

# CG2020 2-3 Delaunay Triangulation

## Description (描述)

Given a set of points on the plane, please construct the Delaunay triangulation for the points set. You need to calculate the sum of the indexes of the endpoints of all edges in this triangulation.

给定平面上一系列的点，对这些点构造一个 Delaunay 三角剖分，求出这个剖分中所有的边所对应的端点的标号。

## Input (输入)

The first line is an integer  $n > 0$ , which indicates the total number of input points.

The  $k$ -th of the following  $n$  lines gives the  $k$ -th point:

$p_k = (x_k, y_k)$ ,  $k = 1, 2, \dots, n$

Both  $x_k$  and  $y_k$  here are integers and they are delimited by a space.

首行为一个正整数  $n > 0$ ，即输入点的总数。

随后  $n$  行中的第  $k$  行给出第  $k$  个点：

$p_k = (x_k, y_k)$ ,  $k = 1, 2, \dots, n$

这里， $x_k$  与  $y_k$  均为整数，且二者之间以空格分隔。

## Output (输出)

Let  $\{e_1, e_2, e_3, \dots, e_h\}$  be the set of all edges in Delaunay triangulation of the points. Assume that the indices of the end points of  $e_k$  are  $i_k$  and  $j_k$ . You need to output the following integer as your solution:

$(i_1 + j_1 + i_2 + j_2 + i_3 + j_3 + \dots + i_h + j_h) \bmod (h + 1)$

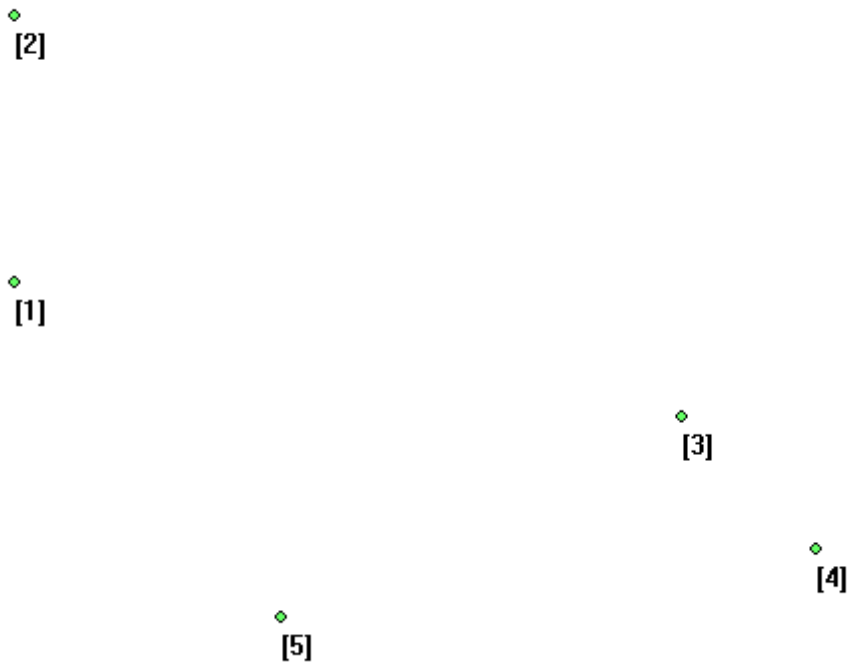
若  $\{e_1, e_2, e_3, \dots, e_h\}$  为构造出来的 Delaunay 三角剖分中的所有边，其中某条边  $e_k$  的两个端点的标号分别为  $i_k, j_k$ 。那么作为你的解答，请输出以下整数：

$(i_1 + j_1 + i_2 + j_2 + i_3 + j_3 + \dots + i_h + j_h) \bmod (h + 1)$

## Sample Input 1 (输入样例 1)

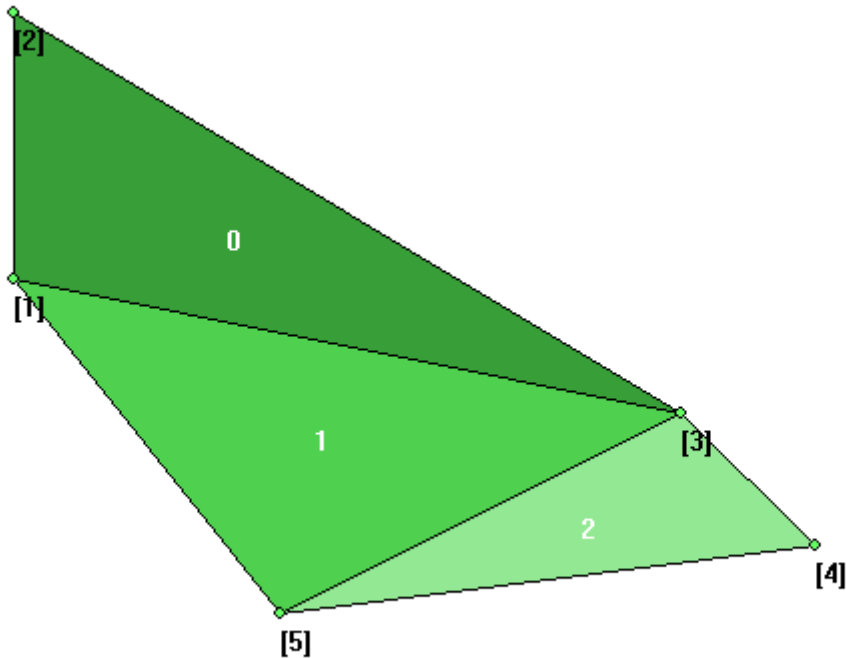
```
5
-5 5
-5 1
5 7
7 9
-1 10
```

- The sample is the 1st test case.
- 该样例是第 1 个测试点



Sample Output 1 (输出样例 1)

```
2 // ((1 + 2) + (2 + 3) + (1 + 3) + (1 + 5) + (3 + 5) + (3 + 4) + (5 + 4)) % (7 + 1)
```



Sample Input 2 (输入样例 2)

```
4
-1 0
0 0
1 0
0 1
```

## Sample Output 2 (输出样例 2)

```
2 // ((1 + 2) + (2 + 3) + (3 + 4) + (4 + 1) + (2 + 4)) % (5 + 1)
```

## Limitation (限制)

- $3 \leq n \leq 10^4$
- The coordinates of the points are integers in the range  $(-10^6, 10^6)$ .
- It is guaranteed that Delaunay triangulation exists and is unique:
  - There are no duplicated points.
  - It's impossible to have all points on the same line.
  - For any pair of adjacent triangles in the Delaunay triangulation, the 4 vertices are non-concyclic.
- Time Limit: 1 sec
- Memory Limit: 512 MB
- $3 \leq n \leq 10^4$
- 所有点的坐标均为范围  $(-10^6, 10^6)$  内的整数
- 测例保证 Delaunay 三角剖分存在且唯一：
  - 测例保证没有重合点
  - 测例保证不会所有点共线
  - 测例保证 Delaunay 三角剖分中任意一对相邻三角形的四个顶点不共圆
- 时间限制：1 sec
- 空间限制：512 MB

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UI powered by Twitter Bootstrap (<http://getbootstrap.com/>).

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