Problem A. Distance Between Two Closest Points (on a Line)

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

You are given n points on the axis Ox. The i-th has coordinate $x = x_i$. Print the distance between two closest (nearest) points.

Input

The first line contains n ($2 \leq n \leq 2 \cdot 10^5$) — number of points. The second line contains the sequence of integer numbers $x_1, x_2, \ldots, x_n$ ($-10^9 \leq x_i \leq 10^9$) — coordinates of the points. It is possible that some points coincide.

Output

Print the distance between a pair of closest (nearest) points.

Examples

standard input	standard output
5 -6 3 10 7 22	3
6 1 2 1 2 1 2	0
2 -1000000000 1000000000	2000000000

Problem B. Intersection of Segments (on a Line)

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

You are given n segments on the axis Ox. The segments are given by their two ends: a_i and b_i — are coordinates of the left and right ends of the i-th segment. The ends of each segment are given in arbitrary order, i.e. it is not guaranteed that a_i is the left end and b_i is the right end.

Intersect all the segments, i.e. find (if any) such maximal segment on the axis Ox that it belongs to each of the given n segments.

Print the length of the intersection of the n given segments, or print 0 if they do not have the intersection.

In this problem any segment can degenerate to a point, i.e. for any segment in this problem it is possible that its left end coincides with its right end.

Input

The first line contains integer n ($1 \leq n \leq 2 \cdot 10^5$) — number of segments. The following n lines contain integers a_i and b_i each ($-10^9 \leq a_i, b_i \leq 10^9$) — coordinates of the ends of the i-th segment.

Output

Print the length of the intersection or 0 if they don't intersect.

Examples

standard input	standard output
3 -5 -9 -7 7 10 -6	1
2 1 10 13 7	3
2 10 20 100 5	10
1 1000000000 -1000000000	2000000000

Problem C. Two Rectangles Intersection

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

You are given two rectangles on a plane. Sides of both rectangles are parallel to the coordinate axes (i.e. all sides are horizontal/vertical).

In this problem the rectangle is a part of a plane on its boundary and inside it (i.e. rectangle is not only its boundary, but it is also the interior). The rectangles are given by coordinates of two opposite corners.

Check if two given rectangles intersect (i.e. they have at least one common point). Thus, the intersection only by a side or even only on a corner is considered as the intersection. Print "**Yes**" or "**No**".

Input

The first line contains four integer numbers $x_{11}, y_{11}, x_{12}, y_{12}$ ($-10^9 \leq x_{11}, y_{11}, x_{12}, y_{12} \leq 10^9$), where (x_{11}, y_{11}) and (x_{12}, y_{12}) — the coordinates of two opposite corners of the first rectangle.

The second line contains four integer numbers $x_{21}, y_{21}, x_{22}, y_{22}$ ($-10^9 \leq x_{21}, y_{21}, x_{22}, y_{22} \leq 10^9$), where (x_{21}, y_{21}) and (x_{22}, y_{22}) — the coordinates of two opposite corners of the second rectangle.

Output

Print "**Yes**" if the given rectangles intersect, print "**No**" if they don't intersect.

Examples

standard input	standard output
1 6 4 3 2 2 9 4	Yes
2 2 3 3 1 1 2 2	Yes
1 1 2 2 3 3 4 4	No
-1 1 1 -1 1 4 -1 1	Yes
-1 -1 1 1 0 0 0 0	Yes

Examples

standard input	standard output
2 0 0 10 10	100
1 -10000 10000	0
5 3 7 4 11 8 4 2 1 8 3	60

Problem D. Covering Rectangle

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

Given n points on a plane. Find the minimal rectangle with sides parallel to the axes which covers all the points.

Print the area of the minimal rectangle which covers all the given points. The sides of the rectangle should be parallel to the coordinate axes (i.e. all the sides are horizontal/vertical). The required rectangle can degenerate to be a segment or even to be a point (in this case its area is zero).

Input

The first line contains n ($1 \le n \le 2 \cdot 10^5$) — the number of points. The following n lines contain two integers x_i, y_i ($-10^4 \le x_i, y_i \le 10^4$) — the coordinates of the i-th points. Points can coincide.

Output

Print the area of minimal rectangle covering all the given points. The sides of the rectangle should be parallel to the coordinate axes (i.e. all the sides are horizontal/vertical).

Problem E. Segment Middle

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

Given segment on a plane. The segment is given by coordinates of its two ends. Print the middle point of the given segment.

Input

The first line contains integers x_1, y_1, x_2, y_2 ($-10000 \le x_1, y_1, x_2, y_2 \le 10000$), where (x_1, y_1) and (x_2, y_2) are coordinates of two its endpoints. It is guaranteed that segment has positive (i.e. non-zero) length.

Output

Print the coordinates the middle as two floating point numbers.

Examples

standard input	standard output
3 5 10 9	6.5 7
0 0 10 10	5 5
0 10 0 -10	0 0

Problem F. K-point

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

Given segment AB on a plane. The segment is given by coordinates of the point A and by coordinates of the point B. Also you are given positive integer k. Find such point M that:

- M belongs to the segment AB,

- AM is k times longer than BM.

Input

The first line contains integers x_1, y_1, x_2, y_2 ($-10000 \le x_1, y_1, x_2, y_2 \le 10000$), where (x_1, y_1) and (x_2, y_2) are coordinates of two its endpoints. It is guaranteed that segment has positive (i.e. non-zero) length.

The second line contains integer k ($1 \le k \le 100$).

Output

Print the coordinates the required point as two floating point numbers. Print at least 9 digits after the decimal point.

Examples

standard input	standard output
3 5 10 9 3	8.2500000000 8.0000000000
0 0 10 10 3	7.5000000000 7.5000000000
0 10 0 -10 1	0.0000000000 0.0000000000

Problem G. Triangle Type

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

Given a triangle. Find the triangle type.

Input

There are three lines containing coordinates of three points, one per line. All coordinates are integers, not exceeding $1\,000$ by absolute value. It is guaranteed that all the points in a line are different and do not lie on one line.

Output

If the triangle is acute print ¡¡ACUTE¿¿ (without quotes). If right, print ¡¡RIGHT¿¿ (without quotes). If obtuse, print ¡¡OBTUSE¿¿ (without quotes).

Examples

standard input	standard output
-1 0 0 0 0 1	RIGHT
5 4 2 3 5 1	ACUTE

Problem H. Is on Segment?

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

You are given a point and a segment. Check if the point is on the segment.

Input

Given 6 integers from $-10\,000$ to $10\,000$: the point (x, y) and two distinct points (x_1, y_1), (x_2, y_2), endpoints of the segment.

Output

Print "YES" (without quotes), if the point is not the segment. Print "NO" (without quotes), if the point is not on the segment.

Example

standard input	standard output
4 0 4 2 4 5	NO

Problem I. Arrangement of Lines

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

Find arrangement type of two given lines and a point of intersection (if exists).

Input

Given 8 integer coordinates from $-32\,000$ to $32\,000$: the first two points $(x_1, y_1), (x_2, y_2)$ (they are distinct) give the first line, the following two points (x_3, y_3), (x_4, y_4) (they are distinct) give the second line.

Output

Print 0 if lines do not intersect, print 1 and coordinates of the intersection if there is exactly one intersection point, print 2 if lines coincide.

Print coordinates with at least 3 digits after a decimal point.

Examples

standard input	standard output
1 2 1 3 1 2 1 3	2
49 -33 28 -15 18 0 42 -33	1 30.4137931034 -17.0689655172

Problem J. Distance from Point to Segment

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

Find the distance from the given point to the given segment.

Input

Given 6 integers from $-10\,000$ to $10\,000$: the point (x, y) and two points (x_1, y_1), (x_2, y_2) — endpoints of the given segment. The endpoints can coincide.

Output

Print the distance with at least 5 digits after a decimal point.

Example

standard input	standard output
0 0 0 0 4 0	0.0000000

Problem K. Polygon Area

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

You are given a polygon by its vertices in clockwise or counterclockwise order. Print its area.

Input

The first line contains N ($3 \le N \le 100\,000$), the number of vertices.

The following N lines contain vertices, one per line. Each line contains a pair of integer coordinates. They are between $-10\,000$ and $10\,000$.

Output

Print the single number, the required area with 5 or more digits after a decimal point.

Example

standard input	standard output
4 0 0 0 1 1 1 1 0	1.0

Problem L. Triangle Perimeter

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

You are given three lines, no two lines are parallel. They intersect in tree points which form a triangle. Return the length of the perimeter of this triangle.

Lines are given by equation $Ax + By = C$. For each line both A and B can't be zero at the same time.

Input

There are three lines in the input. Each line contains A, B and C. All given numbers are integer, do not exceed 100 by absolute value. The answer doesn't exceed 1000.

Output

Print the required length of the perimeter with at least 4 digits after a decimal point.

Example

standard input	standard output
0 1 1 1 0 1 4 3 13	6.000000

Problem M. Symmetrical Point

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

You are given a line passing through two distinct points (x_1, y_1) and (x_2, y_2). Find the point which is symmetric to the point (x, y) relative to the given line.

Input

In the first line there are two integer numbers x_1 and y_1. In the second line there are two integer

numbers x_2 and y_2. The third line contains integers x and y. All the numbers do not exceed 10^9 by absolute value.

Output

Print coordinates of the requited point with at least 8 digits after a decimal point or single integer `-1` if the given point (x, y) is on the given line.

Example

standard input	standard output
1 1 2 2 0 1	1.00000000 0.00000000

Examples

standard input	standard output
0 0 9 9 9 5 0 5	5.000000 5.000000
0 0 9 9 15 15 7 7	7.000000 7.000000 9.000000 9.000000
0 0 9 9 10 10 10 10	-1

Problem N. Two Segments

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	256 mebibytes

Two segments AB and CD in 2D are given as points A, B, C and D.

You are to find their intersection and print:

- number `-1`, if the segments do not intersect;

- coordinates of a single point of intersection, if they intersect by single (exactly one) point;

- coordinates of two points — endpoints of intersection, if intersection of the segments is a segment itself.

Input

The input contains coordinates of the points A, B, C and D — integer numbers not exceeding $1\,000$ by absolute value. The segments can degenerate to be points.

Output

Print the result. Print coordinates with at least 6 digits after a decimal point.