The Land Surveyor

Farmer K. is planting apple trees on his field. Soon, the land surveyor will come and define the borders of his field. By law, the surveyor must define a rectangle with all tree positions within or on the border of the rectangle. In fact, K. would like to have trees on the border, because he would love to attach a sign with his name to one of them. Therefore he is interested to know, wether a tree position is a *potential border position*, i.e. can be on the border of any rectangle the surveyor may legally define.

So far, K. has planted n trees. Furthermore, he has made an ordered list of m positions where he plans to plant more trees; he will first use the first position in this list, then the second, etc. Since the surveyor may appear at any time, K. would like to know, for any $0 \leq i \leq m$, how many of the $n+i$ tree positions (i.e., the n original positions plus the first i of the additional m positions) are potential border positions.

Input

The first line contains the number n of trees already on the field. The next n lines specify their positions: each of these lines contains Integer coordinates x and y.

The following line contains an Integer m: the number of planned tree positions. The next m lines specify these positions in the same way as before.

Output

Your output should consist of $m+1$ lines. Line $(i+1)$ should contain a single integer: the number of potential border positions among the $n+i$ positions composed of the n original positions and the first i of the additional m positions.

Subtasks

It always holds: $3 \leq n \leq 100\,000$ and $0 \leq m \leq 100\,000$. For the coordinates, it is always $0 \leq x, y \leq 10^9$. There are never three trees on one line. *There is always a tree at position* $(0,0)$ *and this position is the first in the input.*

Subtask 1 (20 points). $m = 0$

Subtask 2 (40 points). All $n+m$ input tree positions are sorted by x-coordinate, and no two trees share the same x-coordinate. In particular, all m planned positions have greater x-coordinates than any of the original n tree positions.

Subtask 3 (40 points). No further constraints.

Sample

Input	Output
5 0 0 10 0 20 10 30 30 40 60 2 100 60 200 30	5 4 5
5 0 0 10 0 0 10 10 10 7 5 3 15 5 7 6 47 11	4 5 5 4

Note that the first testcase is a valid input for subtask 2.

For this testcase the pictures on the following page show some legal borders for K.'s field after the first additional tree has been planted. The potential border positions are exactly the four dots appearing on the boundary of these rectangles (marked with an additional circle).

Limits

Time limit: 1 s
Memory limit: 256 MB

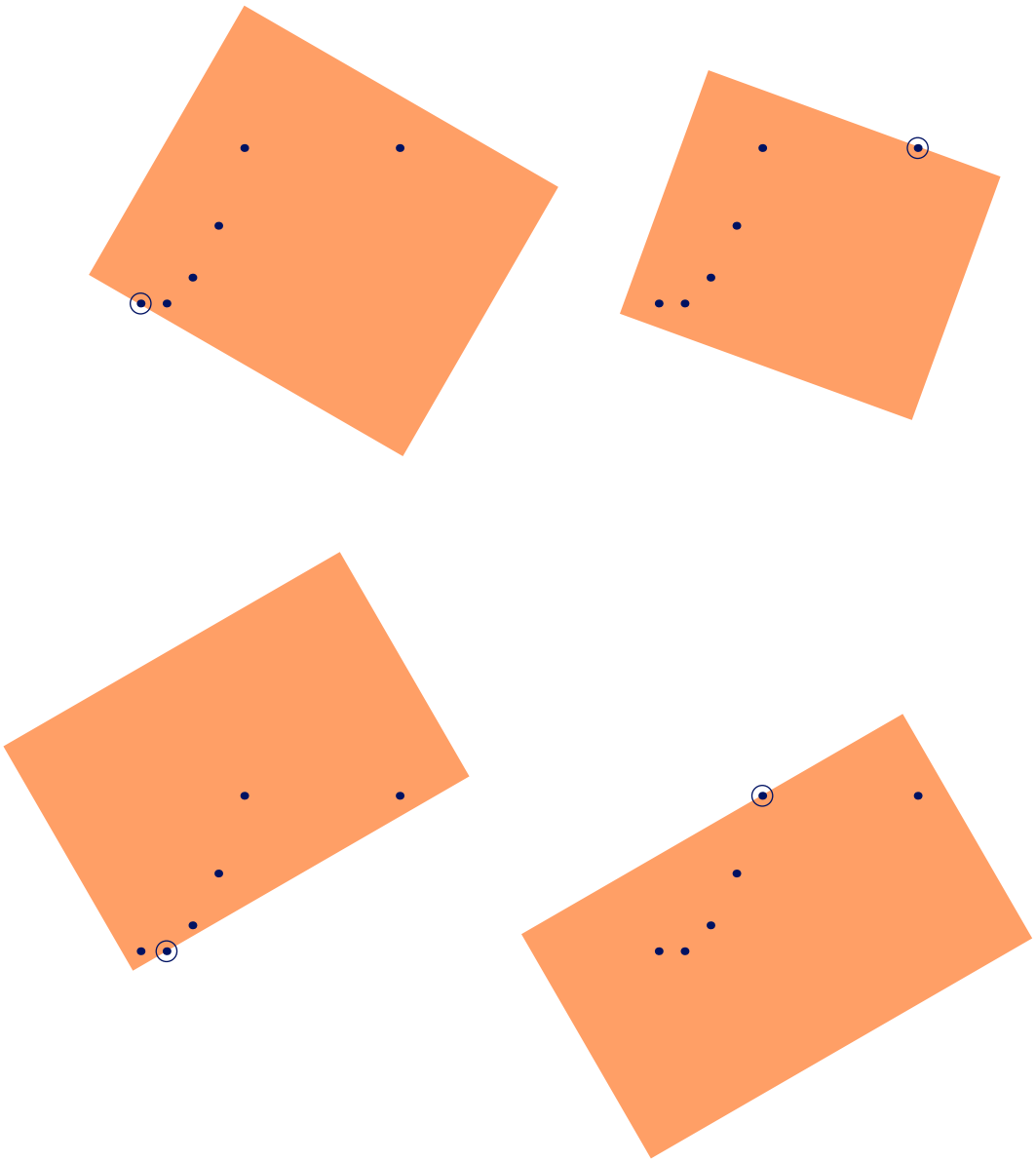

Figure 1: Legal borders and potential border positions for the first six trees of testcase 1