ежегодный чемпионат по программированию

Codeforces Round #472 (rated, Div. 2, based on VK Cup 2018 Round 2)

A. Tritonic Iridescence

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

Overlooking the captivating blend of myriads of vernal hues, Arkady the painter lays out a long, long canvas.

Arkady has a sufficiently large amount of paint of three colours: cyan, magenta, and yellow. On the one-dimensional canvas split into n consecutive segments, each segment needs to be painted in one of the colours.

Arkady has already painted some (possibly none or all) segments and passes the paintbrush to you. You are to determine whether there are at least two ways of colouring all the unpainted segments so that no two adjacent segments are of the same colour. Two ways are considered different if and only if a segment is painted in different colours in them.

Input

The first line contains a single positive integer n $(1 \le n \le 100)$ — the length of the canvas.

The second line contains a string s of n characters, the i-th of which is either '`C`' (denoting a segment painted in cyan), '`M`' (denoting one painted in magenta), '`Y`' (one painted in yellow), or '`?`' (an unpainted one).

Output

If there are at least two different ways of painting, output "`Yes`"; otherwise output "`No`" (both without quotes).

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

Examples

input

```
5
CY??Y
```

output

```
Yes
```

input

```
5
C?C?Y
```

output

```
Yes
```

input

```
5
?CYC?
```

output

```
Yes
```

input

```
5
C??MM
```

output

```
No
```

input

```
3
MMY
```

output

```
No
```

Note

For the first example, there are exactly two different ways of colouring: `CYCMY` and `CYMCY`.

For the second example, there are also exactly two different ways of colouring: `CMCMY` and `CYCMY`.

For the third example, there are four ways of colouring: `MCYCM`, `MCYCY`, `YCYCM`, and `YCYCY`.

For the fourth example, no matter how the unpainted segments are coloured, the existing magenta segments will prevent the painting from satisfying the requirements. The similar is true for the fifth example.

B. Mystical Mosaic

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

There is a rectangular grid of n rows of m initially-white cells each.

Arkady performed a certain number (possibly zero) of operations on it. In the i-th operation, a non-empty subset of rows R_i and a non-empty subset of columns C_i are chosen. For each row r in R_i and each column c in C_i, the intersection of row r and column c is coloured black.

There's another constraint: a row or a column can only be chosen at most once among all operations. In other words, it means that no pair of (i, j) $(i < j)$ exists such that $R_i \cap R_j \neq \varnothing$ or $C_i \cap C_j \neq \varnothing$, where $\cap$ denotes intersection of sets, and $\varnothing$ denotes the empty set.

You are to determine whether a valid sequence of operations exists that produces a given final grid.

Input

The first line contains two space-separated integers n and m $(1 \leq n, m \leq 50)$ — the number of rows and columns of the grid, respectively.

Each of the following n lines contains a string of m characters, each being either '.' (denoting a white cell) or '#' (denoting a black cell), representing the desired setup.

Output

If the given grid can be achieved by any valid sequence of operations, output "Yes"; otherwise output "No" (both without quotes).

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

Examples

input

```
5 8
.#.#..#.
.....#..
.#.#..#.
#.#....#
.....#..
```

output

```
Yes
```

input

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

output

```
No
```

input

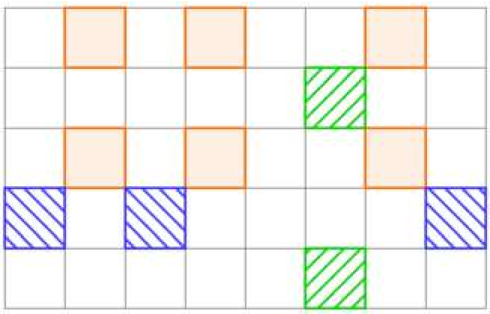
```
5 9
........#
#........
..##.#...
.......#.
....#.#.#
```

output

```
No
```

Note

For the first example, the desired setup can be produced by 3 operations, as is shown below.



For the second example, the desired setup cannot be produced, since in order to colour the center row, the third row and all columns must be selected in one operation, but after that no column can be selected again, hence it won't be possible to colour the other cells in the center column.

C. Three-level Laser

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

An atom of element X can exist in n distinct states with energies $E_1 < E_2 < ... < E_n$. Arkady wants to build a laser on this element, using a three-level scheme. Here is a simplified description of the scheme.

Three distinct states i, j and k are selected, where $i < j < k$. After that the following process happens:

1. initially the atom is in the state i,
2. we spend E_k - E_i energy to put the atom in the state k,
3. the atom emits a photon with useful energy E_k - E_j and changes its state to the state j,
4. the atom spontaneously changes its state to the state i, losing energy E_j - E_i,
5. the process repeats from step 1.

Let's define the energy conversion efficiency as $\eta = \frac{E_k - E_j}{E_k - E_i}$, i. e. the ration between the useful energy of the photon and spent energy.

Due to some limitations, Arkady can only choose such three states that E_k - $E_i \le U$.

Help Arkady to find such the maximum possible energy conversion efficiency within the above constraints.

Input

The first line contains two integers n and U ($3 \le n \le 10^5$, $1 \le U \le 10^9$) — the number of states and the maximum possible difference between E_k and E_i.

The second line contains a sequence of integers $E_1, E_2, ..., E_n$ ($1 \le E_1 < E_2... < E_n \le 10^9$). It is guaranteed that all E_i are given in increasing order.

Output

If it is not possible to choose three states that satisfy all constraints, print `-1`.

Otherwise, print one real number η — the maximum possible energy conversion efficiency. Your answer is considered correct its absolute or relative error does not exceed 10^{-9}.

Formally, let your answer be a, and the jury's answer be b. Your answer is considered correct if $\frac{|a-b|}{\max(1,|b|)} \le 10^{-9}$.

Examples

input

```
4 4
1 3 5 7
```

output

```
0.5
```

input

```
10 8
10 13 15 16 17 19 20 22 24 25
```

output

```
0.875
```

input

```
3 1
2 5 10
```

output

```
-1
```

Note

In the first example choose states 1, 2 and 3, so that the energy conversion efficiency becomes equal to $\eta = \frac{5-3}{5-1} = 0.5$.

In the second example choose states 4, 5 and 9, so that the energy conversion efficiency becomes equal to $\eta = \frac{24-17}{24-16} = 0.875$.

D. Riverside Curio

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

Arkady decides to observe a river for n consecutive days. The river's water level on each day is equal to some real value.

Arkady goes to the riverside each day and makes a mark on the side of the channel at the height of the water level, but if it coincides with a mark made before, no new mark is created. The water does not wash the marks away. Arkady writes down the number of marks strictly above the water level each day, on the i-th day this value is equal to m_i.

Define d_i as the number of marks strictly under the water level on the i-th day. You are to find out the minimum possible sum of d_i over all days. There are no marks on the channel before the first day.

Input

The first line contains a single positive integer n ($1 \le n \le 10^5$) — the number of days.

The second line contains n space-separated integers $m_1, m_2, ..., m_n$ ($0 \le m_i < i$) — the number of marks strictly above the water on each day.

Output

Output one single integer — the minimum possible sum of the number of marks strictly below the water level among all days.

Examples

input

```
6
0 1 0 3 0 2
```

output

```
6
```

input

```
5
0 1 2 1 2
```

output

```
1
```

input

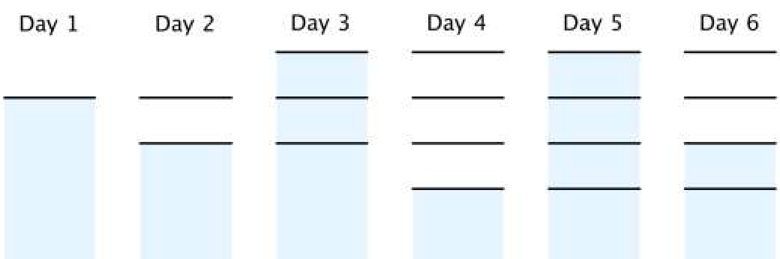
```
5
0 1 1 2 2
```

output

```
0
```

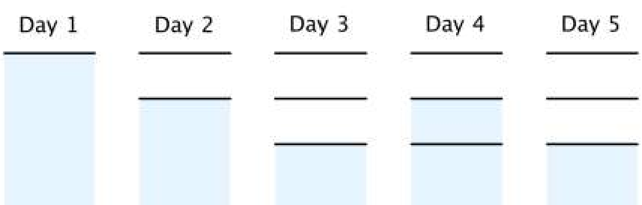
Note

In the first example, the following figure shows an optimal case.



Note that on day 3, a new mark should be created because if not, there cannot be 3 marks above water on day 4. The total number of marks underwater is $0+0+2+0+3+1=6$.

In the second example, the following figure shows an optimal case.



E. Contact ATC

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

Arkady the air traffic controller is now working with n planes in the air. All planes move along a straight coordinate axis with Arkady's station being at point 0 on it. The i-th plane, small enough to be represented by a point, currently has a coordinate of x_i and is moving with speed v_i. It's guaranteed that $x_i \cdot v_i < 0$, i.e., all planes are moving towards the station.

Occasionally, the planes are affected by winds. With a wind of speed v_{wind} (not necessarily positive or integral), the speed of the i-th plane becomes $v_i + v_{wind}$.

According to weather report, the current wind has a steady speed falling inside the range $[-w, w]$ (inclusive), but the exact value cannot be measured accurately since this value is rather small — smaller than the absolute value of speed of any plane.

Each plane should contact Arkady at the exact moment it passes above his station. And you are to help Arkady count the number of pairs of planes (i, j) $(i < j)$ there are such that there is a possible value of wind speed, under which planes i and j contact Arkady at the same moment. This value needn't be the same across different pairs.

The wind speed is the same for all planes. You may assume that the wind has a steady speed and lasts arbitrarily long.

Input

The first line contains two integers n and w $(1 \le n \le 100\,000,\ 0 \le w < 10^5)$ — the number of planes and the maximum wind speed.

The i-th of the next n lines contains two integers x_i and v_i $(1 \le |x_i| \le 10^5,\ w + 1 \le |v_i| \le 10^5,\ x_i \cdot v_i < 0)$ — the initial position and speed of the i-th plane.

Planes are pairwise distinct, that is, no pair of (i, j) $(i < j)$ exists such that both $x_i = x_j$ and $v_i = v_j$.

Output

Output a single integer — the number of unordered pairs of planes that can contact Arkady at the same moment.

Examples

input

```
5 1
-3 2
-3 3
-1 2
1 -3
3 -5
```

output

```
3
```

input

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

output

```
9
```

Note

In the first example, the following 3 pairs of planes satisfy the requirements:

- $(2, 5)$ passes the station at time $3/4$ with $v_{wind} = 1$;
- $(3, 4)$ passes the station at time $2/5$ with $v_{wind} = 1/2$;
- $(3, 5)$ passes the station at time $4/7$ with $v_{wind} = -1/4$.

In the second example, each of the 3 planes with negative coordinates can form a valid pair with each of the other 3, totaling 9 pairs.