P. Vietnam Training

Description

This is an interactive problem. It's 1971 and the Vietnam War is raging. Nguyen Phan is a vietnamese general and he wants to test a new strategy. His task is to make reconnaissance more efficient on the battlefield, using soldiers and tunnels. There are n soldiers placed at integer coordinates on the battlefield. The soldiers are indexed with integers from 1 to n. The i-th soldier has coordinates (x_i, y_i), which are secret. Two soldiers are visible to each other if there are no other soldiers on the straight segment between them.

With a single command (query), Nguyen Phan can order one of his soldiers to travel through the underground tunnels and pop his head out at coordinates x and y. He can get the following response:

- if at (x, y) there is another soldier with index i, then the soldier that was sent through the tunnels will go back to the base and tell Nguyen Phan the index of the soldier that was already there, $-i$;

- otherwise, the soldier that was sent through the tunnels will STAY at coordinates (x, y) with index t, where t is the total current number of soldiers on the battlefield, including the one sent with this command; the soldier sent returns the list of the indices of all soldiers visible from (x, y).

Nguyen Phans task is to find the coordinates of the initial n soldiers using a limited number of commands! Because you are his assistant, he wants YOU to carry out this task.

Interaction Protocol

The first line contains a single integer $n(1 \leq n \leq 400)$, the number of soldiers. The secret coordinates satisfy $0 \leq x_i, y_i \leq 100$ and all n locations are distinct.

To ask a query, output **?** followed by two integers x and y $(-10^9 \leq x, y \leq 10^9)$. If there is already a soldier in (x, y), the result will be $-i$, where i is the index of that soldier. Otherwise the result is given by an integer k, the number of soldiers visible from (x, y), followed by k integers $i_1, ..., i_k$, the indices of the visible soldiers in increasing order $(i_j < i_{j+1}$ for all $1 \leq j < k)$. You can use at most 400 queries.

Once you have determined the coordinates of the original soldiers, first output **!** in a single line. Then output n lines, with two integers x, y_i in the i-th line, being the coordinates of the i-th soldier. After that your program should terminate.

Example

Standard input	Standard output
3	
	? 2 3
2 1 3	
	? 6 6
3 1 2 4	
	? 6 6
-5	
	? 1 11
4 2 3 4 5	
	? 4 7
-2	
	!
	3 5
	4 7
	2 8