Problem A. Algebraic Sequence

Input file:	standard input
Output file:	standard output
Time limit:	2 seconds
Memory limit:	512 megabytes

Consider a sequence A of N elements. Check if you can rearrange its elements in a way that there exists the polynomial $A_0 + A_1 \cdot x + \ldots + A_N \cdot x^{n-1}$ that have 1 as the root.

Input

The first line of the input contains one integer N ($2 \leq N \leq 10^5$).

The second line contains N integers; i-th of those integers is the initial value of A_i ($-1000 \leq A_i \leq 1000$). You may assume that at least one of A_i is not equal to zero.

Output

Print 1, if you can rearrange the elements of A to obtain coefficients of a polynomial with a root 1, and 0 otherwise.

Examples

standard input	standard output
3 24 4 22	0
2 -1 1	1

Problem B. Big Step Of Queen

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

On the chessboard $n \times m$, the queen is placed. The queen may move at any square on the board, that is placed on same horizontal, vertical and diagonal with the square where the queen is currently placed.

Given the coordinates of the cell with the queen, find the most distant cell that can be reached by the queen in one move. The distance between cells is considered as the euclidean distance between its centers.

If there are a tie, choose the cell with least row coordinate. If there is still a tie, choose the cell with least column coordinate.

Input

The first line of the input contains two integer R and C — number of the rows and columns on the chessboard ($2 \le R, C \le 1000$). The second line contains two integers r_q and c_q — the row and column of the cell where the queen is placed ($1 \le r_q \le R$, $1 \le C_q \le C$. Rows and columns are enumerated from 1.

Output

Print two integers — the row and the column of the most distant cell where the queen can go in one move.

Examples

standard input	standard output
8 8 3 4	7 8
8 8 4 1	4 8

Problem C. Check The Fraction

Input file:	standard input
Output file:	standard output
Time limit:	2 seconds
Memory limit:	512 megabytes

Consider an integer $q > 1$ and the numeral system base $b > 1$. Check if the fraction p/q for some $0 < p < q$ can be represented as finite fraction in base b.

Input

The first line of the input contains two integers q and b ($2 \le b, q \le 10^9$), both in decimal notation.

Output

If there is no such p, print -1, otherwise print the minimal possible value of p.

Examples

standard input	standard output
6 10	3
5 8	-1

Problem D. Directions

Input file:	standard input
Output file:	standard output
Time limit:	2 seconds
Memory limit:	512 megabytes

Consider the following game for one player: given a stripe $1 \times N$. Some of those cells contains tokens with directions (left or right), no more than one token per cell. Initially, the player's score is equal to 0.

Player can move token to the cell that share a side with the current one, if there is no token in the target cell. If the token is moved in the same direction, as the token direction, the score is increased by 1, if the token is moved in the opposite direction, the score is decreased by 1.

Given the value of N and the token positions, calculate the maximal possible score that can be obtained by the player.

Input

The first line of the input contains two integers T ($1 \le T \le 10^5$), the number of the tokens, and N ($T \le N \le 10^9$) — the length of the stripe.

Each of the following N lines contains two integers p_i and d_i — the coordinate of the cell with the piece and its direction ($1 \le p_i \le N$, $0 \le d_i \le 1$). The cells are enumerated from left to right, starting by 1. If $d_i = 0$, the token is directed left, if $d_i = 1$, the token is directed right. You may assume that all p_i are pairwise distinct.

Output

Print one integer — the maximum possible score that can be reached.

Examples

standard input	standard output
2 11 4 0 6 1	8
2 9 2 1 9 0	6
2 9 1 0 9 1	0

Problem E. Encoded Palindrome

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

The *hexadecimal string*, i.e. string consisted of digits '`0`' - '`9`' and letters '`A`'-'`F`' is considered an *encoded palindrome*, if the binary string, obtained after replacement of hexadecimal digits with their **4-bit** representations (with leading 0's), is the palindrome.

You have the hexadecimal string. Your task is to rearrange the string and delete the least number of characters (or delete no characters, if that is possible) to obtain the encoded palindrome. If there are more than one encoded palindromes, print lexicographically maximal one. If it is impossible to build any encoded palindrome, print the empty string (as it is the encoded palindrome of length 0).

Input

The input contains the string S, consisting of digits '`0`' - '`9`' and letters '`A`'-'`F`' ($1 \le |S| \le 10^5$).

Output

Print the encoded palindrome of maximum possible length (as the **hexadecimal** string), that can be obtained by rearrangement and possibly deletion of some characters in the string S. If there are more than one encoded palindrome of the maximal length, print lexicographically maximal one.

Examples

standard input	standard output
10836006F	860F061
33	

Problem F. Find The Distance

Input file:	standard input
Output file:	standard output
Time limit:	2 seconds
Memory limit:	512 megabytes

Indiana Jones has set out to investigate the ancient treasure, which is submerged in the ocean. The treasure exists somewhere in the ocean. Indiana decided to use radar to get a rough idea of the location of the treasure from the shoreline, and to estimate how many miles away from the shoreline he would have swim go to investigate.

The observation points are placed on the coastline represented by the straight line, and the exploration radars are placed there. The radar can only tell us that there is the treasure inside or on the border of a semicircle of a certain radii r_i centered on the point where radar is placed. However, by combining multiple observation data, it is possible to narrow down the area to a smaller one.

Given some observation data, consisting of the location of the radars and the radius indicated by them, write a program to find out how far from the coastline Indiana need to survey at most.

Input

The first line of the input contains the number of the radars N ($1 \leq N \leq 10^5$). Each of the following N lines contains two integers x_i that represents the position of the radar i on the coastline in miles ($0 \leq x_i \leq 10^6$) and integers r_i that represents the number of miles within a radius reported by that radar ($1 \leq r_i \leq 10^6$). Two or more observation data with the same observation point x_i may be given.

You may assume that data is consistent, i.e. that there is always a point included in all of those semicircles.

Output

Outputs the actual number of miles that need to be investigated from the coastline with absolute error 10^{-3} or better.

Example

standard input	standard output
2 0 3 1 3	2.9580398916

Problem G. Game Of Risk of Rain

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

In the shooting game `Risk of Rain` the attack with some probability a (that is an integer percent) can be critical.

There is magical item — `Clover` which works in the following way: if the attack is not critical, then additional random check is performed and with same probability the attack become critical.

If the player have k `Clovers` in the inventory, then test if the attack was critical, is performed k additional times.

You are given the percentage of the critical attack b with k `Clovers` in the inventory. Your task is to reconstruct the minimal value of **integer percentage** a.

Input

The first line of the input contains one integer t — the number of the test cases ($1 \le t \le 2020$).

Then t lines follow. Each line represents one test case and contains two integers b and k ($0 \le b \le 100$, $1 \le k \le 20$) — the resulting probability, in percents, and number of `Clovers` in the inventory.

Output

Print t lines, each containing one integer — the answer to the respective test case.

Example

standard input	standard output
2 50 1 99 1	30 90

Problem H. How Many Coins Are Taken?

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Given a rectangular grid $n \times m$. Let's denote the intersection of i-th row and j-th column as (i, j).

Initially Alice puts on the each cell contains exactly one coin.

But then arrives Bob and did k actions of two types:

- "`+ s`" — take all coins placed on the cells (i, j) such as $i + j = s$ $(2 \le s \le n + m)$;
- "`- d`" — take all coins placed on the cells (i, j) such as $i - j = d$ $(1 - m \le d \le n - 1)$;

Your task is to count number of the coins taken by Bob.

Input

The first line of the input contains two integers n and m — the dimensions of the board $(1 \le n, m \le 10^9)$.

The second line contains one integer k $(0 \le k \le 300\,000)$ — the number of Bob's actions.

Each of the following k lines contains one action in the format described in the statement. The actions are listed in the same order as they are performed.

Output

Print one integer — the number of the coins taken by Bob.

Example

standard input	standard output
4 4 3 + 3 + 6 - 0	8

Problem I. Integers And Bitcount

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Find two non-negative integers x and y such as $\texttt{bitcount}(x) = a$, $\texttt{bitcount}(y) = b$ and $\texttt{bitcount}(x + y) = c$.

Here $\texttt{bitcount}(x)$ is number of ones in the binary representation of the integer x.

Input

The first line of the input contains three integers a, b and c ($0 \le a, b, c \le 10^5$).

Output

If it is impossible to find those integers, print "`No`".

Otherwise print "`Yes`" at the first line, in the second line print the binary representation of the integer x, in the third line — the binary representation of the integer y. The length of each integer should not be greater than 10^6.

Examples

standard input	standard output
1 1 1	Yes 1 1
1 2 3	Yes 10 101
1 1 10	No

Problem J. Jumping Subsequences

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Task about the queries on the segment, task about the subsequence, task about the queries on the segment, task about the subsequence, another task about the queries on...

How interesting... And what will be those two ideas are merged in the one task...

Given string S consisting of lowercase English letters. Additionally you are given the queries; each query is the segment l_i, r_i. To answer the query, you shall determine the lenth of the maximal *jumping* subsequence of the substring $S[l..r]$.

We will call the sequence *jumping*, if it have the form "`xyxyx...`" for some two **distinct** letters x and y.

Additionally, you shall print those two letters that are forming the maximal jumping subsequence. If there are more than one solutions, print one where the first character is lexicographically minimal, if there is still a tie, print one where the second character is minimal.

Input

The first line of the input contains one string S ($1 \le |S| \le 300\,000$) consisting of lowercase English letters.

The second line contains one integer m — the number of queries ($1 \le m \le 30\,000$).

Each of the following m lines contains two integers l_i and r_i — the start and the finish of the substring from the i-th query ($1 \le l_i \le r_i \le |S|$).

Output

For each query, print the answer in the separate line: first the length of the maximal jumping subsequence, then the letters that are forming it.

Example

standard input	standard output
abacaba 6 1 7 2 6 1 3 2 3 2 4 4 4	5 ab 3 ac 3 ab 2 ba 2 ac 1 ca

Problem K. Keep Them Equal

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

Given a tree — the connected graph of n vertices and $n-1$ edges.

When the vertex is deleted from the tree, it turns into the several trees.

For each vertex you shall find the second vertex such as if those two vertex will be deleted from the tree, then the size (i.e. the number of vertices) of the maximal of the resulting trees will be minimal as possible.

Input

The first line of the input contains one integer n — the number of the vertices ($2 \le n \le 300\,000$).

Each of the following $n-1$ lines contains two integers a_i and b_i, denoting that those vertices are connected by the edge ($1 \le a_i, b_i \le n$).

Output

For each $1 \le i \le n$ print in the new line the number of the second vertex to be deleted with the vertex i.

If there are more than one solutions, print any of them.

Example

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

Problem L. Little Sasha and Circles

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

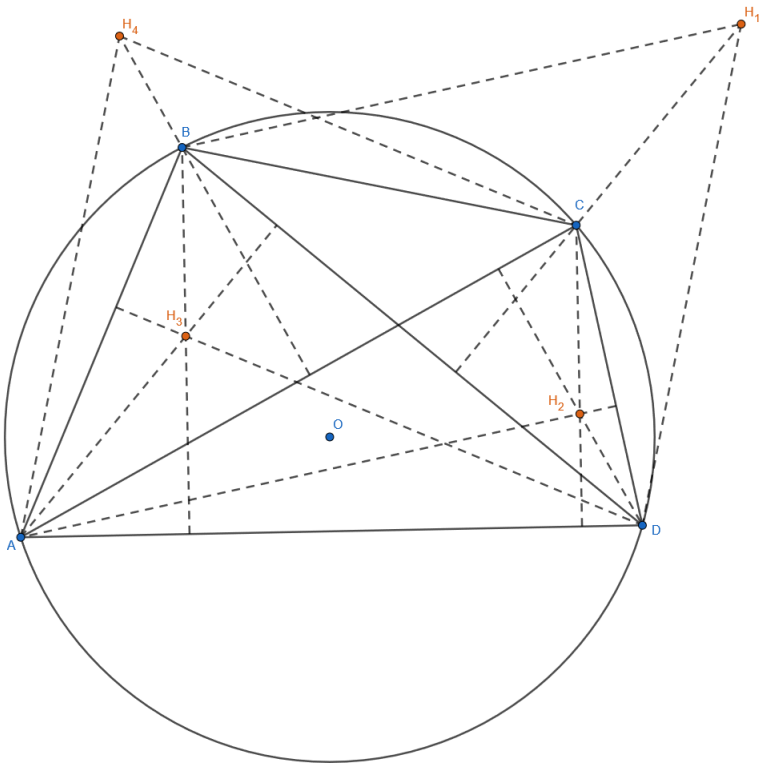
Little Sasha likes geometry, even if he is not so strong in math. He likes to create the interesting geometry drawings.

Yesterday Sasha returned from the school and created the following picture. First, he marked the point O as the center of the coordinate system with axis Ox and Oy, then he drew the circle with the center in O and choose selected points A, B, C and D on that circle.

Then he considered the triangles BCD, ACD, ABD and ABC and marked the intersection point of the heights in those triangles H_1, H_2, H_3 and H_4.

After some time Sasha looked at the drawing and found that all drawing disappeared except for the points H_1, H_2, H_3, H_4 and O.

Help little Sasha to restore the points A, B, C and D or tell that it is impossible.



Its how the drawing may look like

Input

The input consists of the 4 lines. i-th of those lines contains two integers x_i and y_i – the coordinates of the point H_i. Coordinates are not exceeding 10^8 by the absolute value.

Output

If it is possible to uniquely restore the coordinates of the points, print "`YES`", then in each of following four lines print the coordinates of the points A, B, C, D, in that order, otherwise print "`NO`".

The coordinates shall be printed with absolute or relative error 10^{-9} or better.

Examples

standard input	standard output
0 1 1 0 0 -1 -1 0	YES 0.000000000000 -1.000000000000 -1.000000000000 0.000000000000 0.000000000000 1.000000000000 1.000000000000 0.000000000000
0 1 0 2 0 -1 0 -2	NO

Problem M. Modular Recurrent Sequence

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

Consider the sequence $\{f_i\}$ such as $f_0 = 0$, $f_1 = 1$, and $f_n = (af_{n-1} + bf_{n-2}) \mod p$, where p is prime and $1 \le a, b < p$.

Your task is to answer the queries in the form "check if exists the index i such as $f_i = x$ and $f_{i+1} = y$".

Input

The first line of the input contains three integers p, a, b ($0 < a, b < p \le 10^6$). The second line contains one integer $1 \le q \le 10^6$ – the number of the queries. Each of the following q lines contains one query — two integers x and y ($0 \le x, y < p$).

Output

For each query, if the sequence does not contain the pair (x, y) as the continuous subsequence, print -1. Otherwise print $t_i \ge 1$ — the minimal index of the first number in such pair.

Examples

standard input	standard output
5 1 1 3 0 1 1 1 3 3	20 1 6
5 3 2 3 0 1 1 3 3 1	24 1 2