Problem A. Exponentiation

Time limit: please refer to DOM Judge
Memory limit: please refer to DOM Judge

Your task is to efficiently calculate values a^b modulo $10^9 + 7$.

Input

The first input line contains an integer n: the number of calculations.

After this, there are n lines, each containing two integers a and b.

- $1 \le n \le 2 \cdot 10^5$
- $1 \le a, b \le 10^9$

Output

Print each value $a^b \mod 10^9 + 7$.

Examples

Standard Input	Standard Output
3 3 4 2 8 123 123	81 256 921450052

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Problem B. Longest Common Substring

Time limit:	please refer to DOM Judge
Memory limit:	please refer to DOM Judge

You are given two string S and T, find the length of the longest common substring.

A substring is a contiguous sequence of characters within a string. For example, both "BAA" and "ABABA" are substring of "ABABABAA".

Longest common substring of two or more strings is a longest string that is a substring of all of them.

Input

The first input line contains a string S.

The second input line contains a string T.

- $1 \leq |S|, |T| \leq 5 \cdot 10^5$, where $|S|$ denote the length of string S.
- Both S and T consist of two different lowercase English letters.

Output

Print an integer, the length of the longest common substring of S and T.

Examples

Standard Input	Standard Output
abccba bccd	3

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Problem C. Convex Hull Area

Time limit:	please refer to DOM Judge
Memory limit:	please refer to DOM Judge

Given n points on 2D plane. The coordinate of the i-th point is (x_i, y_i).

Please find the area of their convex hull.

Input

The first input line contains an integer n — the number of points.

The i-th of the next n lines contains two integers x_i, y_i — the coordinate of the i-th point.

- $3 \leq n \leq 2 \times 10^5$
- $-10^9 \leq x_i, y_i \leq 10^9$ for $i = 1, 2, \ldots, n$

Output

You should print two integers $2a$, where a is the area of the convex hull.

Examples

Standard Input	Standard Output
5 0 0 0 2 2 0 2 2 1 1	8
6 2 1 2 5 3 3 4 3 4 4 6 3	16

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Problem D. Road Maintenance

Time limit: please refer to DOM Judge
Memory limit: please refer to DOM Judge

There are n cities and m roads connect some of the cities. Sometimes, certain roads are under maintenance and we cannot go through the roads. After assessment, there are at most k roads under maintenance at the same time.

Your task is to determine the minimum number of road need to be added so that there is always a path from city 1 to city n at any moment.

Note that after adding these roads, there may be some cities u, v such that there is more than one road from u to v. The added road may also under maintenance.

Input

The first input line contains three integers n, m, k.

The i-th of the next m lines contains two integers u_i, v_i, which means there is a road from city u_i to city v_i. For every pair of cities u, v, there is at most one road from u to v.

- $2 \leq n \leq 500$
- $1 \leq m, k \leq 1000$
- $1 \leq u_i, v_i \leq n$

Output

Print an integer h: The minimum number of road need to be added so that there is always a path from city 1 to city n at any moment.

Examples

Standard Input	Standard Output
6 7 2 1 2 1 3 2 6 3 4 3 5 4 6 5 6	1

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Problem E. Link Cut Treap

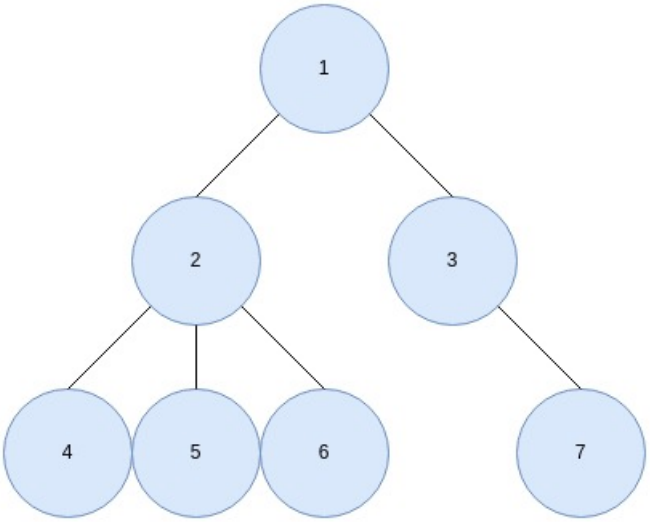
Time limit:	please refer to DOM Judge
Memory limit:	please refer to DOM Judge

You are given a rooted tree with n vertices and $n-1$ edges. The tree is rooted at vertex 1.

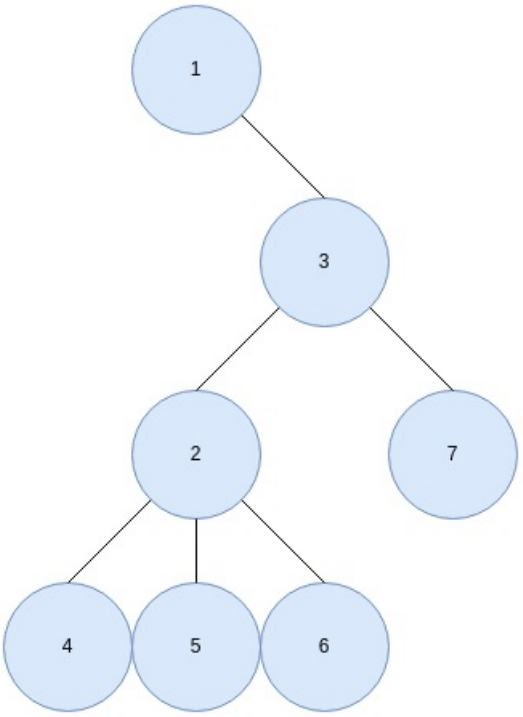
You are asked to perform q operations. There are 2 types of operations:

- For $type = 1$, cut the subtree rooted at u and link its parent to v.
- For $type = 2$, output the maximum vertex id in the subtree of p.

Here's an example of a tree rooted at vertex 1.



After an operation of $type = 1, u = 2, v = 3$, the tree becomes



Please output an integer for each operation of $type = 2$.

Input

The first input line contains an integer n: the number of vertices of the tree.

After that, there are $n-1$ lines. Each line consists of 2 integers x and y, representing that there is an edge between x and y in the tree.

The next line contains an integer q: the number of operations.

After that, there are q lines describing the operations. The format of each operation is one of the following: "1 u v" or "2 p".

- $3 \leq n, q \leq 2 \cdot 10^5$
- $type \in \{1, 2\}$
- $1 \leq u, v \leq n$
- For $type = 1$ operations, v is guaranteed not in subtree of u.

Output

Please output an integer for each operation of $type = 2$.

Examples

Standard Input	Standard Output
7 1 2 3 1 5 2 2 4 6 2 3 7 7 2 2 2 3 2 6 1 2 3 2 2 2 3 2 6	6 7 6 6 7 6
3 1 2 1 3 7 2 1 2 2 2 3 1 3 2 2 1 2 2 2 3	3 2 3 3 3 3

Problem F. Rectangles Perimeter

Time limit:	please refer to DOM Judge
Memory limit:	please refer to DOM Judge

Given n rectangles, your task is to calculate the total perimeter length of their boundary.

Here is an example with 7 rectangles is shown in Figure 1.

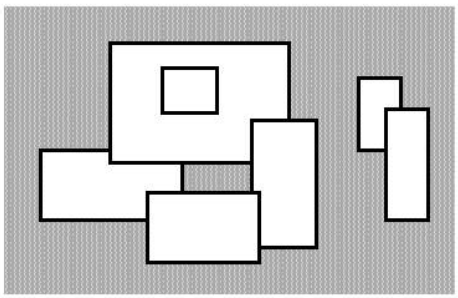


Figure 1. A set of 7 rectangles

The corresponding boundary is the whole set of line segments drawn in Figure 2.

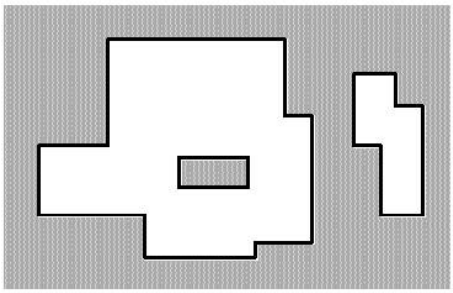


Figure 2. The boundary of the set of rectangles

Input

The first input line contains an integer n: the number of rectangles.

After that, there are n lines describing the rectangles. Each line has four integers x_1, y_1, x_2 and y_2: a rectangle begins at point (x_1, y_1) and ends at point (x_2, y_2)

- $1 \leq n \leq 10^5$
- $-10^6 \leq x1, x2 \leq 10^6$
- $-10^6 \leq y1, y2 \leq 10^6$

Output

The output must contain a single line with a non-negative integer which corresponds to the perimeter for the input rectangles.

Examples

Standard Input	Standard Output
7 -15 0 5 10 -5 8 20 25 15 -4 24 14 0 -6 16 4 2 15 10 22 30 10 36 20 34 0 40 16	228
3 0 0 1 1 1 0 2 1 2 0 3 1	8
2 0 0 1 1 1 1 2 2	8