Problem A. Rook

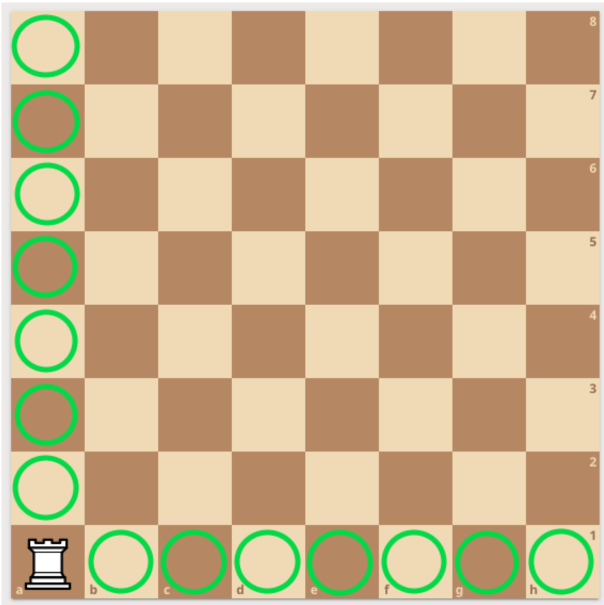
Time limit: 1 second
Memory limit: 256 megabytes

Given a chessboard of size $n \times m$. That is, with n rows and m columns.

On this chessboard, there is only one piece — the rook. It is located in the bottom left corner. There are no other pieces.

Recall that the rook can move any positive number of squares horizontally or vertically in one move, but not diagonally.

Find the number of squares to which the rook can move in exactly one move.



The picture shows a traditional chessboard of size 8×8. On it, the rook can move to all the squares marked in green. There are a total of 14 such squares, so the answer is 14.

Input

The first line contains one integer n ($1 \le n \le 20$).

The second line contains one integer m ($1 \le m \le 20$).

Output

Output the number of squares to which the rook can move in one move.

Examples

standard input	standard output
8 8	14
3 2	3

Note

An explanation of why the answer is 14 for the first example can be seen in the picture above.

In the second example, the answer is 3, because the rook can only move to one position to the right and two positions up.

Problem B. Coordinates

Time limit: 1 second
Memory limit: 256 megabytes

Given a point (x, y, z) in 3D space.

Find the **squared** distance from this point to the origin (i.e., to the point $(0, 0, 0)$).

Recall that the distance between two points (x_1, y_1, z_1) and (x_2, y_2, z_2) is defined by the formula

$$\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

Input

The first line contains one integer x $(-100 \le x \le 100)$.

The second line contains one integer y $(-100 \le y \le 100)$.

The third line contains one integer z $(-100 \le z \le 100)$.

Output

Output one integer.

Example

standard input	standard output
1 -3 5	35

Note

In the first test, we are interested in the squared distance from the point $(1, -3, 5)$ to $(0, 0, 0)$.

Substituting the coordinates into the formula, we get:

$$\left(\sqrt{(1-0)^2 + (-3-0)^2 + (5-0)^2}\right)^2 =$$

$$= \left(\sqrt{1 + 9 + 25}\right)^2 = 35$$

Problem C. Sakurako's Favorite Toy

Time limit: 1 second
Memory limit: 256 megabytes

Sakurako wants to play with her favorite toy, which is m meters from her. In one step, she can go from 1 to k meters forward (if a toy is closer than k meters, then she can step over it). Sakurako is in a hurry, so she asks you what the minimum number of steps required to reach the toy is.

Input

The first line contains m and k ($1 \le m, k \le 10^{18}$) — the distance of the toy from Sakurako and the maximum size of Sakurako's step.

Note that it is recommended to use 64-bit integers (for example, `long long` in C++).

Output

Print a single number — the minimum number of steps Sakurako needs to make.

Scoring

In this problem, there are conditional blocks. If your solution works correctly for certain constraints, it will receive a certain number of points. Note that testing is going test by test, but not by blocks.

1. (40 points): $m \le 10^5$;
2. (60 points): without additional constraints.

Examples

standard input	standard output
5 3	2
9 3	3

Note

In the first example, Sakurako can take steps of 3 and 2. She can also take steps of 2 and 3.

In the second example, she needs to take step 3 three times.

Problem D. Sakurako's Not Favorite Toy

Time limit: 1 second
Memory limit: 256 megabytes

Sakurako is tired of her favorite toy, so now she wants to play with another one, which is m meters from her in the corridor of infinite length.

In one step, she can go from 1 to k meters forward (if the toy is closer than k meters, then she can step over it), but the toy doesn't want to play with Sakurako, so it goes q meters forward from Sakurako **simultaneously** with her.

Sakurako is in a hurry, so she asks you what is the minimum number of steps required to reach the toy if it is possible, and if she starts at position 1 in the corridor.

Input

The first line contains three integers m, k, q ($1 \le m, k, q \le 10^{18}$) — distance of the toy from Sakurako, the maximum size of Sakurako's step, and size of the toy's step.

Note that it is recommended to use 64-bit integers (for example, `long long` in C++).

Output

Print a single number — the minimum number of steps Sakurako needs to make, or -1 if it is impossible to reach the toy.

Scoring

In this problem, there are conditional blocks. If your solution works correctly for certain constraints, it will receive a certain number of points. Note that testing is going test by test, but not by blocks.

1. (50 points): $m \le 10^5$;
2. (50 points): without additional constraints.

Examples

standard input	standard output
6 8 4	2
10 9 5	3

Note

In the first example, the timeline is the following:

1. Sakurako moves from 0 to 8, while the toy moves from 6 to 10;
2. Sakurako moves from 8 to 14 (note that she took not the maximum size), while the toy moves from 10 to 14.

In the second example, the timeline is the following:

1. Sakurako moves from 0 to 9, while the toy moves from 10 to 15;
2. Sakurako moves from 9 to 18, while the toy moves from 15 to 20;
3. Sakurako moves from 18 to 25, while the toy moves from 20 to 25.

Problem E. Successful Investor

Time limit: 1 second
Memory limit: 256 megabytes

Being a professional trader, Sakurako created a plan for the next n days. On the i-th day, she must invest a certain amount of coins in the range $[a_i - x, a_i + x]$, where x is a fixed integer that Sakurako has at the very beginning. Notice that she may invest even a negative amount of coins, which is crazy.

However, she wouldn't be a professional trader if she did not have an ace strategy up her sleeve. Her strategy is that she will invest strictly more coins than she has invested on the previous day. Formally, if she chooses to invest $b_1, b_2, \ldots, b_n$ **integer** coins respectively on each of the n days, the condition $b_1 < b_2 < \cdots < b_n$ must be held, where $a_i - x \le b_i \le a_i + x$.

Your task is to detect whether her strategy may succeed and output one of Sakurako's possible plans.

Input

The first line contains two integers n and x ($1 \le n \le 2 \cdot 10^5; 0 \le x \le 10^9$) — the number of days and a fixed Sakurako's integer.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($0 \le a_i \le 10^9$) — values that describe Sakurako's plan.

Output

In the first line, output "YES" if Sakurako's plan may succeed and "NO" otherwise.

If your output in the first line is "YES", output the n integers $b_1, b_2, \ldots, b_n$ ($-2 \cdot 10^9 \le b_i \le 2 \cdot 10^9$) of her final investments in the second line.

Notice that there may be many possible answers; you are allowed to output an arbitrary one that meets the conditions described in the statement.

Scoring

In this problem, there are conditional blocks. If your solution works correctly for certain constraints, it will receive a certain number of points. Note that testing is going test by test, but not by blocks.

1. (16 points): $x = 1$; that is, Sakurako's fixed number equals 1.
2. (84 points): without additional constraints.

Example

standard input	standard output
5 4 1 4 2 1 3	YES -3 0 1 2 3

Note

In the first example,

1. $1 - 4 \le -3 \le 1 + 4$;
2. $4 - 4 \le 0 \le 4 + 4$;
3. $2 - 4 \le 1 \le 2 + 4$;
4. $1 - 4 \le 2 \le 1 + 4$;
5. $3 - 4 \le 3 \le 3 + 4$.

Problem F. Christmas Eve

Time limit: 1 second
Memory limit: 256 megabytes

Christmas is coming, and Sakurako will celebrate it with her close-knit friends. To make it more fascinating, they plan to hold a gift exchange on Christmas Eve.

Sakurako knows that it will take place at a round table, and this gift exchange will be super simple: everyone will give their present to the person sitting to their right. Everyone has already decided where they will sit, except for Sakurako.

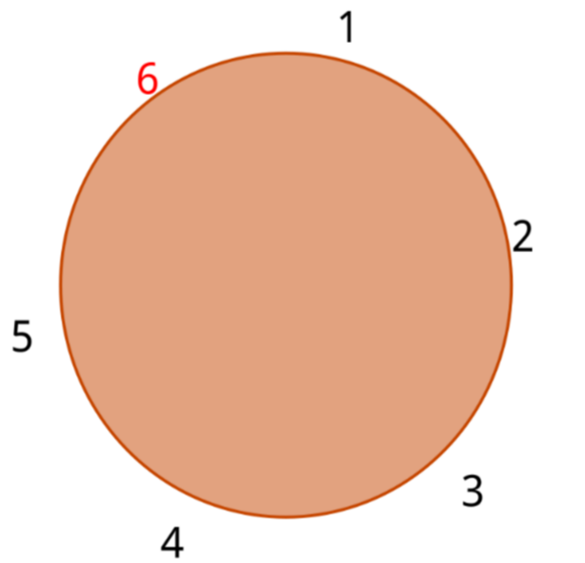
She also knows the price of each friend's gift; the i-th friend's gift costs a_i coins. Of course, after the exchange, someone might be disappointed if they receive a cheaper gift than the one they gave. Intuitively, their disappointment is described as the absolute difference between the cost of the gift they gave and the gift they received. The value Sakurako is interested in is the total disappointment.

More formally, if $b_1, b_2, \ldots, b_n$ are the costs of the friends' gifts respectively, then the total disappointment is calculated as:

$$|b_1 - b_2| + |b_2 - b_3| + \cdots + |b_{n-1} - b_n| + |b_n - b_1|.$$

Sakurako, on her end, bought a gift for x coins. Since she hasn't decided where to sit yet, you can give her a hint. Tell her what the minimal total disappointment might be if Sakurako chooses her position optimally, as she wants the Christmas Eve mood to be as cheerful as possible. With your hint, she will be able to find the optimal position by herself.

For example, if Sakurako has 5 friends where the i-th friend has bought a present for i coins and Sakurako's present costs 6 coins, then one of the possible places where Sakurako may sit is illustrated below:



Here, Sakurako sits between the first and the fifth friend. Hence, the total disappointment is $|1-2| + |2-3| + |3-4| + |4-5| + |5-6| + |6-1| = 10$.

Input

The first line contains two integers n and x ($1 \le n \le 2 \cdot 10^5; 0 \le x \le 10^9$) — the number of friends and the cost of Sakurako's present.

The second line contains n positive integers $a_1, a_2, \ldots, a_n$ ($0 \le a_i \le 10^9$) — the costs of the friends' presents.

Output

Output one integer — the minimal total disappointment after Sakurako takes her place.

Scoring

In this problem, there are conditional blocks. If your solution works correctly for certain constraints, it will receive a certain number of points. Note that testing is going test by test, but not by blocks.

1. (40 points): $n \leq 10^3$;
2. (60 points): without additional constraints.

Example

standard input	standard output
5 6 1 2 3 4 5	10

Problem G. Chefir is Lost

Time limit: 1 second
Memory limit: 256 megabytes

Recently, Chefir got lost on a coordinate axis. Right now he is in position n. In order to get to Sakurako, who's in position x, he can repeat the following operations multiple times:

If your current position is a, you may change it to:

1. $a = a - q$, where q is the minimum divisor of a such that $q > 1$.
2. $a = a - w$, where w is the maximum divisor of a such that $w < a$.

Your task is not only to determine whether there is a sequence of operations which will help Chefir get from position n to position x, but also to output it.

Input

The first line contains two integers n and x ($2 \le x < n \le 10^{12}$).

Output

If it is possible to do so, print "`YES`"; otherwise, print "`NO`".

If it is possible to do so, in the next line output a single integer k ($0 \le k \le 500$) — the amount of shorten operations that you are planning to do. There is **no** need to minimize k.

Each of the next k lines should contain two integers op, y ($op \in \{1, 2\}$ and $1 \le y \le 10^{12}$) — the type of operation that you are making and the amount of times that you will be repeating this operation.

Scoring

In this task, each test is scored individually.

In this task, you can get partial points by only answering whether there is a way for Chefir to get from position n to position x.

In order to get full points, you are supposed to give out the exact way of getting from n to x.

If you correctly determine that there is a sequence, but you print out $k = 0$ and no proof after that, you will get 50% of the points.

Examples

standard input	standard output
20 9	YES 2 1 1 2 1
25 9	YES 2 1 2 2 1
24 13	NO

Note

In the first example, the optimal solution is:

1. first subtract 2 as the smallest divisor of 20, making $n = 18$;

2. subtract 9 from 18 as the biggest divisor of n that is not equal to n.

Now $n = 9$, which is equal to x.

In the second example, n changes in the following way:

$25 \to 20 \to 18 \to 9$.

We can prove that there is no way to get from 24 to 13.

Problem H. Sakurako and a Falling Tree

Time limit: 1.5 seconds
Memory limit: 256 megabytes

When there is a cat and a Christmas tree....

Sakurako is afraid that Chefir will knock over her beautiful Christmas tree and break all m decorations on it. In order to prevent this, she will select some vertices of the tree and reinforce them.

The tree can be represented as a graph with nodes labeled as numbers from 1 to n, in which every node except for the root node (marked as node 1) has a parent node with a label that has a value smaller than its own.

The decoration will not break if and only if it is connected with at least one another decoration. A pair of decorations (x, y) is considered to be connected if all nodes on a path from x to y are reinforced. A path from x to y is a list of nodes that would provide the fastest passage between them if you could only move from a node to its parent or child nodes.

Your task is to find the minimum number of vertices that need to be reinforced so that none of Sakurako's decorations break.

Input

The first line contains two integers n and m ($2 \leq m \leq n \leq 10^6$).

The second line contains $n-1$ numbers $p_2, p_3, \ldots, p_n$ ($2 \leq i \leq n$) — the node to which the i-th node is connected.

The third line contains m numbers $a_1, a_2, \ldots, a_m$ ($1 \leq a_i \leq n$) — different positions of each of the m decorations.

Output

Output one number — the minimal amount of vertices that need to be reinforced in order for every decoration to remain intact.

Scoring

In this problem, there are conditional blocks. If your solution works correctly for certain constraints, it will receive a certain number of points. Note that testing is going test by test, but not by blocks.

1. (13 points): $n \leq 15$;
2. (10 points): $m = 2$;
3. (31 points): $n \leq 10^4$;
4. (46 points): without additional constraints.

Example

standard input	standard output
11 6 1 1 1 1 5 6 7 8 8 8 2 3 4 9 10 11	8

Note

In the first test case, we will be choosing nodes $1, 2, 3, 4, 8, 9, 10, 11$. The decorations would be connected in the following way: $1 \iff 2$, $1 \iff 3$, $4 \iff 5$, $5 \iff 6$.