E - Colinear

Editorial (/contests/abc422/tasks/abc422_e/editorial)

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Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 450 points

Problem Statement

There are N points on a two-dimensional plane. N is odd. The i-th point is at (x_i, y_i). All point coordinates are distinct.

Determine whether there exists a line passing through more than half of the N points, and if so, output it.

For any input satisfying the constraints, if a line satisfying the condition exists, it can be expressed as $ax + by + c = 0$ using integers a, b, c with $-10^{18} \leq a, b, c \leq 10^{18}$ (where $(a, b, c) \neq (0, 0, 0)$). Output these a, b, c.

Constraints

- $3 \leq N \leq 5 \times 10^5$
- N is odd.
- $-10^8 \leq x_i \leq 10^8$
- $-10^8 \leq y_i \leq 10^8$
- If $i \neq j$, then $(x_i, y_i) \neq (x_j, y_j)$.
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{ll}
N & \\
x_1 & y_1 \\
x_2 & y_2 \\
\vdots & \\
x_N & y_N
\end{array}
$$

Output

If no line satisfying the condition exists, output `No`.

If a line satisfying the condition exists, output two lines. On the first line, output `Yes`, and on the second line, output a, b, c in this order separated by spaces. a, b, c must satisfy $-10^{18} \leq a, b, c \leq 10^{18}$ and $(a, b, c) \neq (0, 0, 0)$.

If there are multiple solutions, any of them will be considered correct.

Sample Input 1 Copy

Copy

```
3
1 1
3 2
2 4
```

Sample Output 1 Copy

Copy

```
Yes
2 1 -8
```

The line $2x + y - 8 = 0$ passes through the 2nd and 3rd points, so it satisfies the condition.

Sample Input 2 Copy

Copy

```
5
5 2
1 3
2 6
4 4
5 4
```

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Sample Output 2 Copy

```
No
```

Copy

No line satisfying the condition exists.

Sample Input 3 Copy

```
11
-9374372 85232388
-60705467 86198234
-7475320 80628487
98066347 -23868213
-12177678 85284287
30535572 -35358356
51324557 22410787
28854279 44658587
-28804873 82911971
65052073 8819187
-67744430 68365758
```

Copy

Sample Output 3 Copy

```
Yes
4655800 4702358 -344340416016346
```

Copy

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