A. Curriculum Vitae

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

Hideo Kojima has just quit his job at Konami. Now he is going to find a new place to work. Despite being such a well-known person, he still needs a CV to apply for a job.

During all his career Hideo has produced n games. Some of them were successful, some were not. Hideo wants to remove several of them (possibly zero) from his CV to make a better impression on employers. As a result there should be no unsuccessful game which comes right after successful one in his CV.

More formally, you are given an array $s_1, s_2, \ldots, s_n$ of zeros and ones. Zero corresponds to an unsuccessful game, one — to a successful one. Games are given in order they were produced, and Hideo can't swap these values. He should remove some elements from this array in such a way that no zero comes right after one.

Besides that, Hideo still wants to mention as much games in his CV as possible. Help this genius of a man determine the maximum number of games he can leave in his CV.

Input

The first line contains one integer number n $(1 \leq n \leq 100)$.

The second line contains n space-separated integer numbers $s_1, s_2, \ldots, s_n$ $(0 \leq s_i \leq 1)$. 0 corresponds to an unsuccessful game, 1 — to a successful one.

Output

Print one integer — the maximum number of games Hideo can leave in his CV so that no unsuccessful game comes after a successful one.

Examples

input

```
4
1 1 0 1
```

output

```
3
```

input

```
6
0 1 0 0 1 0
```

output

```
4
```

input

```
1
0
```

output

```
1
```

B. Math Show

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

Polycarp takes part in a math show. He is given n tasks, each consists of k subtasks, numbered 1 through k. It takes him t_j minutes to solve the j-th subtask of any task. Thus, time required to solve a subtask depends only on its index, but not on the task itself. Polycarp can solve subtasks in any order.

By solving subtask of arbitrary problem he earns one point. Thus, the number of points for task is equal to the number of solved subtasks in it. Moreover, if Polycarp *completely* solves the task (solves all k of its subtasks), he recieves one extra point. Thus, total number of points he recieves for the complete solution of the task is $k + 1$.

Polycarp has M minutes of time. What is the maximum number of points he can earn?

Input

The first line contains three integer numbers n, k and M ($1 \le n \le 45$, $1 \le k \le 45$, $0 \le M \le 2 \cdot 10^9$).

The second line contains k integer numbers, values t_j ($1 \le t_j \le 1000000$), where t_j is the time in minutes required to solve j-th subtask of any task.

Output

Print the maximum amount of points Polycarp can earn in M minutes.

Examples

input

```
3 4 11
1 2 3 4
```

output

```
6
```

input

```
5 5 10
1 2 4 8 16
```

output

```
7
```

Note

In the first example Polycarp can complete the first task and spend $1 + 2 + 3 + 4 = 10$ minutes. He also has the time to solve one subtask of the second task in one minute.

In the second example Polycarp can solve the first subtask of all five tasks and spend $5 \cdot 1 = 5$ minutes. Also he can solve the second subtasks of two tasks and spend $2 \cdot 2 = 4$ minutes. Thus, he earns $5 + 2 = 7$ points in total.

C. Four Segments

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

You are given an array of n integer numbers. Let $sum(l, r)$ be the sum of all numbers on positions from l to r non-inclusive (l-th element is counted, r-th element is not counted). For indices l and r holds $0 \le l \le r \le n$. Indices in array are numbered from 0.

For example, if $a = [-5, 3, 9, 4]$, then $sum(0, 1) = -5$, $sum(0, 2) = -2$, $sum(1, 4) = 16$ and $sum(i, i) = 0$ for each i from 0 to 4.

Choose the indices of three delimiters $delim_0$, $delim_1$, $delim_2$ ($0 \le delim_0 \le delim_1 \le delim_2 \le n$) and divide the array in such a way that the value of $res = sum(0, delim_0) - sum(delim_0, delim_1) + sum(delim_1, delim_2) - sum(delim_2, n)$ is maximal.

Note that some of the expressions $sum(l, r)$ can correspond to empty segments (if $l = r$ for some segment).

Input

The first line contains one integer number n ($1 \le n \le 5000$).

The second line contains n numbers $a_0, a_1, \dots, a_{n-1}$ ($-10^9 \le a_i \le 10^9$).

Output

Choose three indices so that the value of res is maximal. If there are multiple answers, print any of them.

Examples

input

```
3
-1 2 3
```

output

```
0 1 3
```

input

```
4
0 0 -1 0
```

output

```
0 0 0
```

input

```
1
10000
```

output

```
1 1 1
```

D. Monitor

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

Recently Luba bought a monitor. Monitor is a rectangular matrix of size $n \times m$. But then she started to notice that some pixels cease to work properly. Luba thinks that the monitor will become broken the first moment when it contains a square $k \times k$ consisting entirely of broken pixels. She knows that q pixels are already broken, and for each of them she knows the moment when it stopped working. Help Luba to determine when the monitor became broken (or tell that it's still not broken even after all q pixels stopped working).

Input

The first line contains four integer numbers n, m, k, q $(1 \le n, m \le 500, 1 \le k \le min(n, m), 0 \le q \le n \cdot m)$ — the length and width of the monitor, the size of a rectangle such that the monitor is broken if there is a broken rectangle with this size, and the number of broken pixels.

Each of next q lines contain three integer numbers x_i, y_i, t_i $(1 \le x_i \le n, 1 \le y_i \le m, 0 \le t \le 10^9)$ — coordinates of i-th broken pixel (its row and column in matrix) and the moment it stopped working. Each pixel is listed at most once.

We consider that pixel is already broken at moment t_i.

Output

Print one number — the minimum moment the monitor became broken, or "-1" if it's still not broken after these q pixels stopped working.

Examples

input

```
2 3 2 5
2 1 8
2 2 8
1 2 1
1 3 4
2 3 2
```

output

```
8
```

input

```
3 3 2 5
1 2 2
2 2 1
2 3 5
3 2 10
2 1 100
```

output

```
-1
```

E. Chemistry in Berland

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

Igor is a post-graduate student of chemistry faculty in Berland State University (BerSU). He needs to conduct a complicated experiment to write his thesis, but laboratory of BerSU doesn't contain all the materials required for this experiment.

Fortunately, chemical laws allow material transformations (yes, chemistry in Berland differs from ours). But the rules of transformation are a bit strange.

Berland chemists are aware of n materials, numbered in the order they were discovered. Each material can be transformed into some other material (or vice versa). Formally, for each i $(2 \le i \le n)$ there exist two numbers x_i and k_i that denote a possible transformation: k_i kilograms of material x_i can be transformed into 1 kilogram of material i, and 1 kilogram of material i can be transformed into 1 kilogram of material x_i. Chemical processing equipment in BerSU allows only such transformation that the amount of resulting material is **always an integer number of kilograms**.

For each i $(1 \le i \le n)$ Igor knows that the experiment requires a_i kilograms of material i, and the laboratory contains b_i kilograms of this material. Is it possible to conduct an experiment after transforming some materials (or none)?

Input

The first line contains one integer number n $(1 \le n \le 10^5)$ — the number of materials discovered by Berland chemists.

The second line contains n integer numbers $b_1, b_2 \dots b_n$ $(1 \le b_i \le 10^{12})$ — supplies of BerSU laboratory.

The third line contains n integer numbers $a_1, a_2 \dots a_n$ $(1 \le a_i \le 10^{12})$ — the amounts required for the experiment.

Then $n - 1$ lines follow. j-th of them contains two numbers x_{j+1} and k_{j+1} that denote transformation of $(j+1)$-th material $(1 \le x_{j+1} \le j,\ 1 \le k_{j+1} \le 10^9)$.

Output

Print `YES` if it is possible to conduct an experiment. Otherwise print `NO`.

Examples

input

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

output

```
YES
```

input

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

output

```
NO
```

F. Random Query

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

You are given an array a consisting of n positive integers. You pick two integer numbers l and r from 1 to n, inclusive (numbers are picked randomly, equiprobably and independently). If $l > r$, then you swap values of l and r. You have to calculate the expected value of the number of unique elements in segment of the array from index l to index r, inclusive (1-indexed).

Input

The first line contains one integer number n $(1 \le n \le 10^6)$. The second line contains n integer numbers a_1, a_2, ... a_n $(1 \le a_i \le 10^6)$ — elements of the array.

Output

Print one number — the expected number of unique elements in chosen segment.

Your answer will be considered correct if its absolute or relative error doesn't exceed 10^{-4} — formally, the answer is correct if $min(|x - y|, \frac{|x-y|}{x}) \le 10^{-4}$, where x is jury's answer, and y is your answer.

Examples

input

```
2
1 2
```

output

```
1.500000
```

input

```
2
2 2
```

output

```
1.000000
```