

IOI '13 P6 - Game (Standard I/O)

Time limit: 8.0s **Memory limit:** 512M

Bazza and Shazza are playing a game. The board is a grid of cells, with R rows number $0, \dots, R - 1$, and C columns numbered $0, \dots, C - 1$. We let (P, Q) denote the cell in row P and column Q . Each cell contains a non-negative integer, and at the beginning of the game all of these integers are zero.

The game proceeds as follows. At any time, Bazza may either:

- update a cell (P, Q) , by assigning the integer that it contains;
- ask Shazza to calculate the greatest common divisor (GCD) of all integers within a rectangular block of cells, with opposite corners (P, Q) and (U, V) inclusive.

Bazza will take $N_U + N_Q$ actions (updating cells N_U times and asking question N_Q times) before he gets bored and goes outside to play cricket.

Your task is to work out the correct answers.

Example

Suppose $R = 2$ and $C = 3$, and Bazza begins with the following updates:

- Update cell $(0, 0)$ to 20;
- Update cell $(0, 2)$ to 15;
- Update cell $(1, 1)$ to 12.

20	0	15
0	12	0

The resulting grid is shown in the picture above. Bazza might then ask for GCDs in the following rectangles:

- Opposite corners $(0, 0)$ and $(0, 2)$: The three integers in this rectangle are 20, 0 and 15, and their GCD is 5.
- Opposite corners $(0, 0)$ and $(1, 1)$: The four integers in this rectangle are 20, 0, 0, and 12, and their GCD is 4.

Now suppose Bazza makes the following updates:

- Update cell $(0, 1)$ to 6;
- Update cell $(1, 1)$ to 14.

20	6	15
0	14	0

The new grid is shown in the picture above. Bazza might then ask for GCDs in the following rectangles again:

- Opposite corners $(0, 0)$ and $(0, 2)$: Now the three integers in this rectangle are 20, 6 and 15, and their GCD is 1.
- Opposite corners $(0, 0)$ and $(1, 1)$: Now the four integers in this rectangle are 20, 6, 0 and 14, and their GCD is 2.

Here Bazza has performed $N_U = 5$ updates and $N_Q = 4$ questions.

Procedures

You will first be given the initial size of the grid, allowing you to initialise any variables and data structures.

Parameters

- R : The number of rows.
- C : The number of columns.

Your Procedure: `update()`

Description

Your submission must implement this procedure.

This procedure will be called when Bazza assigns the number in some grid cell.

Parameters

- P : The row of the grid cell ($0 \leq P \leq R - 1$)
- Q : The column of the grid cell ($0 \leq Q \leq C - 1$)
- K : The new integer in this grid cell ($0 \leq K \leq 10^{18}$). May be the same as the current value.

Your Function: `calculate()`

Description

Your submission must implement this function.

This function should calculate the greatest common divisor of all integers in the rectangle with opposite corners (P, Q) and (U, V) . This range is inclusive, i.e., the cells (P, Q) and (U, V) are included in the rectangle.

If all the integers in this rectangle are zero, then this function should return zero also.

Parameters

- `P`: The row of the top-left cell in the rectangle ($0 \leq P \leq R - 1$)
- `Q`: The column of the top-left cell in the rectangle ($0 \leq Q \leq C - 1$)
- `U`: The row of the bottom-right cell in the rectangle ($P \leq U \leq R - 1$).
- `V`: The column of the bottom-right cell in the rectangle ($Q \leq V \leq C - 1$)
- *Returns*: The GCD of all integers in the rectangle, or 0 if all those integers are zero.

Sample Session

The following session describes the example above:

Function Call	Returns
<code>init(2, 3)</code>	
<code>update(0, 0, 20)</code>	
<code>update(0, 2, 15)</code>	
<code>update(1, 1, 12)</code>	
<code>calculate(0, 0, 0, 2)</code>	5
<code>calculate(0, 0, 1, 1)</code>	4
<code>update(0, 1, 6)</code>	
<code>update(1, 1, 14)</code>	
<code>calculate(0, 0, 0, 2)</code>	1
<code>calculate(0, 0, 1, 1)</code>	2

Input Specification

The input will be in the following format:

- line 1: $R C N$
- next N lines: one action per line, in the order in which actions occur

The line for each action must be in one of the following formats:

- To indicate `update`: $1 P Q K$
- To indicate `calculate`: $2 P Q U V$

Output Specification

For every call of `calculate`, output an integer on a single line - the GCD of all integers in the calculated rectangle, or 0 if all of those integers are zero.

Sample Input

```
2 3 9
1 0 0 20
1 0 2 15
1 1 1 12
2 0 0 0 2
2 0 0 1 1
1 0 1 6
1 1 1 14
2 0 0 0 2
2 0 0 1 1
```

Sample Output

```
5
4
1
2
```

Constraints

- $1 \leq R, C \leq 10^9$
- $0 \leq K \leq 10^{18}$, where K is any integer that Bazza places in a grid cell.

Subtasks

Subtask	Points	R	C	N_U	N_Q
1	10	≤ 100	≤ 100	≤ 100	≤ 100
2	27	≤ 10	$\leq 100\,000$	$\leq 10\,000$	$\leq 250\,000$
3	26	$\leq 2\,000$	$\leq 2\,000$	$\leq 10\,000$	$\leq 250\,000$
4	17	$\leq 10^9$	$\leq 10^9$	$\leq 10\,000$	$\leq 250\,000$
5	20	$\leq 10^9$	$\leq 10^9$	$\leq 22\,000$	$\leq 250\,000$