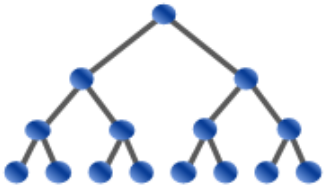

USACO 2021 February Contest, Silver
Problem 1. Comfortable Cows

Return to Problem List

Contest has ended.

English (en)

Farmer Nhoj's pasture can be regarded as a large 2D grid of square "cells" (picture a huge chessboard). Initially, the pasture is empty.

Farmer Nhoj will add N ($1 \leq N \leq 10^5$) cows to the pasture one by one. The ith cow will occupy a cell (x_i, y_i) that is distinct from the cells occupied by all other cows ($0 \leq x_i, y_i \leq 1000$).

A cow is said to be "comfortable" if it is horizontally or vertically adjacent to exactly three other cows. Unfortunately, cows that are too comfortable tend to lag in their milk production, so Farmer Nhoj wants to add additional cows until no cow (including the ones that he adds) is comfortable. Note that the added cows do not necessarily need to have x and y coordinates in the range $0 \ldots 1000$.

For each i in the range $1 \ldots N$, please output the minimum number of cows Farmer Nhoj would need to add until no cows are comfortable if initially, the pasture started with only cows $1 \ldots i$.

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains a single integer N. Each of the next N lines contains two space-separated integers, indicating the (x, y) coordinates of a cow's cell.

OUTPUT FORMAT (print output to the terminal / stdout):

The minimum number of cows Farmer Nhoj needs to add for each i in $1 \ldots N$, on N separate lines.

SAMPLE INPUT:

```
9
0 1
1 0
1 1
1 2
2 1
2 2
3 1
3 2
4 1
```

SAMPLE OUTPUT:

```
0
0
0
1
0
0
1
2
4
```

For $i = 4$, Farmer Nhoj must add an additional cow at $(2, 1)$ to make the cow at $(1, 1)$ uncomfortable.

For $i = 9$, the best Farmer Nhoj can do is place additional cows at $(2, 0)$, $(3, 0)$, $(2, -1)$, and $(2, 3)$.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.