G - A/B < p/q < C/D

Editorial (/contests/abc408/tasks/abc408_g/editorial)

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Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 625 points

Problem Statement

You are given positive integers A, B, C, D satisfying $\frac{A}{B} < \frac{C}{D}$.

Find the smallest positive integer q satisfying the following condition:

- There exists a positive integer p such that $\frac{A}{B} < \frac{p}{q} < \frac{C}{D}$.

T test cases are given, so solve each.

Constraints

- $1 \leq T \leq 2 \times 10^5$
- $1 \leq A, B, C, D \leq 10^{18}$
- $\frac{A}{B} < \frac{C}{D}$
- All input values are integers.

Input

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

$$
\begin{aligned}
&T\\
&\mathrm{case}_1\\
&\mathrm{case}_2\\
&\vdots\\
&\mathrm{case}_T
\end{aligned}
$$

Here, case_i represents the i-th test case.

Each test case is given in the following format:

$$
A \quad B \quad C \quad D
$$

Output

Output T lines. The i-th line should contain the answer for the i-th test case.

Sample Input 1 Copy

Copy

```
5
3 2 2 1
5 2 8 3
1 2 2 1
60 191 11 35
40 191 71 226
```

Sample Output 1 Copy

Copy

```
3
5
1
226
4
```

Consider the first test case.

For example, if $p = 5, q = 3$, then $\dfrac{3}{2} < \dfrac{5}{3} < \dfrac{2}{1}$, so $q = 3$ satisfies the condition.

There is no positive integer less than 3 that satisfies the condition for q, so the answer for the first test case is 3.

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