10^9$), where n is the number of waterborne vehicles in the boat depot, and v is the truck body volume of the lorry in cubic metres. The following n lines contain the information about the waterborne vehicles, that is a pair of numbers t_i, p_i ($1 \le t_i \le 2$; $1 \le p_i \le 10^4$), where t_i is the vehicle type (1 – a kayak, 2 – a catamaran), and p_i is its carrying capacity. The waterborne vehicles are enumerated in order of their appearance in the input file.

Output

In the first line print the maximum possible carrying capacity of the set. In the second line print a string consisting of the numbers of the vehicles that make the optimal set. If the answer is not unique, print any of them.

input
3 2 1 2 2 7 1 3
output
7 2

B. Imbalanced Array

2 seconds, 256 megabytes

You are given an array a consisting of n elements. The *imbalance value* of some subsegment of this array is the difference between the maximum and minimum element from this segment. The *imbalance value* of the array is the sum of *imbalance values* of all subsegments of this array.

For example, the *imbalance value* of array $[1, 4, 1]$ is 9, because there are 6 different subsegments of this array:

- $[1]$ (from index 1 to index 1), *imbalance value* is 0;
- $[1, 4]$ (from index 1 to index 2), *imbalance value* is 3;
- $[1, 4, 1]$ (from index 1 to index 3), *imbalance value* is 3;
- $[4]$ (from index 2 to index 2), *imbalance value* is 0;
- $[4, 1]$ (from index 2 to index 3), *imbalance value* is 3;
- $[1]$ (from index 3 to index 3), *imbalance value* is 0;

You have to determine the *imbalance value* of the array a.

Input

The first line contains one integer n ($1 \le n \le 10^6$) — size of the array a.

The second line contains n integers $a_1, a_2 \dots a_n$ ($1 \le a_i \le 10^6$) — elements of the array.

Output

Print one integer — the *imbalance value* of a.

input
3 1 4 1
output
9

C. Case of Fugitive

3 seconds, 256 megabytes

Andrewid the Android is a galaxy-famous detective. He is now chasing a criminal hiding on the planet Oxa-5, the planet almost fully covered with water.

The only dry land there is an archipelago of n narrow islands located in a row. For more comfort let's represent them as non-intersecting segments on a straight line: island i has coordinates $[l_i, r_i]$, besides, $r_i < l_{i+1}$ for $1 \le i \le n - 1$.

To reach the goal, Andrewid needs to place a bridge between each pair of **adjacent** islands. A bridge of length a can be placed between the i-th and the $(i+1)$-th islads, if there are such coordinates of x and y, that $l_i \le x \le r_i$, $l_{i+1} \le y \le r_{i+1}$ and $y - x = a$.

The detective was supplied with m bridges, each bridge can be used at most once. Help him determine whether the bridges he got are enough to connect each pair of adjacent islands.

Input

The first line contains integers n ($2 \le n \le 2 \cdot 10^5$) and m ($1 \le m \le 2 \cdot 10^5$) — the number of islands and bridges.

Next n lines each contain two integers l_i and r_i ($1 \le l_i \le r_i \le 10^{18}$) — the coordinates of the island endpoints.

The last line contains m **integer** numbers $a_1, a_2, \dots, a_m$ ($1 \le a_i \le 10^{18}$) — the lengths of the bridges that Andrewid got.

Output

If it is impossible to place a bridge between each pair of adjacent islands in the required manner, print on a single line "No" (without the quotes), otherwise print in the first line "Yes" (without the quotes), and in the second line print $n - 1$ numbers $b_1, b_2, \dots, b_{n-1}$, which mean that between islands i and $i+1$ there must be used a bridge number b_i.

If there are multiple correct answers, print any of them. Note that in this problem it is necessary to print "Yes" and "No" in correct case.

input

```
4 4
1 4
7 8
9 10
12 14
4 5 3 8
```

output

```
Yes
2 3 1
```

input

```
2 2
11 14
17 18
2 9
```

output

```
No
```

input

```
2 1
1 1
1000000000000000000 1000000000000000000
999999999999999999
```

output

```
Yes
1
```

In the first sample test you can, for example, place the second bridge between points 3 and 8, place the third bridge between points 7 and 10 and place the first bridge between points 10 and 14.

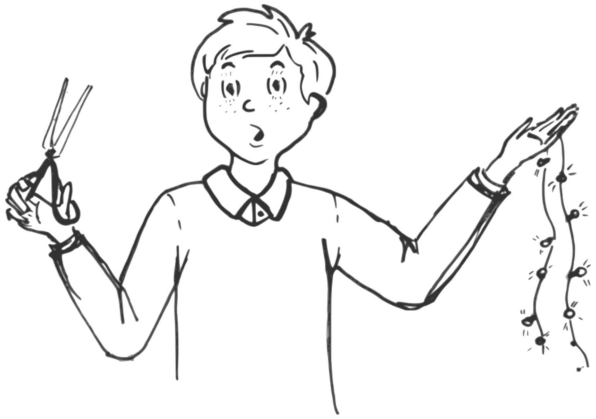
In the second sample test the first bridge is too short and the second bridge is too long, so the solution doesn't exist.

D. Garland

2 seconds, 256 megabytes

Once at New Year Dima had a dream in which he was presented a fairy garland. A garland is a set of lamps, some pairs of which are connected by wires. Dima remembered that each two lamps in the garland were connected directly or indirectly via some wires. Furthermore, the number of wires was exactly one less than the number of lamps.

There was something unusual about the garland. Each lamp had its own brightness which depended on the temperature of the lamp. Temperatures could be positive, negative or zero. Dima has two friends, so he decided to share the garland with them. He wants to cut two different wires so that the garland breaks up into three parts. Each part of the garland should shine equally, i. e. the sums of lamps' temperatures should be equal in each of the parts. Of course, each of the parts should be non-empty, i. e. each part should contain at least one lamp.



Help Dima to find a suitable way to cut the garland, or determine that this is impossible.

While examining the garland, Dima lifted it up holding by one of the lamps. Thus, each of the lamps, except the one he is holding by, is now hanging on some wire. So, you should print two lamp ids as the answer which denote that Dima should cut the wires these lamps are hanging on. Of course, the lamp Dima is holding the garland by can't be included in the answer.

Input

The first line contains single integer n ($3 \le n \le 10^6$) — the number of lamps in the garland.

Then n lines follow. The i-th of them contain the information about the i-th lamp: the number lamp a_i, it is hanging on (and 0, if is there is no such lamp), and its temperature t_i ($-100 \le t_i \le 100$). The lamps are numbered from 1 to n.

Output

If there is no solution, print -1.

Otherwise print two integers — the indexes of the lamps which mean Dima should cut the wires they are hanging on. If there are multiple answers, print any of them.

input

```
6
2 4
0 5
4 2
2 1
1 1
4 2
```

output

```
1 4
```

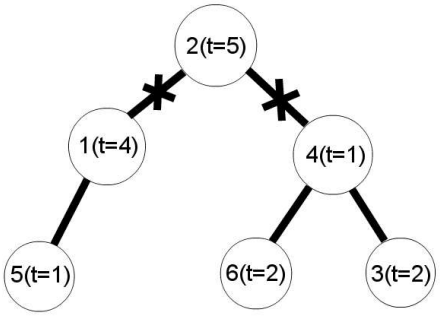
input

```
6
2 4
0 6
4 2
2 1
1 1
4 2
```

output

```
-1
```

The garland and cuts scheme for the first example:



E. Tavas and Malekas

2 seconds, 256 megabytes

Tavas is a strange creature. Usually "zzz" comes out of people's mouth while sleeping, but string s of length n comes out from Tavas' mouth instead.

Today Tavas fell asleep in Malekas' place. While he was sleeping, Malekas did a little process on s. Malekas has a favorite string p. He determined all positions $x_1 < x_2 < ... < x_k$ where p matches s. More formally, for each x_i $(1 \le i \le k)$ he condition $s_{x_i}s_{x_i+1}... s_{x_i+|p|-1} = p$ is fullfilled.

Then Malekas wrote down one of subsequences of $x_1, x_2, ... x_k$ (possibly, he didn't write anything) on a piece of paper. Here a sequence b is a subsequence of sequence a if and only if we can turn a into b by removing some of its elements (maybe no one of them or all).

After Tavas woke up, Malekas told him everything. He couldn't remember string s, but he knew that both p and s only contains lowercase English letters and also he had the subsequence he had written on that piece of paper.

Tavas wonders, what is the number of possible values of s? He asked SaDDas, but he wasn't smart enough to solve this. So, Tavas asked you to calculate this number for him.

Answer can be very large, so Tavas wants you to print the answer modulo $10^9 + 7$.

Input

The first line contains two integers n and m, the length of s and the length of the subsequence Malekas wrote down ($1 \le n \le 10^6$ and $0 \le m \le n - |p| + 1$).

The second line contains string p $(1 \le |p| \le n)$.

The next line contains m space separated integers $y_1, y_2, ..., y_m$, Malekas' subsequence $(1 \le y_1 < y_2 < ... < y_m \le n - |p| + 1)$.

Output

In a single line print the answer modulo $1000\,000\,007$.

input
6 2 ioi 1 3

output
26

input
5 2 ioi 1 2

output
0

In the first sample test all strings of form "ioioi?" where the question mark replaces arbitrary English letter satisfy.

Here $|x|$ denotes the length of string x.

Please note that it's possible that there is no such string (answer is 0).

F. Babaei and Birthday Cake

2 seconds, 256 megabytes

As you know, every birthday party has a cake! This time, Babaei is going to prepare the very special birthday party's cake.

Simple cake is a cylinder of some radius and height. The volume of the simple cake is equal to the volume of corresponding cylinder. Babaei has n simple cakes and he is going to make a *special cake* placing some cylinders on each other.

However, there are some additional culinary restrictions. The cakes are numbered in such a way that the cake number i can be placed only on the table or on some cake number j where $j < i$. Moreover, in order to impress friends Babaei will put the cake i on top of the cake j only if the volume of the cake i is strictly greater than the volume of the cake j.

Babaei wants to prepare a birthday cake that has a maximum possible total volume. Help him find this value.

Input

The first line of the input contains a single integer n $(1 \le n \le 100\,000)$ — the number of simple cakes Babaei has.

Each of the following n lines contains two integers r_i and h_i $(1 \le r_i, h_i \le 10\,000)$, giving the radius and height of the i-th cake.

Output

Print the maximum volume of the cake that Babaei can make. Your answer will be considered correct if its absolute or relative error does not exceed 10^{-6}.

Namely: let's assume that your answer is a, and the answer of the jury is b. The checker program will consider your answer correct, if $\frac{|a-b|}{max(1,b)} \le 10^{-6}$.

input
2 100 30 40 10

output
942477.796077000

input
4 1 1 9 7 1 4 10 7
output
3983.539484752

In first sample, the optimal way is to choose the cake number 1.

In second sample, the way to get the maximum volume is to use cakes with indices 1, 2 and 4.

G. Multipliers

2 seconds, 256 megabytes

Ayrat has number n, represented as it's prime factorization p_i of size m, i.e. $n = p_1 \cdot p_2 \cdot \ldots \cdot p_m$. Ayrat got secret information that that the product of all divisors of n taken modulo $10^9 + 7$ is the password to the secret data base. Now he wants to calculate this value.

Input

The first line of the input contains a single integer m ($1 \le m \le 200\,000$) — the number of primes in factorization of n.

The second line contains m primes numbers p_i ($2 \le p_i \le 200\,000$).

Output

Print one integer — the product of all divisors of n modulo $10^9 + 7$.

input
2 2 3
output
36

input
3 2 3 2
output
1728

In the first sample $n = 2 \cdot 3 = 6$. The divisors of 6 are 1, 2, 3 and 6, their product is equal to $1 \cdot 2 \cdot 3 \cdot 6 = 36$.

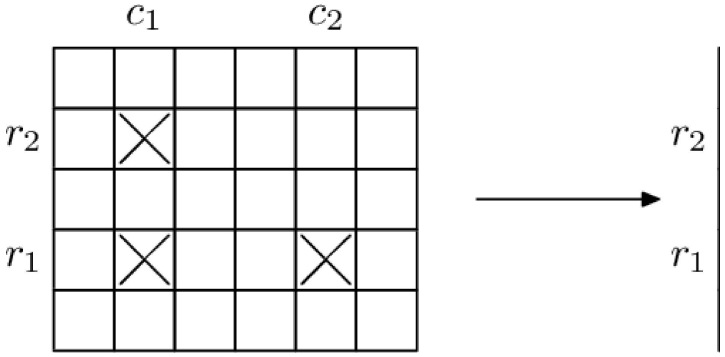
In the second sample $2 \cdot 3 \cdot 2 = 12$. The divisors of 12 are 1, 2, 3, 4, 6 and 12. $1 \cdot 2 \cdot 3 \cdot 4 \cdot 6 \cdot 12 = 1728$.

H. Chemical table

1 second, 512 megabytes

Innopolis University scientists continue to investigate the periodic table. There are $n \cdot m$ known elements and they form a periodic table: a rectangle with n rows and m columns. Each element can be described by its coordinates (r, c) ($1 \le r \le n$, $1 \le c \le m$) in the table.

Recently scientists discovered that for every four different elements in this table that form a rectangle with sides parallel to the sides of the table, if they have samples of three of the four elements, they can produce a sample of the fourth element using nuclear fusion. So if we have elements in positions (r_1, c_1), (r_1, c_2), (r_2, c_1), where $r_1 \neq r_2$ and $c_1 \neq c_2$, then we can produce element (r_2, c_2).



Samples used in fusion are not wasted and can be used again in future fusions. Newly crafted elements also can be used in future fusions.

Innopolis University scientists already have samples of q elements. They want to obtain samples of all $n \cdot m$ elements. To achieve that, they will purchase some samples from other laboratories and then produce all remaining elements using an arbitrary number of nuclear fusions in some order. Help them to find the minimal number of elements they need to purchase.

Input

The first line contains three integers n, m, q ($1 \le n, m \le 200\,000$; $0 \le q \le min(n \cdot m, 200\,000)$), the chemical table dimensions and the number of elements scientists already have.

The following q lines contain two integers r_i, c_i ($1 \le r_i \le n$, $1 \le c_i \le m$), each describes an element that scientists already have. All elements in the input are different.

Output

Print the minimal number of elements to be purchased.

input
2 2 3 1 2 2 2 2 1
output
0

input
1 5 3 1 3 1 1 1 5
output
2

input
4 3 6 1 2 1 3 2 2 2 3 3 1 3 3
output
1

For each example you have a picture which illustrates it.

The first picture for each example describes the initial set of element samples available. Black crosses represent elements available in the lab initially.

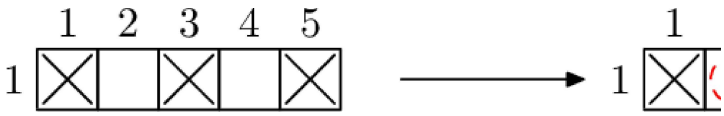
The second picture describes how remaining samples can be obtained. Red dashed circles denote elements that should be purchased from other labs (the optimal solution should minimize the number of red circles). Blue dashed circles are elements that can be produced with nuclear fusion. They are numbered in order in which they can be produced.

Test 1

We can use nuclear fusion and get the element from three other samples, so we don't need to purchase anything.

Test 2

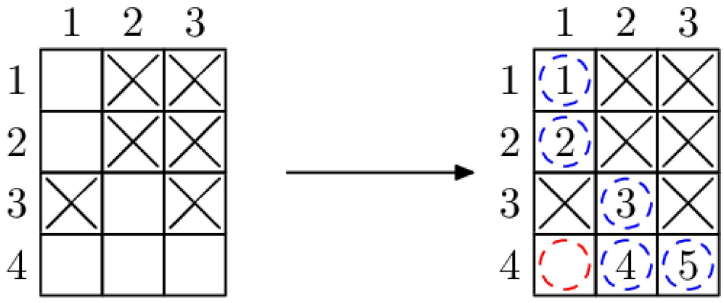
We cannot use any nuclear fusion at all as there is only one row, so we have to purchase all missing elements.



Test 3

There are several possible solutions. One of them is illustrated below.

Note that after purchasing one element marked as red it's still not possible to immidiately produce the middle element in the bottom row (marked as 4). So we produce the element in the left-top corner first (marked as 1), and then use it in future fusions.



I. Moving Points

2 seconds, 256 megabytes

There are n points on a coordinate axis OX. The i-th point is located at the integer point x_i and has a speed v_i. It is guaranteed that no two points occupy the same coordinate. All n points move with the constant speed, the coordinate of the i-th point at the moment t (t **can be non-integer**) is calculated as $x_i + t \cdot v_i$.

Consider two points i and j. Let $d(i, j)$ be the minimum possible distance between these two points over any possible moments of time (even **non-integer**). It means that if two points i and j coincide at some moment, the value $d(i, j)$ will be 0.

Your task is to calculate the value $\sum\limits_{1 \le i < j \le n} d(i, j)$ (the sum of minimum distances over all pairs of points).

Input

The first line of the input contains one integer n ($2 \le n \le 2 \cdot 10^5$) — the number of points.

The second line of the input contains n integers $x_1, x_2, \ldots, x_n$ ($1 \le x_i \le 10^8$), where x_i is the initial coordinate of the i-th point. It is guaranteed that all x_i are distinct.

The third line of the input contains n integers $v_1, v_2, \ldots, v_n$ ($-10^8 \le v_i \le 10^8$), where v_i is the speed of the i-th point.

Output

Print one integer — the value $\sum\limits_{1 \le i < j \le n} d(i, j)$ (the sum of minimum distances over all pairs of points).

input
3 1 3 2 -100 2 3
output
3

input
5 2 1 4 3 5 2 2 2 3 4
output
19

input
2 2 1 -3 0
output
0

J. Reverse

2 seconds, 256 megabytes

You are given two positive integers x and y. You can perform the following operation with x: write it in its binary form without leading zeros, add 0 or 1 to the right of it, reverse the binary form and turn it into a decimal number which is assigned as the new value of x.

For example:

- 34 can be turned into 81 via one operation: the binary form of 34 is 100010, if you add 1, reverse it and remove leading zeros, you will get 1010001, which is the binary form of 81.
- 34 can be turned into 17 via one operation: the binary form of 34 is 100010, if you add 0, reverse it and remove leading zeros, you will get 10001, which is the binary form of 17.
- 81 can be turned into 69 via one operation: the binary form of 81 is 1010001, if you add 0, reverse it and remove leading zeros, you will get 1000101, which is the binary form of 69.
- 34 can be turned into 69 via two operations: first you turn 34 into 81 and then 81 into 69.

Your task is to find out whether x can be turned into y after a certain number of operations (possibly zero).

Input

The only line of the input contains two integers x and y ($1 \le x, y \le 10^{18}$).

Output

Print YES if you can make x equal to y and NO if you can't.

input
3 3
output
YES

input
7 4
output
NO

input
2 8
output
NO

input
34 69
output
YES

input
8935891487501725 71487131900013807
output
YES

In the first example, you don't even need to do anything.

The fourth example is described in the statement.