Draw Polygon Lines

Input file: `standard input`
Output file: `standard output`
Time limit: 2 seconds
Memory limit: 512 megabytes

This is an interactive problem.

You are given n points $A_i = (x_i, y_i)$ on the plane. It is known that all x_i are distinct and all y_i are distinct.

Your task is to draw polygonal lines connecting these n points.

A polygonal line is defined by a permutation $p_1, p_2, \ldots, p_n$ of numbers from 1 to n. The polygonal line consists of $n-1$ segments, the first segment connects points A_{p_1} and A_{p_2}, the second segment connects points A_{p_2} and A_{p_3}, …, the last segment connects points $A_{p_{n-1}}$ and A_{p_n}. Note that segments may intersect.

The *sharpness* of a polygonal line is defined as the number of indices $2 \le i \le n-1$ such that the angle $\angle A_{p_{i-1}} A_{p_i} A_{p_{i+1}}$ is acute, i.e., strictly less than 90°.

You need to solve four tasks:

1. Find any polygonal line that has the maximum possible sharpness.
2. Given an integer c. Find any polygonal line whose sharpness is $\le c$.
3. Given an integer c.

   Answer q queries, each specified by a single integer k_i ($c \le k_i \le n-c$). In the i-th query, you need to construct a polygonal line that has sharpness exactly k_i.
4. Given an integer c.

   For each k from c to $n-c$, construct a polygonal line $p^{(k)}$ with sharpness exactly k. Provide $n-2c+1$ numbers $\text{hash}\left(p^{(c)}\right), \text{hash}\left(p^{(c+1)}\right), \ldots, \text{hash}\left(p^{(n-c)}\right)$ as the answer, where $hash(p) = \left(\sum_{i=1}^{n} p_i b^{i-1}\right) \bmod m$ is the polynomial hash of permutation p with parameters $b = 10^6+3$ and $m = 10^9+7$.

   Then answer q queries, each specified by a single integer k_i ($c \le k_i \le n-c$). In the i-th query, you need to provide the polygonal line $p^{(k_i)}$. It will be checked that the sharpness of this polygonal line is exactly k_i and its hash matches the previously provided value $\text{hash}\left(p^{(k_i)}\right)$.

   Note that queries will appear after receiving the hashes.

It is guaranteed, that under given constraints, the answers always exist.

Interaction Protocol

The first line contains two integers task, group ($1 \le \text{task} \le 4$, $0 \le \text{group} \le 21$) — the number of the task to be solved in this test and the test group number.

The second line contains a single integer n ($3 \le n \le 80\,000$) — the number of points on the plane.

Each of the next n lines contains two integers x_i, y_i ($|x_i|, |y_i| \le 10^9$) — the coordinates of the points. It is guaranteed that all x_i are distinct and all y_i are distinct.

If task $= 1$, then the input ends here and you should output any permutation with the maximum possible sharpness. The interaction ends here.

If task $\ne 1$, then the next line contains a single integer c ($2 \le c \le \frac{n}{2}$).

If task $= 2$, then the input ends here and you should output any permutation with sharpness $\le c$. The interaction ends here.

If task $= 4$, your solution should output $n - 2c + 1$ integers $\text{hash}\left(p^{(c)}\right), \text{hash}\left(p^{(c+1)}\right), \ldots, \text{hash}\left(p^{(n-c)}\right)$, where $0 \le \text{hash}\left(p^{(i)}\right) < 10^9 + 7$. Note that this should not be done if task $= 3$.

Further interaction occurs only if task $= 3$ or task $= 4$.

The next line contains a single integer q ($1 \le q \le 50$) — the number of queries.

Then q times, in each line, a query k_i ($c \le k_i \le n - c$) appears. As a response, you should output a permutation on a separate line. The sharpness of this permutation should be exactly k_i. If task $= 4$, the hash of this permutation should match the previously provided hash.

Since this is an interactive problem, after outputting each line, do not forget to output a newline character and flush the output buffer.

Scoring

The tests for this problem consist of twenty-one groups. Points for each group are given only if all tests of the group and all tests of the required groups are passed.

Group	Points	Constraints				Required Groups	Comment
		task	n	c	Additional constraints		
0	0	–	–	–	–	–	Examples.
1	8	1	$n \le 20\,000$	–	$x_i < x_{i+1}$, $y_i < y_{i+1}$	–	
2	6	1	$n \le 10$	–	random points	–	
3	5	1	$n \le 1000$	–	random points	2	
4	5	1	$n \le 20\,000$	–	random points	2 – 3	
5	6	1	$n \le 20\,000$	–	–	1 – 4	
6	17	2	$n = 80\,000$	$c = 800$	–	–	
7	7	3	$n = 80\,000$	$c = 800$	$x_i < x_{i+1}$, $y_i < y_{i+1}$	–	
8	4	3	$n = 50$	$c = 25$	random points	–	
9	4	3	$n = 200$	$c = 80$	random points	–	
10	4	3	$n = 1000$	$c = 300$	random points	–	
11	3	3	$n = 5000$	$c = 600$	random points	–	
12	3	3	$n = 80\,000$	$c = 35\,000$	random points	–	
13	3	3	$n = 80\,000$	$c = 5000$	random points	12	
14	3	3	$n = 80\,000$	$c = 2000$	–	12 – 13	
15	2	3	$n = 80\,000$	$c = 800$	–	7, 12 – 14	
16	6	4	$n = 80\,000$	$c = 800$	$x_i < x_{i+1}$, $y_i < y_{i+1}$	–	
17	3	4	$n = 5000$	$c = 600$	random points	–	
18	3	4	$n = 80\,000$	$c = 35\,000$	random points	–	
19	3	4	$n = 80\,000$	$c = 5000$	random points	18	
20	3	4	$n = 80\,000$	$c = 2000$	–	18 – 19	
21	2	4	$n = 80\,000$	$c = 800$	–	16, 18 – 20	

In the groups where it is indicated that the points are random, all coordinates of all points x_i, y_i are randomly generated with equal probability in the interval $[-10^9, 10^9]$.

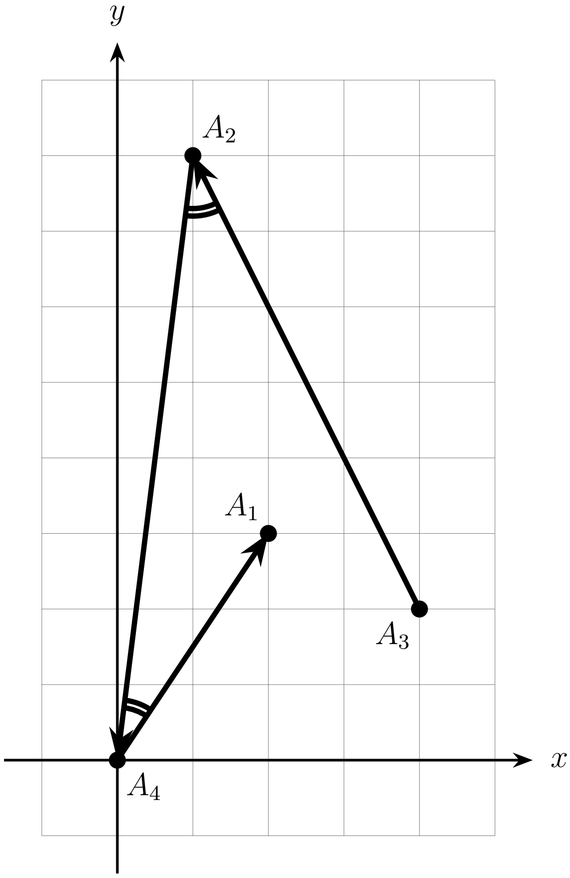
Examples

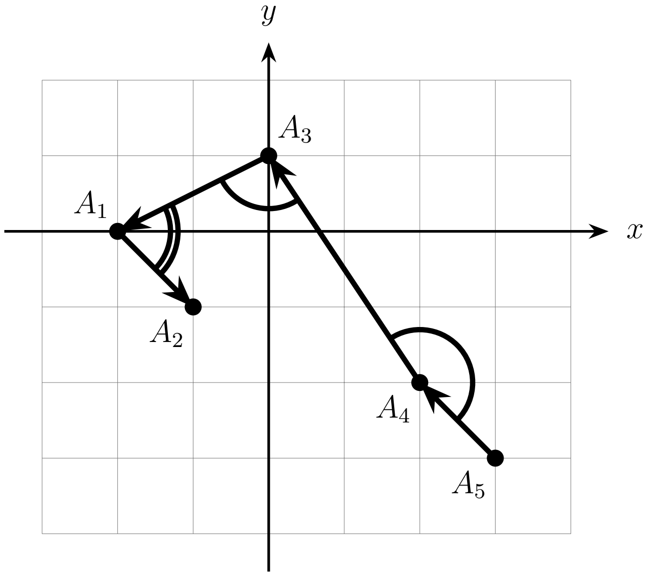
standard input	standard output
1 0 4 2 3 1 8 4 2 0 0	 3 2 4 1
2 0 5 -2 0 -1 -1 0 1 2 -2 3 -3 2	 5 4 3 1 2
3 0 6 0 0 1 1 2 2 3 -3 4 -2 5 -1 2 3 2 3 4	 1 2 3 4 5 6 4 5 6 1 3 2 6 2 4 3 5 1
4 0 5 -2 -1 -1 1 1 6 0 -3 2 0 2 2 2 3	 534735187 776162084 4 5 1 2 3 1 3 2 5 4

Note

In all the figures, acute angles are denoted by two arcs, and non-acute angles are denoted by a single arc.

First and second examples

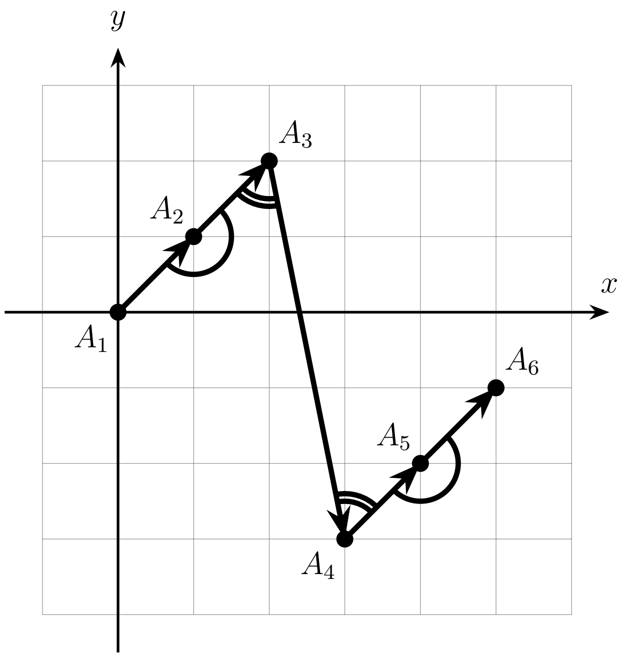


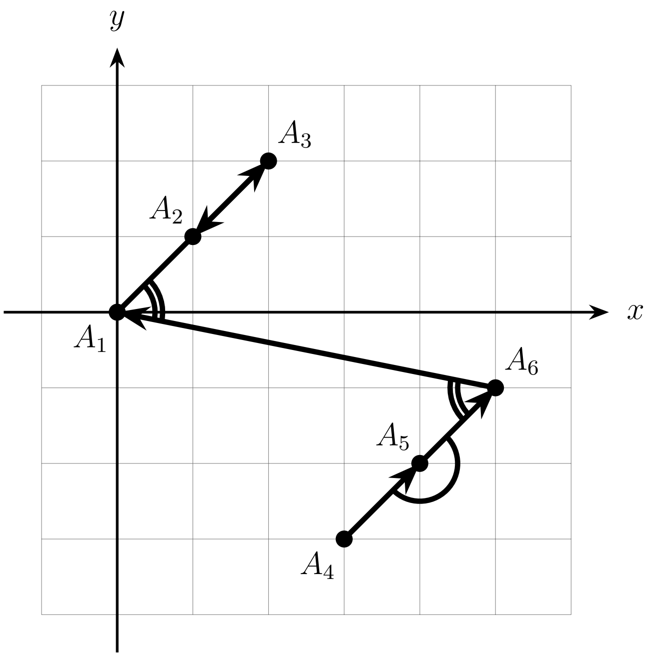


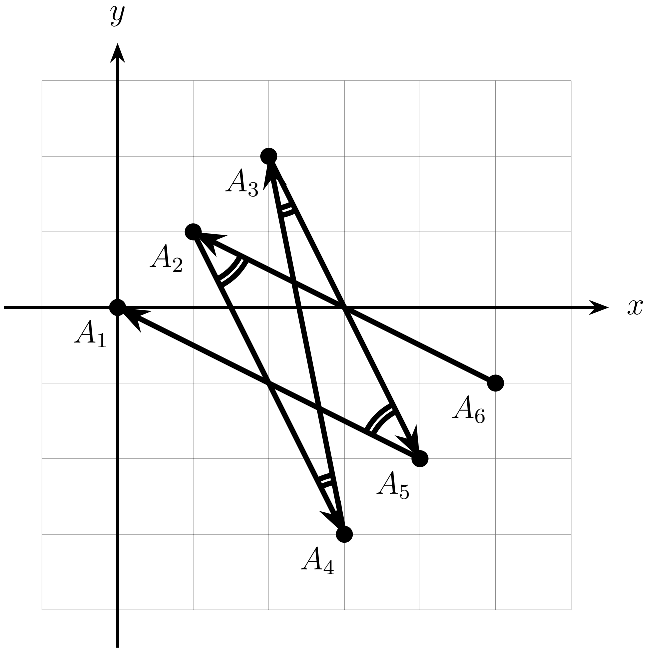
In the first example all angles are sharp, so the line has maximum sharpness 2.

In the second sample the sharpness equals to 1, it is ≤ 2.

Third example

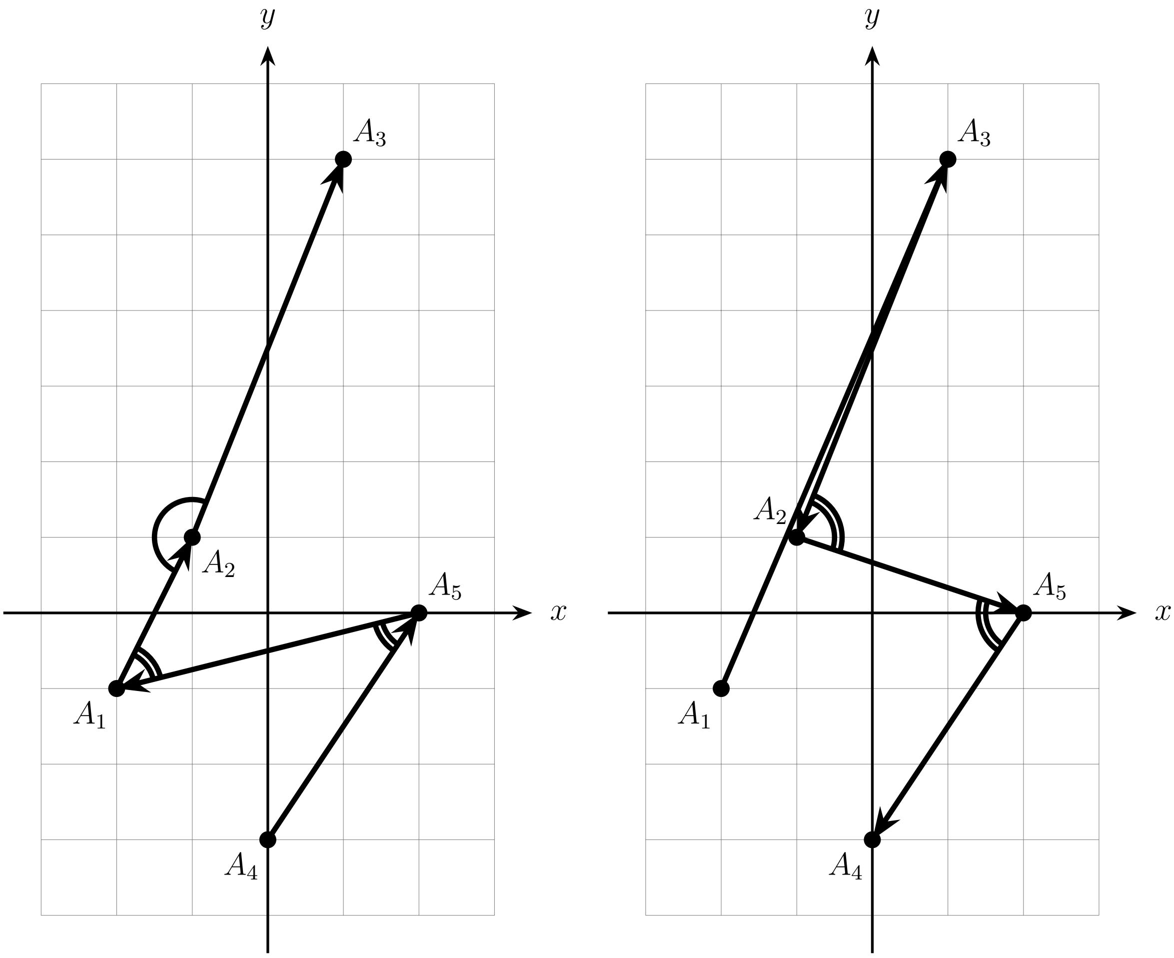






In the third example the lines have sharpness 2, 3, 4.

Forth example



In the forth example we build lines that have sharpness 2 and 3. The lines have hashes equal to the ones provided earlier.