Code Jam 2010 - Round 2

Bacteria

Problem

A number of bacteria lie on an infinite grid of cells, each bacterium in its own cell.

Each second, the following transformations occur (all simultaneously):

1. If a bacterium has no neighbor to its north and no neighbor to its west, then it will die.
2. If a cell has no bacterium in it, but there are bacteria in the neighboring cells to the north and to the west, then a new bacterium will be born in that cell.

Upon examining the grid, you note that there are a positive, finite number of bacteria in one or more rectangular regions of cells.

Determine how many seconds will pass before all the bacteria die.

Here is an example of a grid that starts with 6 cells containing bacteria, and takes 6 seconds for all the bacteria to die. '1's represent cells with bacteria, and '0's represent cells without bacteria.

```
000010
011100
010000
010000
000000

000000
001110
011000
010000
000000

000000
000110
001100
011000
000000

000000
000010
000110
001100
000000

000000
000000
000010
000110
000000

000000
000000
000000
```

```
000010
000000

000000
000000
000000
000000
000000
```

Input

The input consists of:

- One line containing **C**, the number of test cases.

Then for each test case:

- One line containing **R**, the number of rectangles of cells that initially contain bacteria.
- **R** lines containing four space-separated integers $\mathbf{X_1}$ $\mathbf{Y_1}$ $\mathbf{X_2}$ $\mathbf{Y_2}$. This indicates that all the cells with X coordinate between X_1 and X_2, inclusive, and Y coordinate between Y_1 and Y_2, inclusive, contain bacteria.

The rectangles may overlap.

North is in the direction of decreasing Y coordinate.
West is in the direction of decreasing X coordinate.

Output

For each test case, output one line containing "Case #N: T", where N is the case number (starting from 1), and T is the number of seconds until the bacteria all die.

Limits

Time limit: 30 seconds per test set.
Memory limit: 1GB.
$1 \leq \mathbf{C} \leq 100$.

Small dataset (Test set 1 - Visible)

$1 \leq \mathbf{R} \leq 10$
$1 \leq \mathbf{X_1} \leq \mathbf{X_2} \leq 100$
$1 \leq \mathbf{Y_1} \leq \mathbf{Y_2} \leq 100$

Large dataset (Test set 2 - Hidden)

$1 \leq \mathbf{R} \leq 1000$
$1 \leq \mathbf{X_1} \leq \mathbf{X_2} \leq 1000000$
$1 \leq \mathbf{Y_1} \leq \mathbf{Y_2} \leq 1000000$

The number of cells initially containing bacteria will be at most 1000000.

Sample

Sample Input

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

Sample Output

```
Case #1: 6
```