A. Airport

time limit per test: 1 second
memory limit per test: 32 megabytes
input: standard input
output: standard output

El viejo del aeropuerto is not that good solving problems.

He is facing the following easy task. He has two integers a and b and he wants to know how many perfect squares lie inside the closed interval $[a, b]$.

Of course, this problem is really easy for you, so please help Viejo to solve this problem.

Input

One integer $1 \le t \le 10^5$, denoting the number of test cases. Following t lines, one per test case. Each line consists of two integers $1 \le a \le b \le 10^{13}$.

Output

One integer per test case. The number of perfect squares in the interval $[a, b]$.

Example

input

```
3
3 6
1 12
5 8
```

output

```
1
3
0
```

B. Birthday

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Cowboy Vlad has a birthday today! There are n children who came to the celebration. In order to greet Vlad, the children decided to form a circle around him. Among the children who came, there are both tall and low, so if they stand in a circle arbitrarily, it may turn out, that there is a tall and low child standing next to each other, and it will be difficult for them to hold hands. Therefore, children want to stand in a circle so that the maximum difference between the growth of two neighboring children would be minimal possible.

Formally, let's number children from 1 to n in a circle order, that is, for every i child with number i will stand next to the child with number $i+1$, also the child with number 1 stands next to the child with number n. Then we will call the discomfort of the circle the maximum absolute difference of heights of the children, who stand next to each other.

Please help children to find out how they should reorder themselves, so that the resulting discomfort is smallest possible.

Input

The first line contains a single integer n ($2 \le n \le 100$) — the number of the children who came to the cowboy Vlad's birthday.

The second line contains integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$) denoting heights of every child.

Output

Print exactly n integers — heights of the children in the order in which they should stand in a circle. You can start printing a circle with any child.

If there are multiple possible answers, print any of them.

Examples

input

```
5
2 1 1 3 2
```

output

```
1 2 3 2 1
```

input

```
3
30 10 20
```

output

```
10 20 30
```

Note

In the first example, the discomfort of the circle is equal to 1, since the corresponding absolute differences are 1, 1, 1 and 0. Note, that sequences $[2, 3, 2, 1, 1]$ and $[3, 2, 1, 1, 2]$ form the same circles and differ only by the selection of the starting point.

In the second example, the discomfort of the circle is equal to 20, since the absolute difference of 10 and 30 is equal to 20.

C. Conservation

time limit per test: 8 seconds
memory limit per test: 512 megabytes
input: standard input
output: standard output

The most famous painting in Byteland — a portrait of a lady with a computer mouse by Leonardo da Bitci — needs to be conserved. The work will be conducted in two narrowly specialized laboratories. The conservation process has been divided into several stages. For each of them, we know the laboratory in which it will take place.

Transporting the very precious and fragile painting introduces additional risk; therefore, it should be avoided whenever possible. Ideally, all the work in the first laboratory would be done, and then the painting would be moved to the second one. Unfortunately, there are several dependencies between the conservation stages — some of them need to be completed before others may begin. Your task is to find an ordering of conservation stages that minimizes the number of times the painting needs to be moved from one laboratory to the other. The conservation can begin in any of the two laboratories.

Input

The first line of the input contains the number of test cases T. The descriptions of the test cases follow:

The first line of each test case contains two space-separated integers n and m ($1 \leq n \leq 10^5$, $0 \leq m \leq 10^6$) — the number of conservation stages and the number of dependencies between them. In the next line there are n space-separated integers — the i-th of them is 1 if the i-th conservation stage will take place in the first laboratory, and 2 otherwise. The following m lines contain pairs of integers i, j ($1 \leq i, j \leq n$), denoting that the i-th stage has to be completed before the j-th.

You may assume that it is always possible to order the conservation stages so that all the dependencies are satisfied.

Output

Print the answers to the test cases in the order in which they appear in the input. For each test case, output a single line containing the minimal number of times the painting needs to be transported between the laboratories.

Example

input

```
1
5 6
1 2 1 2 1
1 2
1 3
2 4
3 4
2 5
3 5
```

output

```
2
```

D. Digit sum

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Our friend REC is back.

While he was flying back to his country, Mexico, he started to think about a very important problem he was given during the competition. He had to compute the sum of digits of the sum of digits of the sum of digits of the sum of digits of the sum of digits... ok... of the sum of digits of a number.

WTF? Yes, for example if you have the number 99281293, its sum of digits is 43, and the sum of the digits is 7, and the sum of the digits is 7, and the sum of the digits is 7... And so on for the eternity.

So, if you are given a number, you have to compute what is the last number (one-digit) you get when you perform this operation, i.e. the number that remains for the eternity.

Concretely, you will be given two numbers a and b, and you have to compute the result of applying the described operation for a^b.

Input

You are given two integers $1 \leq a \leq 10000$ and $1 \leq b \leq 10000$.

Output

One integer, the answer of performing the operation to the number a^b.

Examples

input

```
2 5
```

output

```
5
```

input

```
4 3
```

output

```
1
```

E. Extra Digit Sum

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given one integer $1 \leq m \leq 10^6$, and you have to print the least integer n such that the sum of digits of n and the sum of the digits of $n+1$ are both divisible by m. In the case that such a number doesn't exist, you have to report that fact.

Input

One integer $1 \leq m \leq 10^6$.

Output

One integer n as in the statement. If there is not such an n, print -1.

Examples

input
```
2
```
output
```
19
```

input
```
3
```
output
```
-1
```

F. Fly

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Natasha is going to fly on a rocket to Mars and return to Earth. Also, on the way to Mars, she will land on $n-2$ intermediate planets. Formally: we number all the planets from 1 to n. 1 is Earth, n is Mars. Natasha will make exactly n flights: $1 \to 2 \to \ldots n \to 1$.

Flight from x to y consists of two phases: take-off from planet x and landing to planet y. This way, the overall itinerary of the trip will be: the 1-st planet $\to$ take-off from the 1-st planet $\to$ landing to the 2-nd planet $\to$ 2-nd planet $\to$ take-off from the 2-nd planet $\to \ldots \to$ landing to the n-th planet $\to$ the n-th planet $\to$ take-off from the n-th planet $\to$ landing to the 1-st planet $\to$ the 1-st planet.

The mass of the rocket together with all the useful cargo (but without fuel) is m tons. However, Natasha does not know how much fuel to load into the rocket. Unfortunately, fuel can only be loaded on Earth, so if the rocket runs out of fuel on some other planet, Natasha will not be able to return home. Fuel is needed to take-off from each planet and to land to each planet. It is known that 1 ton of fuel can lift off a_i tons of rocket from the i-th planet or to land b_i tons of rocket onto the i-th planet.

For example, if the weight of rocket is 9 tons, weight of fuel is 3 tons and take-off coefficient is 8 ($a_i = 8$), then 1.5 tons of fuel will be burnt (since $1.5 \cdot 8 = 9 + 3$). The new weight of fuel after take-off will be 1.5 tons.

Please note, that it is allowed to burn non-integral amount of fuel during take-off or landing, and the amount of initial fuel can be non-integral as well.

Help Natasha to calculate the minimum mass of fuel to load into the rocket. Note, that the rocket must spend fuel to carry both useful cargo and the fuel itself. However, it doesn't need to carry the fuel which has already been burnt. Assume, that the rocket takes off and lands instantly.

Input

The first line contains a single integer n ($2 \le n \le 1000$) — number of planets.

The second line contains the only integer m ($1 \le m \le 1000$) — weight of the payload.

The third line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 1000$), where a_i is the number of tons, which can be lifted off by one ton of fuel.

The fourth line contains n integers $b_1, b_2, \ldots, b_n$ ($1 \le b_i \le 1000$), where b_i is the number of tons, which can be landed by one ton of fuel.

It is guaranteed, that if Natasha can make a flight, then it takes no more than 10^9 tons of fuel.

Output

If Natasha can fly to Mars through $(n-2)$ planets and return to Earth, print the minimum mass of fuel (in tons) that Natasha should take. Otherwise, print a single number -1.

It is guaranteed, that if Natasha can make a flight, then it takes no more than 10^9 tons of fuel.

The answer will be considered correct if its absolute or relative error doesn't exceed 10^{-6}. Formally, let your answer be p, and the jury's answer be q. Your answer is considered correct if $\frac{|p-q|}{\max(1,|q|)} \le 10^{-6}$.

Examples

input

```
2
12
11 8
7 5
```

output

```
10.0000000000
```

input

```
3
1
1 4 1
2 5 3
```

output

```
-1
```

input

```
6
2
4 6 3 3 5 6
2 6 3 6 5 3
```

output

```
85.4800000000
```

Note

Let's consider the first example.

Initially, the mass of a rocket with fuel is 22 tons.

- At take-off from Earth one ton of fuel can lift off 11 tons of cargo, so to lift off 22 tons you need to burn 2 tons of fuel. Remaining weight of the rocket with fuel is 20 tons.
- During landing on Mars, one ton of fuel can land 5 tons of cargo, so for landing 20 tons you will need to burn 4 tons of fuel. There will be 16 tons of the rocket with fuel remaining.
- While taking off from Mars, one ton of fuel can raise 8 tons of cargo, so to lift off 16 tons you will need to burn 2 tons of fuel. There will be 14 tons of rocket with fuel after that.
- During landing on Earth, one ton of fuel can land 7 tons of cargo, so for landing 14 tons you will need to burn 2 tons of fuel. Remaining weight is 12 tons, that is, a rocket without any fuel.

In the second case, the rocket will not be able even to take off from Earth.

G. Greatest fan of meat

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Thomas is an argentine guy that loves eating asado.

In Argentina there's a very important tradition of eating meat cooked in a barbecue grill. These are opportunities to also meet some old friends.

Given the fact that now we are on quarantine, Thomas is making asados in his house for himself and his family.

Since he also loves numbers, he was writing all integer numbers in a piece of paper. He wrote:

$$1, 2, 3, 4, \ldots.$$

And at a certain point he got tired and stopped writing when he arrived at a certain integer k. He then went to cook an asado and absolutely forgot about this list.

His mother found this piece of paper and decided to erase exactly one number of the list. Let's call this number n.

Then, his father found this deprecated list and calculated the arithmetic mean of the remaining terms and got a fraction $\frac{a}{b}$.

Then both of them¸ Thomas mother and father told Thomas: "try to guess what whas your value k and which number we erased".

Input

The first line starts with an integer $1 \leq t \leq 10^5$. The number of test cases. For each test case we have a line with two integer numbers $1 \leq a, b \leq 10^{18}$. The arithmetic mean calculated by the father of Thomas.

Output

For each test case output in the first line the number m of all the possibilities for the numbers k and n. Then print m lines with two integer numbers k and n that satisfy the conditions of the statement. Print them sorted according the value of k.

Example

input

```
4
101 4
302 7
101 2
91 19
```

output

```
1
49 13
1
85 31
2
99 1
101 101
0
```

H. Helping Crayonazo

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Crayonazo is not that good at math.

He is facing the following task: given an integer $1 \leq n \leq 10^{12}$ he wants to know if it is possible to write n as a product between a perfect square m^2 and the power of a prime, say p^k where p is prime and $k \geq 1$.

$$n = m^2 p^k$$

Please help Crayonazo to give an answer to this question.

DISCLAIMER: 0 is even and 1 is **not** a prime.

Input

There's one line containing one integer number $1 \leq n \leq 10^{12}$.

Output

You have to print 'YES' if n can be written as a product as in the statement or 'NO' otherwise.

Examples

input

```
1
```

output

```
NO
```

input

```
4
```

output

```
YES
```

input

```
6
```

output

```
NO
```

input

```
50
```

output

```
YES
```

input

```
896329745845
```

output

```
NO
```

I. Island Puzzle

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

A remote island chain contains n islands, labeled 1 through n. Bidirectional bridges connect the islands to form a simple cycle — a bridge connects islands 1 and 2, islands 2 and 3, and so on, and additionally a bridge connects islands n and 1. The center of each island contains an identical pedestal, and all but one of the islands has a fragile, uniquely colored statue currently held on the pedestal. The remaining island holds only an empty pedestal.

The islanders want to rearrange the statues in a new order. To do this, they repeat the following process: First, they choose an island directly adjacent to the island containing an empty pedestal. Then, they painstakingly carry the statue on this island across the adjoining bridge and place it on the empty pedestal.

Determine if it is possible for the islanders to arrange the statues in the desired order.

Input

The first line contains a single integer n $(2 \le n \le 200\,000)$ — the total number of islands.

The second line contains n space-separated integers a_i $(0 \le a_i \le n - 1)$ — the statue currently placed on the i-th island. If $a_i = 0$, then the island has no statue. It is guaranteed that the a_i are distinct.

The third line contains n space-separated integers b_i $(0 \le b_i \le n - 1)$ — the desired statues of the ith island. Once again, $b_i = 0$ indicates the island desires no statue. It is guaranteed that the b_i are distinct.

Output

Print "YES" (without quotes) if the rearrangement can be done in the existing network, and "NO" otherwise.

Examples

input
```
3
1 0 2
2 0 1
```
output
```
YES
```

input
```
2
1 0
0 1
```
output
```
YES
```

input
```
4
1 2 3 0
0 3 2 1
```
output
```
NO
```

Note

In the first sample, the islanders can first move statue 1 from island 1 to island 2, then move statue 2 from island 3 to island 1, and finally move statue 1 from island 2 to island 3.

In the second sample, the islanders can simply move statue 1 from island 1 to island 2.

In the third sample, no sequence of movements results in the desired position.

J. Journey

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Recently Irina arrived to one of the most famous cities of Berland — the Berlatov city. There are n showplaces in the city, numbered from 1 to n, and some of them are connected by one-directional roads. The roads in Berlatov are designed in a way such that there **are no** cyclic routes between showplaces.

Initially Irina stands at the showplace 1, and the endpoint of her journey is the showplace n. Naturally, Irina wants to visit as much showplaces as she can during her journey. However, Irina's stay in Berlatov is limited and she can't be there for more than T time units.

Help Irina determine how many showplaces she may visit during her journey from showplace 1 to showplace n within a time not exceeding T. It is guaranteed that there is at least one route from showplace 1 to showplace n such that Irina will spend no more than T time units passing it.

Input

The first line of the input contains three integers n, m and T ($2 \le n \le 5000,\ 1 \le m \le 5000,\ 1 \le T \le 10^9$) — the number of showplaces, the number of roads between them and the time of Irina's stay in Berlatov respectively.

The next m lines describes roads in Berlatov. i-th of them contains 3 integers u_i, v_i, t_i ($1 \le u_i, v_i \le n, u_i \ne v_i, 1 \le t_i \le 10^9$), meaning that there is a road starting from showplace u_i and leading to showplace v_i, and Irina spends t_i time units to pass it. It is guaranteed that the roads do not form cyclic routes.

It is guaranteed, that there is at most one road between each pair of showplaces.

Output

Print the single integer k ($2 \le k \le n$) — the maximum number of showplaces that Irina can visit during her journey from showplace 1 to showplace n within time not exceeding T, in the first line.

Print k distinct integers in the second line — indices of showplaces that Irina will visit on her route, in the order of encountering them.

If there are multiple answers, print any of them.

Examples

input

```
4 3 13
1 2 5
2 3 7
2 4 8
```

output

```
3
1 2 4
```

input

```
6 6 7
1 2 2
1 3 3
3 6 3
```

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

output

```
4
1 2 4 6
```

input

```
5 5 6
1 3 3
3 5 3
1 2 2
2 4 3
4 5 2
```

output

```
3
1 3 5
```

K. Knights

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Berland is facing dark times again. The army of evil lord Van de Mart is going to conquer the whole kingdom. To the council of war called by the Berland's king Valery the Severe came n knights. After long discussions it became clear that the kingdom has exactly n control points (if the enemy conquers at least one of these points, the war is lost) and each knight will occupy one of these points.

Berland is divided into $m + 1$ regions with m fences, and the only way to get from one region to another is to climb over the fence. Each fence is a circle on a plane, no two fences have common points, and no control point is on the fence. You are given k pairs of numbers a_i, b_i. For each pair you have to find out: how many fences a knight from control point with index a_i has to climb over to reach control point b_i (in case when Van de Mart attacks control point b_i first). As each knight rides a horse (it is very difficult to throw a horse over a fence), you are to find out for each pair the minimum amount of fences to climb over.

Input

The first input line contains three integers n, m, k ($1 \le n, m \le 1000$, $0 \le k \le 100000$). Then follow n lines, each containing two integers Kx_i, Ky_i ($-10^9 \le Kx_i, Ky_i \le 10^9$) — coordinates of control point with index i. Control points can coincide.

Each of the following m lines describes fence with index i with three integers r_i, Cx_i, Cy_i ($1 \le r_i \le 10^9$, $-10^9 \le Cx_i, Cy_i \le 10^9$) — radius and center of the circle where the corresponding fence is situated.

Then follow k pairs of integers a_i, b_i ($1 \le a_i, b_i \le n$), each in a separate line — requests that you have to answer. a_i and b_i can coincide.

Output

Output exactly k lines, each containing one integer — the answer to the corresponding request.

Examples

input

```
2 1 1
0 0
3 3
2 0 0
1 2
```

output

```
1
```

input

```
2 3 1
0 0
4 4
1 0 0
2 0 0
3 0 0
1 2
```

output

```
3
```

L. Land Lot

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Vasya has a beautiful garden where wonderful fruit trees grow and yield fantastic harvest every year. But lately thieves started to sneak into the garden at nights and steal the fruit too often. Vasya can't spend the nights in the garden and guard the fruit because there's no house in the garden! Vasya had been saving in for some time and finally he decided to build the house. The rest is simple: he should choose in which part of the garden to build the house. In the evening he sat at his table and drew the garden's plan. On the plan the garden is represented as a rectangular checkered field $n \times m$ in size divided into squares whose side length is 1. In some squares Vasya marked the trees growing there (one shouldn't plant the trees too close to each other that's why one square contains no more than one tree). Vasya wants to find a rectangular land lot $a \times b$ squares in size to build a house on, at that the land lot border should go along the lines of the grid that separates the squares. All the trees that grow on the building lot will have to be chopped off. Vasya loves his garden very much, so help him choose the building land lot location so that the number of chopped trees would be as little as possible.

Input

The first line contains two integers n and m $(1 \le n, m \le 50)$ which represent the garden location. The next n lines contain m numbers 0 or 1, which describe the garden on the scheme. The zero means that a tree doesn't grow on this square and the 1 means that there is a growing tree. The last line contains two integers a and b $(1 \le a, b \le 50)$. Note that Vasya can choose for building an $a \times b$ rectangle as well a $b \times a$ one, i.e. the side of the lot with the length of a can be located as parallel to the garden side with the length of n, as well as parallel to the garden side with the length of m.

Output

Print the minimum number of trees that needs to be chopped off to select a land lot $a \times b$ in size to build a house on. It is guaranteed that at least one lot location can always be found, i. e. either $a \le n$ and $b \le m$, or $a \le m$ и $b \le n$.

Examples

input

```
2 2
1 0
1 1
1 1
```

output

```
0
```

input

```
4 5
0 0 1 0 1
0 1 1 1 0
1 0 1 0 1
1 1 1 1 1
2 3
```

output

```
2
```

Note

In the second example the upper left square is (1,1) and the lower right is (3,2).

M. Minimum number of steps

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

We have a string of letters 'a' and 'b'. We want to perform some operations on it. On each step we choose one of substrings "ab" in the string and replace it with the string "bba". If we have no "ab" as a substring, our job is done. Print the minimum number of steps we should perform to make our job done modulo $10^9 + 7$.

The string "ab" appears as a substring if there is a letter 'b' right after the letter 'a' somewhere in the string.

Input

The first line contains the initial string consisting of letters 'a' and 'b' only with length from 1 to 10^6.

Output

Print the minimum number of steps modulo $10^9 + 7$.

Examples

input

```
ab
```

output

```
1
```

input

```
aab
```

output

```
3
```

Note

The first example: "ab" → "bba".

The second example: "aab" → "abba" → "bbaba" → "bbbbaa".