Codeforces Round #514 (Div. 2)

A. Cashier

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

Vasya has recently got a job as a cashier at a local store. His day at work is L minutes long. Vasya has already memorized n regular customers, the i-th of which comes after t_i minutes after the beginning of the day, and his service consumes l_i minutes. It is guaranteed that no customer will arrive while Vasya is servicing another customer.

Vasya is a bit lazy, so he likes taking smoke breaks for a minutes each. Those breaks may go one after another, but Vasya must be present at work during all the time periods he must serve regular customers, otherwise one of them may alert his boss. What is the maximum number of breaks Vasya can take during the day?

Input

The first line contains three integers n, L and a ($0 \le n \le 10^5$, $1 \le L \le 10^9$, $1 \le a \le L$).

The i-th of the next n lines contains two integers t_i and l_i ($0 \le t_i \le L - 1$, $1 \le l_i \le L$). It is guaranteed that $t_i + l_i \le t_{i+1}$ and $t_n + l_n \le L$.

Output

Output one integer — the maximum number of breaks.

Examples

input

```
2 11 3
0 1
1 1
```

output

```
3
```

input

```
0 5 2
```

output

```
2
```

input

```
1 3 2
1 2
```

output

```
0
```

Note

In the first sample Vasya can take 3 breaks starting after 2, 5 and 8 minutes after the beginning of the day.

In the second sample Vasya can take 2 breaks starting after 0 and 2 minutes after the beginning of the day.

In the third sample Vasya can't take any breaks.

B. Forgery

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

Student Andrey has been skipping physical education lessons for the whole term, and now he must somehow get a passing grade on this subject. Obviously, it is impossible to do this by legal means, but Andrey doesn't give up. Having obtained an empty certificate from a local hospital, he is going to use his knowledge of local doctor's handwriting to make a counterfeit certificate of illness. However, after writing most of the certificate, Andrey suddenly discovered that doctor's signature is impossible to forge. Or is it?

For simplicity, the signature is represented as an $n \times m$ grid, where every cell is either filled with ink or empty. Andrey's pen can fill a 3×3 square without its central cell if it is completely contained inside the grid, as shown below.

```
xxx
x.x
xxx
```

Determine whether is it possible to forge the signature on an empty $n \times m$ grid.

Input

The first line of input contains two integers n and m ($3 \leq n, m \leq 1000$).

Then n lines follow, each contains m characters. Each of the characters is either '`.`', representing an empty cell, or '`#`', representing an ink filled cell.

Output

If Andrey can forge the signature, output "`YES`". Otherwise output "`NO`".

You can print each letter in any case (upper or lower).

Examples

input Copy

```
3 3
###
#.#
###
```

output Copy

```
YES
```

input Copy

```
3 3
###
###
###
```

output Copy

```
NO
```

input Copy

```
4 3
###
###
###
###
```

output Copy

```
YES
```

input Copy

```
5 7
.......
.#####.
.#.#.#.
.#####.
.......
```

output Copy

```
YES
```

Note

In the first sample Andrey can paint the border of the square with the center in $(2, 2)$.

In the second sample the signature is impossible to forge.

In the third sample Andrey can paint the borders of the squares with the centers in $(2, 2)$ and $(3, 2)$:

1. we have a clear paper:

```
...
...
```

```
...
...
```

2. use the pen with center at $(2, 2)$.

```
###
#.#
###
...
```

3. use the pen with center at $(3, 2)$.

```
###
###
###
###
```

In the fourth sample Andrey can paint the borders of the squares with the centers in $(3, 3)$ and $(3, 5)$.

C. Sequence Transformation

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

Let's call the following process a transformation of a sequence of length n.

If the sequence is empty, the process ends. Otherwise, append the greatest common divisor (GCD) of all the elements of the sequence to the result and remove one arbitrary element from the sequence. Thus, when the process ends, we have a sequence of n integers: the greatest common divisors of all the elements in the sequence before each deletion.

You are given an integer sequence $1, 2, \ldots, n$. Find the lexicographically maximum result of its transformation.

A sequence $a_1, a_2, \ldots, a_n$ is lexicographically larger than a sequence $b_1, b_2, \ldots, b_n$, if there is an index i such that $a_j = b_j$ for all $j < i$, and $a_i > b_i$.

Input

The first and only line of input contains one integer n ($1 \leq n \leq 10^6$).

Output

Output n integers — the lexicographically maximum result of the transformation.

Examples

input	Copy
3	
output	**Copy**
1 1 3	

input	Copy
2	
output	**Copy**
1 2	

input	Copy
1	
output	**Copy**
1	

Note

In the first sample the answer may be achieved this way:

- Append GCD$(1, 2, 3) = 1$, remove 2.
- Append GCD$(1, 3) = 1$, remove 1.
- Append GCD$(3) = 3$, remove 3.

We get the sequence $[1, 1, 3]$ as the result.

D. Nature Reserve

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

There is a forest that we model as a plane and live n rare animals. Animal number i has its lair in the point (x_i, y_i). In order to protect them, a decision to build a nature reserve has been made.

The reserve must have a form of a circle containing all lairs. There is also a straight river flowing through the forest. All animals drink from this river, therefore it must have at least one common point with the reserve. On the other hand, ships constantly sail along the river, so the reserve must not have more than one common point with the river.

For convenience, scientists have made a transformation of coordinates so that the river is defined by $y = 0$. Check whether it is possible to build a reserve, and if possible, find the minimum possible radius of such a reserve.

Input

The first line contains one integer n ($1 \le n \le 10^5$) — the number of animals.

Each of the next n lines contains two integers x_i, y_i ($-10^7 \le x_i, y_i \le 10^7$) — the coordinates of the i-th animal's lair. It is guaranteed that $y_i \neq 0$. No two lairs coincide.

Output

If the reserve cannot be built, print -1. Otherwise print the minimum radius. Your answer will be accepted if absolute or relative error does not exceed 10^{-6}.

Formally, let your answer be a, and the jury's answer be b. Your answer is considered correct if $\frac{|a-b|}{\max(1, |b|)} \le 10^{-6}$.

Examples

input	Copy

```
1
0 1
```

output Copy

```
0.5
```

input Copy

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

output Copy

```
-1
```

input Copy

```
2
0 1
1 1
```

output Copy

```
0.625
```

Note

In the first sample it is optimal to build the reserve with the radius equal to 0.5 and the center in $(0,\ 0.5)$.

In the second sample it is impossible to build a reserve.

In the third sample it is optimal to build the reserve with the radius equal to $\frac{5}{8}$ and the center in $(\frac{1}{2},\ \frac{5}{8})$.

E. Split the Tree

time limit per test: 2 seconds

memory limit per test: 256 megabytes

input: standard input

output: standard output

You are given a rooted tree on n vertices, its root is the vertex number 1. The i-th vertex contains a number w_i. Split it into the minimum possible number of vertical paths in such a way that each path contains no more than L vertices and the sum of integers w_i on each path does not exceed S. Each vertex should belong to exactly one path.

A vertical path is a sequence of vertices $v_1, v_2, \ldots, v_k$ where v_i ($i \geq 2$) is the parent of v_{i-1}.

Input

The first line contains three integers n, L, S ($1 \leq n \leq 10^5$, $1 \leq L \leq 10^5$, $1 \leq S \leq 10^{18}$) — the number of vertices, the maximum number of vertices in one path and the maximum sum in one path.

The second line contains n integers $w_1, w_2, \ldots, w_n$ ($1 \leq w_i \leq 10^9$) — the numbers in the vertices of the tree.

The third line contains $n - 1$ integers $p_2, \ldots, p_n$ ($1 \leq p_i < i$), where p_i is the parent of the i-th vertex in the tree.

Output

Output one number — the minimum number of vertical paths. If it is impossible to split the tree, output -1.

Examples

input

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

output

```
3
```

input

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

output

```
2
```

input

```
1 1 10000
10001
```

output

Copy

```
-1
```

Note

In the first sample the tree is split into $\{1\}, \{2\}, \{3\}$.

In the second sample the tree is split into $\{1, 2\}, \{3\}$ or $\{1, 3\}, \{2\}$.

In the third sample it is impossible to split the tree.