A. All coprime

time limit per test: 6 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Demetrio has n different positive numbers $x_1, \ldots, x_n$ such that

$$x_1 + x_2 + \ldots + x_n = m.$$

He forms the set S of all the numbers of the form $x_i x_j + 1$ where $i \neq j$. Let's call d the greatest common divisor of all the elements in S.

Penazzi only knows n and m and he wants to know all the possible values of the value d obtained by Demetrio. Please help Penazzi to reconstruct the whole list of possible values for d. Recall that the list must come from a list of different positive integers x_i.

Input

Two integers $2 \leq n \leq 10^5$ and $1 \leq m \leq 10^8$ as in the statement.

Output

Print the list of all possible values of d in increasing order. If the list is empty just print -1.

Examples

input
2 6
output
6 9

input
3 10
output
1

input
3 547
output
1 2 41 82 89

input
4 14
output
1

input
3 5
output

```
-1
```

B. Bases

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

What do you get if you multiply 6 by 9? The answer, of course, is 42, but only if you do the calculations in base 13.

Given an integer $B \geq 2$, the base B numbering system is a manner of writing integers using only digits between 0 and $B - 1$, inclusive. In a number written in base B, the rightmost digit has its value multiplied by 1, the second rightmost digit has its value multiplied by B, the third rightmost digit has its value multiplied by B^2, and so on.

Some equations are true or false depending on the base they are considered in. The equation $2 + 2 = 4$, for instance, is true for any $B \geq 5$ — it does not hold in base 4, for instance, since there is no digit $'4'$ in base 4. On the other hand, an equation like $2 + 2 = 5$ is never true.

Write a program that given an equation determines for which bases it holds.

Input

Each line of the input contains a test case; each test case is an equation of the form $EXPR = EXPR$, where both $EXPR$ are arithmetic expressions with at most 17 characters.

All expressions are valid, and contain only the characters $+$, $*$ and the digits from 0 to 9. No expressions contain leading plus signs, and no numbers in it have leading zeros. The end of input is indicated by a line containing only "=.

Output

For each test case in the input your program should produce a single line in the output, indicating for which bases the given equation holds. If the expression is true for infinitely many bases, print $B+$, where B is the first base for which the equation holds. If the expression is valid only for a finite set of bases, print them in ascending order, separated by single spaces. If the expression is not true in any base, print the character $*$.

Example

input
6*9=42 10000+3*5*334=3*5000+10+0 2+2=3 2+2=4 0*0=0 =

output
13 6 10 * 5+ 2+

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. Extreme Auto Tune

time limit per test: 5.0 s
memory limit per test: 512 megabytes
input: standard input
output: standard output

Last year's Training Camp we included a somewhat hard problem called `Auto Tune` asking to compute the following sum:

$$1^k + 2^k + ... + n^k$$

modulo a large prime. The problem was that although k was small, the value of n was huge: it was $1 \le n \le 10^{18}$.

Now we come with an even harder problem. You're given $1 \le m \le 25000$ values for n as above, and only one value for $1 \le k \le 25000$.

Input

You're given $1 \le m, k \le 25000$. Then you have m values, $1 \le n_1, n_2, ..., n_m \le 10^{18}$.

Output

You have to print one line with m integers: for each n_i, the value of $1^k + ... + n_i^k$ modulo $p = 998244353$.

Examples

input
5 2 1 2 4 3 5
output
1 5 30 14 55

input
3 3 4 5 6
output
100 225 441

F. Fifty shades of Cuco

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

Cuco is a beloved ICPC contestant. He has a large tattoo on his chest with the legend:

$$\text{I love strings and I don't bring bad luck.}$$

Yesterday he dreamed of a problem about strings. In this dream he was given a string s of length $1 \leq n \leq 10^6$ and a string p of length $1 \leq m \leq n$.

Cuco's strings consisted only on two letters 'a' and 'b'. In his dream he had to classify for each position $1 \leq i \leq n - m + 1$ of the string s exactly how many mistakes there were if we made a juxtaposition of p on s starting on that position and compare them.

For example, if we have the string $s = \texttt{abbaaba}$, and $p = \texttt{bba}$ we have that on position 1 of s we have to compare $\texttt{abb}$ with $\texttt{bba}$ that have exactly 2 mismatches (on the first and third positions).

Please give a hand to Cuco, he's not being able to solve this problem now that he is awake.

Input

Two integers $1 \leq n, m \leq 10^6$. It is guaranteed that $m \leq n$. Then two strings s and p of length n and m respectively. Both of them contain only the characters a and b.

Output

For each integer $0 \leq k \leq m$ you have to print a line starting with k : and then the list of all positions of s (indexed from 1 to n) such that the string p generates exactly k mismatches in that position. These numbers have to be printed in increasing order.

Examples

input
4 3 aaba aab

output
0: 1 1: 2: 2 3:

input
11 3 abbababaaab aab

output
0: 9 1: 1 3 5 8 2: 4 6 7 3: 2

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. Jorobado's Company

time limit per test: 2.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

The accounting team in company `Tender Hug` is calling for help. Their wage payment system doesn't handle very well changes (like new hires, salary increments, and restructuring the hierarchy) and if truth be told, this company make those types of changes a lot more than they should. This system is very important for them to build the yearly budget for each team and area (estimating it by calculating the sum of salaries in each of them).

All the employees are referenced by their Employee Id Number (because names are not important here). There are n employees in `Tender Hug` and no one has been fired or left the company yet, so all employees from 1 to n are currently working here.

As told before, the hierarchy of this company changes very frequently but the only thing that never changes is that the employee 1 (also known as 'El Jorobado', the CEO and founder of the Company) doesn't have a supervisor.

To understand better this organization, we will define two concepts for some employee A:

- direct supervisor of A: employee to which A directly reports to. Every employee (except the CEO) has exactly one other employee who fills this role.
- supervisees of A: every employee that has the employee A as their direct supervisor and their supervisees.

Some of the most relevant changes in this company that affects the payment system are: Your direct supervisor can be changed. You and your supervisees may receive an increment in salaries.

You must write a program that handles these operations:

1. Change the direct supervisor of the employee A so that it reports directly to the employee B.
2. Increase by `sInc` the salaries of the employee A and supervisees of A.
3. Calculate the sum of the salary of the employee A and supervisees of A $\pmod{10^9+7}$, written formally as

$$\left(\text{salary}(\texttt{A}) + \sum_{\texttt{B} \in \text{supervisees}(\texttt{A})} \text{salary}(\texttt{B})\right) \pmod{10^9+7}$$

Input

The first line contains the integers n and q ($1 \leq n, q \leq 2 \cdot 10^5$), where n is the number of employees working in `Tender Hug` initially and q is the number of operations.

The second line contains n integers s_i ($1 \leq s_i < 10^9 + 7$) which represents the initial salary for the employee i.

The third line contains $n - 1$ integers p_i ($1 \leq p_i < i$) which represents the Employee Id Number of employee i's direct supervisor.

Next q lines start with an integer t representing the type of the operation (explained in the statement):

If $t = 1$ then the line also contains the integers a and b, where both integers are valid Employee Id Number at that moment. Also, $a > 1$ because 'El Jorobado' won't have a supervisor and b is not a supervisee of a.

If $t = 2$ then the line also contains the integers $sInc$ and a where $sInc$ ($1 \leq sInc < 10^9 + 7$) represents the amount to increase the salaries and a is a valid Employee Id Number at that moment.

If $t = 3$ then the line also contains the integer a where a is a valid Employee Id Number at that moment.

Output

For each query of type 3, print the result of the corresponding operation.

Example

input
5 8 1 2 3 4 5 1 1 2 2 3 3 1 2 3 3 3 2 10 3 3 3 3 2 1 2 1 3 3

output
3 14 54 41 13

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".