Problem A. Coloring

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 megabytes

A *coloring* of an undirected graph T is a function $C\colon V(T) \to \mathbb{N}$ where $V(T)$ is a set of vertices of T. A coloring C is *pretty* if for every two vertices a and b they are connected with an edge if and only if $|C(a) - C(b)| = 1$.

You are given an undirected graph. Find some pretty coloring of this graph or report its nonexistence.

Input

The first line of input contains two integers n and m ($1 \le n \le 2 \cdot 10^5$, $0 \le m \le 2 \cdot 10^5$): the number of vertices and the number of edges in the graph. Each of the next m lines contains two integers x and y ($1 \le x, y \le n$) which are the pair of vertices connected by the corresponding edge. Loops and multiple edges *are not allowed.*

Output

If a pretty coloring does not exist, print "`NET`" ("no" in Russian) on the single line of the output.

Otherwise, print "`DA`" ("yes" in Russian) on the first line. On the next line, print n integers $C(1), \ldots, C(n)$ for some pretty coloring C. The values of $C(x)$ should satisfy the constraints $1 \le C(x) \le 10^9$. If there are multiple possible answers, print any one of them.

Examples

standard input	standard output
2 1 1 2	DA 1 2
3 3 1 2 2 3 3 1	NET
5 4 1 2 2 3 2 4 4 5	DA 1 2 1 3 4

Problem B. Robot

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2.5 seconds
Memory limit:	256 megabytes

You are participating in a robot programming contest. In the next competition, your robot has to pass through n points on a plane in a fixed order. However, your robot's path must satisfy the following requirements:

- Each part of the path between two adjacent points must be either a line segment or a circular arc.
- The whole path must form a smooth curve. In particular, it means that the directed tangents to adjacent parts of the path in their common point must coincide.

In order to win, you have to find a path for your robot which has the minimum possible length.

Input

The first line of input contains a single integer n ($2 \le n \le 1000$), the number of points. Each of the next n lines contains two integers x_i and y_i not exceeding 10^6 by absolute value: the coordinates of the i-th point. The robot must visit these points in the order they are given in the input. Every two adjacent points are distinct. However, it is not guaranteed that all points in the input will be distinct.

Output

Print one real number: the length of the shortest path. Your answer will be accepted if the absolute or relative error is no more than 10^{-6}.

Examples

standard input	standard output
2 0 0 3 4	5.0000000000
5 1 0 0 1 -1 0 0 -1 1 0	6.2831853072

Problem C. Cosine

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 megabytes

You are given two rational numbers x and y. Find a non-degenerate triangle with integer side lengths such that the cosine of one angle is x and the cosine of another is y, and print its side lengths.

Input

The four lines of input contain four integers, one per line: P, Q, U and V ($-10^9 \le P, U \le 10^9$, $1 \le Q, V \le 10^9$). These integers define x and y as follows: $x = \frac{P}{Q}$, $y = \frac{U}{V}$.

Output

If such a non-degenerate triangle exists, print three integers on the only line of output: its side lengths in non-descending order. The numbers should be coprime, that is, the greatest common divisor of these three integers should be equal to 1. If there are multiple possible answers, print any one of them.

If such a non-degenerate triangle does not exist, print one number -1 on the only line of output.

Examples

standard input	standard output
3 5 4 5	3 4 5

Problem D. Billiard

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Let G be a convex polygon and p a point lying strictly outside of the polygon. There are two tangents from p to G. Let's take the "right" one (related to p) and assume that q is the tangent point and r is the point symmetrical to p if q is the center of symmetry. We say $r = T(p)$ and call T a *billiard transform*.

A tangent pq from point p to a convex polygon G, where q is the tangent point, is called "right" if for every point $u \in G$ the counter-clockwise rotation from vector $\vec{pq}$ to vector $\vec{pu}$ is in the interval $[0, \pi)$.

Here is an example which may help you better understand what T is. Suppose G is a triangle with vertices $(0, 0)$, $(2, 0)$, $(1, 1)$ and p has coordinates $(-1, -1)$. Then the "right" tangent will pass through vertex $(2, 0)$, so $T(p) = (5, 1)$. Similarly, $T((3, 0)) = (-1, 2)$, $T((3, 2)) = (-1, 0)$, $T((3, 4)) = (-3, -4)$. In some cases the "right" tangent may touch the polygon not in the vertex, but by the side. If this happens, $T(p)$ is undefined. For example, for the former G the values $T((3, 3))$, $T((-1, 0))$, $T((4, -2))$ are undefined.

Consider the sequence $S(p) = (p, T(p), T(T(p)), \ldots)$. Depending on the behavior of this sequence, the set of all points p outside of the polygon may be divided into three classes:

1. The sequence $S(p)$ is finite (that is, $T(v)$ is undefined for its last term v).
2. The sequence $S(p)$ is infinite and periodic, maybe with some preperiod.
3. The sequence $S(p)$ is infinite and non-periodic.

In this problem, the "billiard table", or the figure G, is the parallelogram $OABC$, where $O = (0, 0)$. You are given the coordinates of some "table" and a point strictly outside of it. Find the type of this sequence. If this sequence is periodic (of type 2), find the period.

Input

The first line of input contains one integer T ($1 \le T \le 3 \cdot 10^5$) which is the number of test cases. Each of the next T lines contains six integers x_A, y_A, x_C, y_C, x_p, y_p not exceeding 10^9 by absolute value: the coordinates of points A, C and p. It is guaranteed that $OABC$ is a non-degenerate parallelogram and that p lies strictly outside of it.

Output

Print one number per test case. This number should be:

- -1 if the sequence is finite,
- Period length if the sequence is periodic,
- -3 if the sequence is infinite and non-periodic.

Each number must be printed on a separate line.

Examples

standard input	standard output
2 0 2 2 0 1 -1 1 0 0 1 -1 1	4 -1

Problem E. Queue

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 megabytes

There are some people standing in a line. Some people are leaving the line. More specifically, every second, the following happens.

1. The remaining people are enumerated from 1 to m from left to right where m is the number of people in the line.
2. One person leaves the line. It may be either the person number l or the person number $m - r + 1$ where l and r are some constants. Note that one of the options above may not be possible if $l > m$ or $r > m$. However, the constraints will guarantee that at least one of the options is possible.

This process continues for k seconds.

You are given numbers n, l, r and k. Find how many different sets of people could remain after k seconds. Two sets of people are different if and only if there is a person present in one set and not present in the other. Since the answer can be quite big, you must find it modulo $10^9 + 7$.

Input

The first line of input contains one integer T ($1 \le T \le 10^5$): the number of test cases. Each of the next T lines contains integers n, l, r and k ($1 \le n, l, r, k \le 10^{18}$) describing the test cases. It is guaranteed that in each test case, $k \le n - min(l, r) + 1$, that is, in each of the k seconds, at least one of the options at step 2 is possible.

Output

Print T lines: the i-th line must contain the answer to the i-th test case modulo $10^9 + 7$.

Examples

standard input	standard output
4	2
3 1 1 1	2
6 2 3 4	3
9 2 2 2	1
9 1 5 9	

Problem F. Rank

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 megabytes

You are given a matrix which contains only 0s and 1s. Furthermore, there are exactly two 1s in every column of this matrix. Calculate the rank of this matrix.

A *rank* of a matrix is a maximum number k such that there exist a set of k linearly independent rows. A set $\{v_1, \ldots, v_k\}$ is called *linearly independent* if and only if for any real numbers $a_1, \ldots, a_k$ such that $a_1^2 + \ldots + a_k^2 \neq 0$ the inequality $a_1 \cdot v_1 + \ldots + a_k \cdot v_k \neq \overline{0}$ holds.

For the rows, we assume the use of the standard rules of multiplication by a scalar and addition:

$$\begin{aligned} a \cdot (u^{(1)}, \ldots, u^{(m)}) &= (au^{(1)}, \ldots, au^{(m)}), \\ (u^{(1)}, \ldots, u^{(m)}) + (v^{(1)}, \ldots, v^{(m)}) &= (u^{(1)} + v^{(1)}, \ldots, u^{(m)} + v^{(m)}). \end{aligned}$$

A zero row is $\overline{0} = (0, \ldots, 0)$.

Input

The first line of input contains two integers n and m ($2 \leq n \leq 2 \cdot 10^5$, $1 \leq m \leq 2 \cdot 10^5$): the number of rows and columns in the matrix. Next $2 \cdot m$ lines each contain two integers r and c ($1 \leq r \leq n$, $1 \leq c \leq m$) specifying the position of a 1 in the matrix. Here, r is the row and c is the column. Any cell which was not mentioned in this list contains a zero. It is guaranteed that all pairs (r, c) will be distinct and that there will be exactly two 1s in each column of the matrix.

Output

Print the only number: the rank of the given matrix.

Examples

standard input	standard output
3 3 1 1 2 1 2 2 3 2 1 3 3 3	3
2 3 1 1 1 2 1 3 2 1 2 2 2 3	1

Problem G. Remarkable Substrings

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

Let S be a string consisting of lowercase English letters. A nonempty string T is called a *remarkable* string of rank k with respect to S if the string $k \cdot T = T + T + \ldots + T$ (that is, T repeated k times) is a substring of S. More formally, $S = U + k \cdot T + V$ where U and V are some (possibly empty) strings.

Given a string S, find the maximum possible rank x such that there exists a string T which is a remarkable string of rank x with respect to S.

Input

The only line of input contains the string S ($1 \le |S| \le 10^6$). It is guaranteed that S consists only of lowercase English letters.

Output

Print one number: the maximum rank of a remarkable string with respect to S.

Examples

standard input	standard output
aaabc	3
abacacacacaba	4

Problem H. Moderate Numbers

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 megabytes

A positive integer is called a *moderate number* if the product of its digits is equal to their sum.

You are given an integer n. Find the n-th moderate number. Moderate numbers are numbered starting from 1.

Input

The only line of input contains a single integer n ($1 \le n \le 10^{18}$).

Output

Print the n-th moderate number on the only line of the output.

Examples

standard input	standard output
5	5
10	22

Problem I. Sum of Powers

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 megabytes

Consider the set of integers $\{0, 1, 2, \ldots, 2^n - 1\}$. Your task is to divide it into two sets, A and B, so that the sums of k-th powers of elements in these sets are equal, or report that such a division is impossible.

In this problem, we assume that $0^0 = 1$.

Input

The only line of input contains two integers n and k ($0 \le k < n \le 16$).

Output

If a solution exists, print 2^n letters without spaces on a single line: for each integer from 0 to $2^n - 1$, print the name of the set in which you put it (letter "`A`" or "`B`"). If there is more than one possible solution, print any one of them.

If the division is impossible, print "`NO SOLUTION`" on a single line instead.

Examples

standard input	standard output
2 1	ABBA

Problem J. Tree Distance

Input file:	`standard input`
Output file:	`standard output`
Time limit:	6 seconds (*10 seconds for Java*)
Memory limit:	256 megabytes

You are given an undirected tree T. Let S be the set of all integers x such that there exist two distinct leaves u and v in T satisfying $d(u, v) = x$. Here, $d(u, v)$ is the number of edges on the shortest path between u and v. Find this set S.

Input

The first line of input contains one integer n ($1 \le n \le 200\,000$), the number of vertices in the tree. Each of the next $n - 1$ lines contains two integers x and y ($1 \le x, y \le n$): the numbers of vertices connected by the corresponding edge. It is guaranteed that the resulting graph is a tree.

Output

On the first line, print the number of elements in S. After that, print all elements of S in ascending order, one per line.

Examples

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

Problem K. Dot Product

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds (*6 seconds for Java*)
Memory limit:	256 megabytes

You have two arrays A and B of the same length. You must process three kinds of queries.

- "`*` l r x": add an integer x to all A_i where $l \le i \le r$.
- "`.` l r x": add an integer x to all B_i where $l \le i \le r$.
- "`?` l r": calculate the sum $A_l \cdot B_l + \ldots + A_r \cdot B_r$.

Arrays are 1-indexed. Initially, both arrays are filled with zeroes.

Input

The first line of input contains two space-separated integers n and m: the arrays' lengths and the number of queries, respectively ($1 \le n, m \le 100\,000$).

The next m lines contain queries in the format described above. In each query, $1 \le l \le r \le n$ and $1 \le x < 10^9 + 7$.

Output

For each query of the third type, print its result modulo $10^9 + 7$ on a separate line.

Examples

standard input	standard output
5 4 * 1 4 10 . 2 5 8 ? 1 3 ? 2 5	160 240