Problem A. Big Matrix

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	1024 megabytes

You are given a matrix consisting of integers from -1000 to 1000. The matrix is represented in the form of r rows, each containing exactly c numbers. The values of r and c are not provided. Your task is to find them.

Input

The input consists of several lines, each containing the same number of integers from -1000 to 1000. The numbers in the lines are separated by spaces. It is guaranteed that both the number of lines and the number of integers in the lines do not exceed 100.

Output

Output two integers — the number of rows r and the number of columns c.

Example

standard input	standard output
`1 2 3` `124 20 25`	`2 3`

Problem B. Divisible Trees

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	256 mebibytes

Let A and B be two undirected trees. We define the sum $A+B$ as the set of all undirected trees that can be obtained by connecting the trees A and B with a single edge between any node in A and any node in B.

Similarly, we define the product of a scalar k and a tree A as a set of trees which look like k copies of A connected by $k-1$ new edges. For example, $1 \cdot A$ is the set consisting of a single tree A. The set $2 \cdot A$ is just $A+A$. Now, $3 \cdot A$ is the set of trees each of which is 3 copies of A with 2 additional edges connecting them into a single tree. And so on.

We say that a tree A divides a tree B if there exists a positive integer k such that B is included in the set $k \cdot A$. We observe that, similar to divisibility in the case of natural numbers, any tree is divisible by itself and the "unit" tree: the tree consisting of a single node.

Given a tree T, the task is to count how many distinct trees divide it.

We say that two trees are distinct if vertices of one tree cannot be relabeled to obtain the other tree.

Input

The first line of the input contains a single integer n ($1 \le n \le 10^5$), the number of vertices in the tree.

Each of the next $n-1$ lines contains two distinct integers u and v ($1 \le u, v \le n$), the ends of an edge in the tree.

Output

Output a single integer, the number of distinct trees that divide T.

Example

standard input	*standard output*
8 8 3 6 3 4 3 5 2 1 2 7 2 3 2	3

Problem C. The Quest for the Sacred Groves

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 256 mebibytes

In the heart of ancient Romania, where dense forests meet towering mountains, there lies the enchanted kingdom of Vatra Codrilor. The kingdom is protected by n sacred groves, numbered from 1 to n, each watched over by a guardian spirit. These groves are connected by secret paths known only to the wise elders, forming a vast and ancient tree of life. The paths are pure and free of any treacherous loops, ensuring that a traveler can always find their way through the kingdom without getting lost. Formally, the secret paths form a tree.

One night, as the full moon rises, the n guardians receive a divine message from the Dacian gods. The message is an ancient scroll with a sacred list called p. Formally, p is a sequence of length n where every number from 1 to n appears exactly once. This list tells the guardians the order in which they must stand in the final battle to protect the forest.

However, the wise guardians know that there's more to this list. For each subsegment $[\ell, r]$ of the list, if the groves $p_\ell, p_{\ell+1}, \ldots, p_r$ are all connected through the secret paths without involving any other groves, the guardians from these groves can meet together and harness the power of the forest's magic.

Your challenge is to help the guardians discover how many such subsegments exist in the sacred list p. Can you count the magical segments in the dance of the guardians, ensuring the power of the groves remains strong and united?

Input

The first line contains an integer n ($1 \le n \le 2 \cdot 10^5$).

Each of the next $n-1$ lines contains two integers, u_i and v_i ($1 \le u_i, v_i \le n$), denoting an edge of the tree.

The last line contains the n distinct integers $p_1, p_2, \ldots, p_n$ ($1 \le p_i \le n$).

Output

You need to write a single line with an integer: the number of subsegments $[\ell, r]$ such that $1 \le \ell \le r \le n$ and the groves $p_\ell, p_{\ell+1}, \ldots, p_r$ form a connected undirected graph.

Examples

standard input	*standard output*
7 1 2 1 3 3 4 3 5 3 6 2 7 7 3 4 1 2 5 6	16
7 1 2 1 3 3 4 3 5 3 6 2 7 7 2 4 1 3 5 6	22

Problem D. The Romanian Sieve

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Ionuț Cercel (the son of Petrică Cercel) achieved everything there was to achieve in music after the absolute hit "Made in Romania".

Now he got an interest in competitive programming. In his preparation for the training camp in Phapos, he came across a concept called "The Romanian Sieve", which can be summarized by the following piece of code:

```
int64_t iters = 0;
for (int64_t i = 1; i <= n; i++) {
    for (int64_t j = i; j <= n; j += i) {
        max_div[j] = i;
        iters++;
    }
}
```

As a curious individual, Ionuț asks himself: "Given an integer t, what is the largest value of n such that `iters` $\leq t$ after running the Romanian Sieve algorithm?" Please help him answer this question.

Input

The first line contains an integer t ($1 \leq t \leq 3 \cdot 10^{13}$).

Output

Print one integer: the maximum n such that `iters` $\leq t$ after running the algorithm.

Examples

standard input	standard output
11	5
2846010382	149946143

Problem E. Goddess of Olympos

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	256 mebibytes

Mr. Tzanca Hurricane wants to go visit his goddess girlfriend who lives on Mount Olympus. When planning his trip, he knows the temperature on the mountain for n consecutive days. The temperature values can be viewed as an array t of n integers where t_i represents the temperature on the i-th day.

Since the gasoline prices went up, he is very cautious with the gas consumption of his red Ferrari. In particular, he doesn't want to waste gas on cooling or heating. Mr. Hurricane doesn't want the temperature to be too low or too high. He has q temperature ranges that he finds comfortable.

For each temperature range (x, y) Mr. Hurricane gives you, he is curious how many different pairs (ℓ, r) there are such that $\min(t_\ell, t_{\ell+1}, \ldots, t_r) = x$ and $\max(t_\ell, t_{\ell+1}, \ldots, t_r) = y$. Please help him figure that out.

Input

The first line of input contains two integers n and q ($1 \le n, q \le 10^5$).

The second line contains n integers $t_1, t_2, \ldots, t_n$ ($1 \le t_i \le n$).

The next q lines describe the queries. The i-th of them contains the integers x_i and y_i ($1 \le x_i \le y_i \le n$).

Output

The output will consist of q lines, the i-th line containing a single integer, the answer to the i-th query.

Example

standard input	*standard output*
6 3 3 4 2 2 1 5 1 5 2 3 2 4	5 0 4

Problem F. The Cypriote Mermaid

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Every summer Stelinuța goes to Cyprus for an 11-day programming camp, and while being there, she loves to go swimming and snorkeling in the sea.

One day, when she was snorkeling, she found a very interesting pearl necklace: a straight (non-cyclic) thread with pearls on it. Originally, all the pearls had to be either black or white. However, some pearls were so damaged that she couldn't even distinguish their original color.

From that, Stelinuța came up with an idea: imagine that you can remove any two adjacent pearls that have the same color from the necklace. She is curious to know in how many different ways the original necklace could have looked so that, after applying that operation any number of times, she could end up with an empty necklace. As the answer may be very large, it is sufficient to find it modulo 998 244 353.

Input

The first line contains a string containing "`1`", "`0`" and "`?`" describing the necklace Stelinuța found. Each pearl is represented as follows:

- "`1`": the pearl is black,
- "`0`": the pearl is white,
- "`?`": the original color is unknown.

The length of the string will be at least 1 and at most $2 \cdot 10^5$.

Output

Output a single integer: the number of different ways the necklace could have looked like modulo 998 244 353.

Example

standard input	*standard output*
`01?1??`	`1`

Note

In the given example, the only way the necklace could have looked like is "`011110`". We can remove "`11`" twice, and then remove the remaining "`00`" to get an empty necklace.

For all the remaining assignments, there is no way to remove all the pearls by repeatedly removing two adjacent pearls of the same color.

Problem G. FS's Critical Concert

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	256 mebibytes

In the vibrant land of Romania, FS was preparing for his legendary concert. His iconic song, "Sfântul Trapez", was going to rock the stage, and every fan was eagerly awaiting the show. But FS had a special twist for this performance: he planned a unique game to entertain his audience.

In this musical game, FS imagined a grand, magical graph representing his concert, where each vertex was a performer and each edge was a lively connection between them. For the grand finale, FS decided to explore the secrets of these connections. He wanted to know how many "critical edges" were in his graph. He says that an edge is critical if and only if, **by removing it, we increase the number of connected components**.

To spice things up, FS envisioned every possible graph arrangement with his performers and set a challenge: count the number of these critical edges for every possible graph configuration. Then, he planned to sum up all these critical edges to uncover the grand total.

With his powerful voice and a flair for drama, FS was ready to perform and solve this graph theory puzzle at his concert. As the crowd cheered, FS's iconic beats and the complexity of his graph game combined into an unforgettable spectacle of music and mathematical marvels.

So, the challenge was clear: sum up the number of critical edges for all possible labeled graphs with n vertices, and let the concert's energy light up the math! You have to simulate the show's success by finding the answer modulo 998 244 353.

Input

The first line of the input contains an integer n ($1 \le n \le 5 \cdot 10^5$).

Output

Output a single integer: the requested sum modulo 998 244 353.

Examples

standard input	*standard output*
3	9
8	130981312

Problem H. The Lottery WINNER

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

WINNER is fed up with implementing the Z-function for the 500-th time at his new accountant job at NUP, and now he is looking for a quick way to retire. Thanks to his wide network of connections, he managed to obtain the winning numbers from all the n lotteries in Paphos. These winning numbers are written in base 12, where the numbers can include leading zeros.

However, the lotteries couldn't agree on a standard for representing the digits 10 and 11 using letters (from the uppercase English alphabet), so each lottery uses its own choice of two letters for these values. Despite having access to this information, WINNER is still uncertain about the exact rules for winning. He suspects that, in order to claim a prize, he only needs to correctly guess at least one digit from the winning number for each lottery.

WINNER forgot how to write with pen and paper, so he needs help figuring out the minimum number of unique alphanumerics he should learn in order to "win" (according to his understanding) at all the lotteries.

Input

The input begins with a single integer n ($1 \le n \le 2.5 \cdot 10^5$), representing the number of lotteries.

Each of the next n lines contains a number in base 12, representing the winning numbers for each lottery. For each line, there is an uppercase letter that means the digit 10, and a different uppercase letter that means the digit 11. This line can contain only digits and these two letters.

It is guaranteed that the total length of all the numbers is at most $4 \cdot 10^6$.

Output

The output should consist of a single integer, k, indicating the minimum number of unique alphanumerics WINNER needs to learn in order to believe he can win every lottery.

Example

standard input	*standard output*
4 EEXEE X221 DEE 2555539BD	2

Problem I. The Interview Problem

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

You are given a string s consisting of parentheses ("`(`" and "`)`") and digits ("`0`" through "`9`"). From the string s, you construct another string t by considering every character of s in order and performing the following operations based on the character values:

- "`(`": append "`(`" to t.
- "`)`": append "`)`" to t.
- $0 \le c \le 9$: delete any c characters from t. It is guaranteed that it is always possible to do so. The deleted characters don't need to be consecutive.

Is it possible to construct t to be a balanced bracket sequence?

Input

The first line contains an integer t ($1 \le t \le 10^4$), the number of test cases.

For each test case, you are given a non-empty string s consisting of parentheses and digits ("`()0123456789`"). The length of the string will be at most $3 \cdot 10^5$ characters.

It is guaranteed that the total length of the strings will not exceed $3 \cdot 10^5$ characters.

Output

For each test case, output "`YES`" if it is possible to construct t to be a balanced bracket sequence, and "`NO`" otherwise.

You may output each letter in any case (lowercase or uppercase). For example, the strings "`yEs`", "`yes`", "`Yes`", and "`YES`" will be accepted as a positive answer.

Examples

standard input	*standard output*
2 ((()(3)1 (()1)	Yes No
5 ()1() (()) ()1((((2()()))))3)() ((2))() ((1()))(1)()	No Yes Yes No Yes

Problem J. Count them!

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	1024 megabytes

Given the number of digits n and the base b, find number of the positive base b integers of length n, that have the given sum of digits s.

Input

Input consists of three integers n, b and s ($2 \le n, b < 30$; $1 \le s < 30$).

Output

Print one integer — the answer to the problem

Example

standard input	standard output
`2 10 12`	`7`

Problem K. Find the Property

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

You are given a graph g with n vertices and m edges. Determine whether the graph is bipartite.

Additionally, you will receive a list of q pairs (u_j, v_j) describing edges to be added one by one in the order they are given in the input. Your task is to identify the first moment when the graph stops to be bipartite. If graph was not bipartite initially, print -1. If no such moment occurs, print -2.

Note that a graph G is called *bipartite* when its vertices can be colored in two colors such that every edge in the graph connects two vertices colored in different colors.

Input

The first line of the standard input contains three integers n, m, and q – the number of vertices in the graph, the number of edges in the original graph, and the number of edges to be added later ($1 \le n \le 2 \cdot 10^5$, $0 \le m, q \le 4 \cdot 10^5$).

Each of the following m lines contains a pair (u_i, v_i), describing an edge present in the original graph.

Each of the following q lines contains a pair (u_j, v_j), describing an edge to be added to the graph. The additional edges are given in the input *exactly* in the order they will be added to the graph ($1 \le u_i, v_i, u_j, v_j \le n$).

Note that the graph (initial one as well the modified) may contain multiple edges and loops.

Output

On the only line of the standard output, print a single number:

- -1 if the input graph is not bipartite before any edge additions.
- -2 if the graph is bipartite and no added edge violates its bipartiteness.
- x where x is the index of the edge whose addition violates the bipartiteness of the graph.

Example

standard input	standard output
3 0 4 2 3 1 2 1 2 2 3	-2

Problem L. Single-Crossing

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	256 mebibytes

The summer has already been long and boring, and to entertain yourself, you started to look over some recent papers. You stumbled upon an interesting problem: Let's consider a list of n permutations $X^1, \ldots, X^n$ over $\{1, 2, \ldots, m\}$. In other words, each X^i is a vector $X^i_1, \ldots, X^i_m$ of size m in which all the numbers from 1 to m appear exactly once. The paper is about rearranging the given permutations such that the new order, let it be $Y^1, \ldots, Y^n$, is single-crossing.

A sequence of permutations $Y^1, \ldots, Y^n$ is called *single-crossing* if and only if, when we choose any three indices $1 \leq i < j < k \leq n$ and any two distinct values $1 \leq a, b \leq m$ such that a appears before b in both Y^i and Y^k, it holds that a appears before b in Y^j as well.

In a more intuitive way: we say that $Y^1, \ldots, Y^n$ is single-crossing if and only if any two elements a and b change their relative order at most once (see the image above).

You can't find the paper anymore, but you really want to implement a solution for the problem it proposes. So, given t test cases, find out for each of them if there is such a way to rearrange the permutations to be single-crossing, and, if so, output one possible solution.

Input

The first line contains one number t ($1 \leq t \leq 5$), the number of test cases.

Each test case is described as follows. The first line contains two integers n and m ($1 \leq n \leq 10^5$; $1 \leq n \cdot m \leq 10^6$). Each of the next n lines contains m integers: the permutations $X^1, \ldots, X^n$.

Output

For each of the t test cases, print a single line. If there is no way to rearrange the permutations so that the sequence becomes single-crossing, print `-1`. Otherwise, print a permutation p containing n space-separated integers: the order in which the original permutations could be rearranged.

If there are multiple solutions, output any one of them.

Example

standard input	*standard output*	*explanation*
2 5 4 2 3 1 4 1 2 3 4 2 1 3 4 4 3 2 1 3 2 4 1 4 4 2 1 3 4 1 2 3 4 2 1 4 3 1 2 4 3	2 3 1 5 4 -1	first test case, ordered as 2 3 1 5 4: 1 2 3 4 2 1 3 4 2 3 1 4 3 2 4 1 4 3 2 1