Problem A
A Classic Problem

Time limit: 10 seconds
Memory limit: 1024 megabytes

Problem Description

Classic problems in competitive programming are problems frequently appearing in programming contests. This problem is also a very classic one in the field of computational geometry. It is about to answer which points are covered by a given simple polygon.

To state the problem precisely, we first give the definition of a polygon. A polygon of n edges is described by n straight line segments $e_1, e_2, \ldots, e_n$ connected to form a closed chain. That is, there exists a sequence of vertices $v_1 = (x_1, y_1), v_2 = (x_2, y_2), \ldots, v_n = (x_n, y_n)$ such that $e_n = \overline{v_n v_1}$ and $e_i = \overline{v_i v_{i+1}}$ for $1 \leq i < n$. Note that we can define a polygon with a sequence of vertices mentioned above.

A simple polygon is a polygon that does not intersect itself. That is, any two line segments may only meet each other on their endpoints. Therefore, a simple polygon encloses a region call its interior. A point p is covered by a simple polygon P if and only if p lies on some edge of P or the interior of P.

In this problem, you are given a simple polygon of n edges defined by a sequence of vertices and m points on 2D-plane. Please write a program to determine which points are covered by the givin simple polygon.

Input Format

The first line contains two space-separated positive integers n and m. n is the number of edges of the simple polygon, and m is the number of points. Then $n + m$ lines follow. For $1 \leq i \leq n$, the $(i+1)$-th line of the input contains two space-separated integers x_i and y_i where $v_i = (x_i, y_i)$ is the i-th item of the sequence describing the simple polygon. For $1 \leq j \leq m$, the $(1 + n + j)$-th line of the input contains two space-separated integers X_j and Y_j where $p_j = (X_j, Y_j)$ is the j-th point to be tested whether it is covered by the simple polygon.

Output Format

Output m lines. On the j-th line of the output, print `YES` if p_j is covered by the simple polygon defined by the sequence $v_1, v_2, \ldots, v_n$. Otherwise, print `NO`.

Technical Specification

- $3 \leq n \leq 10^5$
- $1 \leq m \leq 10^5$
- The sequence $v_1, v_2, \ldots, v_n$ always defines a simple polygon.
- $x_i, y_i \in [-10^9, 10^9]$ for $1 \leq i \leq n$
- $X_j, Y_j \in [-10^9, 10^9]$ for $1 \leq j \leq m$

Sample Input 1

```
3 3
0 0
5 5
5 0
1 1
1 2
2 1
```

Sample Output 1

```
YES
NO
YES
```

Sample Input 2

```
4 4
0 0
1 1
2 0
1 5
1 0
1 1
1 2
1 3
```

Sample Output 2

```
NO
YES
YES
YES
```