Code Jam 2010 - Round 1A

Number Game

Problem

Arya and Bran are playing a game. Initially, two positive integers **A** and **B** are written on a blackboard. The players take turns, starting with Arya. On his or her turn, a player can replace **A** with **A** - **k*****B** for any positive integer **k**, or replace **B** with **B** - **k*****A** for any positive integer **k**. The first person to make one of the numbers drop to zero or below loses.

For example, if the numbers are initially (12, 51), the game might progress as follows:

- Arya replaces 51 with 51 - 3*12 = 15, leaving (12, 15) on the blackboard.
- Bran replaces 15 with 15 - 1*12 = 3, leaving (12, 3) on the blackboard.
- Arya replaces 12 with 12 - 3*3 = 3, leaving (3, 3) on the blackboard.
- Bran replaces one 3 with 3 - 1*3 = 0, and loses.

We will say (**A**, **B**) is a *winning* position if Arya can always win a game that starts with (**A**, **B**) on the blackboard, no matter what Bran does.

Given four integers $\mathbf{A_1}$, $\mathbf{A_2}$, $\mathbf{B_1}$, $\mathbf{B_2}$, count how many winning positions (**A**, **B**) there are with $\mathbf{A_1} \le \mathbf{A} \le \mathbf{A_2}$ and $\mathbf{B_1} \le \mathbf{B} \le \mathbf{B_2}$.

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow, one per line. Each line contains the four integers $\mathbf{A_1}$, $\mathbf{A_2}$, $\mathbf{B_1}$, $\mathbf{B_2}$, separated by spaces.

Output

For each test case, output one line containing "Case #x: y", where x is the case number (starting from 1), and y is the number of winning positions (**A**, **B**) with $\mathbf{A_1} \le \mathbf{A} \le \mathbf{A_2}$ and $\mathbf{B_1} \le \mathbf{B} \le \mathbf{B_2}$.

Limits

Memory limit: 1GB.
$1 \le \mathbf{T} \le 100$.
$1 \le \mathbf{A_1} \le \mathbf{A_2} \le 1{,}000{,}000$.
$1 \le \mathbf{B_1} \le \mathbf{B_2} \le 1{,}000{,}000$.

Small dataset (Test set 1 - Visible)

Time limit: 30 seconds.
$\mathbf{A_2} - \mathbf{A_1} \le 30$.
$\mathbf{B_2} - \mathbf{B_1} \le 30$.

Large dataset (Test set 2 - Hidden)

Time limit: 90 seconds.
$\mathbf{A_2} - \mathbf{A_1} \le 999{,}999$.
$\mathbf{B_2} - \mathbf{B_1} \le 999{,}999$.

No additional constraints.

Sample

Sample Input

```
3
5 5 8 8
11 11 2 2
1 6 1 6
```

Sample Output

```
Case #1: 0
Case #2: 1
Case #3: 20
```