A. Arithmetic (1 point)

Mirko is practicing arithmetic operations in an interesting way during math class. First, he writes a sequence of integers **A**. Then, underneath the first sequence, he writes another sequence of integers **B** which he gets by replacing every number from the sequence **A** with the average value of all the numbers before the current one, including it.

For example, if the first sequence of integers **A** is equal to

$$1, 3, 2, 6, 8,$$

then the second sequence of integers **B** is going to be

$$\frac{1}{1}, \frac{1+3}{2}, \frac{1+3+2}{3}, \frac{1+3+2+6}{4}, \frac{1+3+2+6+8}{5},$$

in other words

$$1, 2, 2, 3, 4.$$

You are given the second sequence of integers **B**. Determine the first sequence of integers **A** to check Mirko's calculations.

INPUT

The first line of input contains the integer **N** ($1 \leq \mathbf{N} \leq 100$), the length of sequence **B**.
The second line of input contains the sequence of **N** space-separated integers $\mathbf{B_i}$ ($1 \leq \mathbf{B_i} \leq 10^9$).

OUTPUT

The first and only line of output must contain a sequence of **N** space-separated integers $\mathbf{A_i}$.
Please note: The input data will be such that the elements from the sequence **A** are integers ($1 \leq \mathbf{A_i} \leq 10^9$).

SAMPLE TESTS

input	input	input
1 2	4 3 2 3 5	5 1 2 2 3 4
output	**output**	**output**
2	3 1 5 11	1 3 2 6 8

Clarification of the third sample test: Look at the task description.

B. Mosquitos (1 point)

The city of Osijek has recently been plagued by a swarm of mosquitoes. The solution to this problem was proposed long ago by Mr. Perić, a brave inventor from Benkovci, in an episode of the TV-show Gitak called "Globalno sjelo"[1]. Among other inspiring inventions, he presented a mosquito trap. It is basically a box with which you cover the mosquito after it falls for the piece of cheese or "kajmak" you placed there, depending on what your mosquitoes prefer. Simple, isn't it?

If you're lucky, the box can cover more than one mosquito. You have spotted **N** mosquitoes on the table and know their positions precisely. **What is the area of the smallest square-shaped box that can, placed parallel to the sides of the table, cover all the mosquitoes?** The box, of course, can cover the mosquito with its edge.

INPUT

The first line of input contains the integer **N** ($2 \leq \mathbf{N} \leq 20$), the number of spotted mosquitoes.
Each of the following **N** lines contains the positions of mosquitoes as space-separated integer coordinates **X** and **Y** ($1 \leq \mathbf{X}, \mathbf{Y} \leq 100$) in an imaginary coordinate system whose axes are the sides of the table. At least two mosquitoes will be in different positions.

OUTPUT

The first and only line of output must contain the required area of the smallest **square-shaped** box (expressed, of course, in unit squares of the aforementioned coordinate system).

SAMPLE TESTS

input	input
3 3 4 5 7 4 3	4 1 5 5 1 10 5 5 10
output	**output**
16	81

Clarification of the first sample test: A square with vertices (3,3) and (7,7) solves all the problems.

[1] http://www.youtube.com/watch?v=mutagnjp_VA

C. Mafia (2 points)

Mafia is a social game played frequently by high school competitors in informatics on summer and winter camps and national competitions, usually very late at night, drinking various fruit sodas. This game is not about winning, it's about ~~los~~ taking part, like in competitions.

To solve this task, you don't need to know the rules of mafia: all you need to know is that some of the players are "mobsters" and the rest are "civilians". The mobsters know who is who, but the civilians don't. The civilians are trying to figure out who the mobsters are during the game.

In the current round of the game, out of **N** surviving players so far, each one has accused **exactly one** other player saying that he is the mobster. **The civilians were only guessing** and **the mobsters have accused civilians**, pretending to know nothing.

Not knowing who the mobsters are, but knowing who accused whom, determine **the maximum possible number of mobsters** among these players!

INPUT

The first line of input contains the integer **N** ($2 \leq \mathbf{N} \leq 500\,000$), the number of players. The players are labeled with integers from 1 to **N**.
The $\mathbf{K}^{th}$ line of input, out of the following **N** lines, contains the label of the player accused by the player **K**. (No player can accuse themselves.)

OUTPUT

The first and only line of output must contain the maximum possible number of mobsters.

SCORING

In test cases worth 40 points, it will hold $\mathbf{N} < 15$.
In test cases worth 80 points, it will hold $\mathbf{N} \leq 2000$.

SAMPLE TESTS

input	input	input
3 2 1 1	3 2 3 1	7 3 3 4 5 6 4 4
output	output	output
2	1	4

Clarification of the first sample test: The mobsters can be players 2 and 3.
Clarification of the second sample test: The mobster can be any player, but there cannot be more of them because that would mean that one of them accused the other.

D. Dorm (2 points)

A new student dorm has been opened! It consists of **M** buildings, labeled with integers from 1 to **M**. The dorm is initially empty, but soon **N** students will be moving in at a rate of exactly one student per day.

Each time a new student moves in a building, a big party is being held inside that building. The noise of the party is equal to the number of students located inside the building. The dorm management is not particularly fond of noise, so they will occasionally empty a certain building to keep the parties at a reasonable noise level. They do this by moving all its residents to a completely different student dorm. The management can decide to do this after any day, but they realized that it doesn't pay off to do it more than **K** times.

Help the management! Knowing which buildings are being moved in by students, determine the minimal possible total noise level (the sum of noise levels of all **N** parties) that can be achieved with emptying some of the buildings at most **K** times.

INPUT

The first line of input contains the integers **N** ($1 \leq \mathbf{N} \leq 1\,000\,000$), **M** ($1 \leq \mathbf{M} \leq 100$) and **K** ($1 \leq \mathbf{K} \leq 500$) from the task description.
The **i**$^{\text{th}}$ line, out of **N** in total, contains an integer from the interval [1,**M**]: the label of the building where a student is moving in on the **i**$^{\text{th}}$ day.

OUTPUT

The first and only line of output must contain the required minimal possible total noise level.

SCORING

In test cases worth 40 points, **M** = 1 will hold.
In test cases worth 60 points, it will hold **N** ≤ 1 000.
In test cases worth 80 points, it will hold **N** ≤ 50 000.

SAMPLE TESTS

input

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

output

```
7
```

input

```
11 2 3
1
2
1
2
1
2
1
2
1
2
1
```

output

```
18
```

Clarification of the first sample test: The building is emptied after the first and the third day so the noise levels are, respectively, 1, 1, 2, 1, 2. If we didn't empty the building, the noise levels would be 1, 2, 3, 4, 5.
Clarification of the second sample test: For example, building 1 is emptied after the fourth and eighth day and building 2 after the sixth day. The noise levels are, respectively, 1, 1, 2, 2, 1, 3, 2, 1, 1, 2, 2.

E. Camp (2 points)

In a certain flooded village, a secret superhuman humanitarian camp is being opened as we speak. The village consists of **N** houses marked with integers from 1 to **N**. The houses are connected to each other with **N**-1 roads so that there is **a unique way** between each two houses. For each road, we know the time it takes for a truck to pass it. The camp should be put up in some house's garden, but the camp manager still hasn't decided which house it is going to be.

Mirko has been appointed as the driver. His job is to drive around teams of volunteers in his super truck from the camp to the house where that certain team is going to work. His van is super because all teams at once can drive in it! In total, there are **K** teams and all the teams are going to **a different house**.

All K teams board into Mirko's truck initially, and then he drives them to houses in the sequence he determined for himself. After he drives around all teams, Mirko stays and helps the last team (**he doesn't go back to camp**).

In order for the camp manager to determine where to put up the camp, he wants to know, **for each house**, **the minimal time** it takes for Mirko to drive around all teams if **that house is the headquarters**. Write a programme that will determine the numbers Mirko's boss wants to see!

INPUT

The first line of input contains the integers **N** ($1 \leq N \leq 500\,000$), and **K** ($1 \leq K \leq N$).
Each of the following **N**-1 lines contains integers A_i, B_i, C_i ($1 \leq A_i, B_i \leq N$, $1 \leq C_i \leq 1\,000\,000$), where C_i is the time it takes to pass a two-way road between houses A_i and B_i.
Each of the following **K** lines contains the integers that mark the house where the i^{th} team is going, respectively.

OUTPUT

Output **N** lines. The i^{th} line of output must contain the minimal times it takes Mirko to drive around all the teams if the camp headquarters is located in the i^{th} house.

SCORING

In test cases worth 50% of total points, it will hold $N \leq 2\,000$.

SAMPLE TESTS

input	input
5 2 2 5 1 2 4 1 1 2 2 1 3 2 4 5	7 2 1 2 4 1 3 1 2 5 1 2 4 2 4 7 3 4 6 2 3 7
output	**output**
5 3 7 2 2	11 15 10 13 16 15

	10

Clarification of the first sample test: If Mirko starts off at house 1, he can drop off volunteers at houses 1-2-4-2-5, respectively. If he starts off at house 2, the possible sequence is 2-5-4.

F. Formurosa (3 points)

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

The Bytelandian Institute for Biological Research (BIBR) is investigating the properties of two species of bacteria, named simply 0 and 1. Even under a microscope, bacteria of those two species are very difficult to distinguish. In fact, the only thing the scientists possess that is able to differentiate between them is a plant called Formurosa.

If the scientists place a sample of colonies of bacteria on each on Formurosa's leaves, it will activate a complicated nutrition process. During that process color of Formurosa changes to reflect the result of a — possibly very complicated — logical formula on the species of bacteria, involving constants and the operators | (OR), & (AND) and ^ (XOR). If it is 0, the plant will turn red, otherwise — it will turn blue.

For example, if the nutrition process of Formurosa is described by the formula: $(((?\text{^}?)|?)\&(1\text{^}?))$; then Formurosa has four leaves (the "?" signs denote the leaves). If we place $0, 1, 0, 0$ on the respective leaves, the result of the nutrition process will be $(((0\text{^}1)|0)\&(1\text{^}0)) = 1$, therefore the plant will turn blue.

The scientists have n colonies of bacteria. They do not know their types; the only thing they know for sure is that **not all colonies are of the same type**. They want to attempt to determine the bacteria's species by repeated evaluations with Formurosa. During each evaluation they must place exactly one sample on every leaf of the plant. However, they may use multiple samples of one colony during a single evaluation; they can even cover the whole plant with bacteria from one colony!

Is it possible for them to always determine the species of each colony, no matter what they are (assuming they are not all the same)?

Input

The first line of input contains a single integer n ($2 \le n \le 10^6$) — the number of colonies of bacteria.

The second line contains the formula describing the nutrition process of Formurosa. This line contains only characters «0», «1», «?», «|», «&», «^», «(», «)» and complies with the following grammar:

$$s \to 0|1|?|(s|s)|(s\&s)|(s\text{^}s)$$

The formula consists of no more than 10^6 characters.

Output

If it is always possible to determine the species of each colony, output "YES" (without quotes). Otherwise, output "NO" (without quotes).

Sample test(s)

input
2 (?^?)
output
NO

input
10 ?
output
YES

input
2 ((?^?)&?)
output
YES