Problem 10: Cousins
14 Points

Problem ID: `cousins`
Rank: `4`

Introduction

Today is Ignacio's cousin's birthday[1]. They miss each other a lot, since his cousin is in Matraganto and Ignacio is studying abroad in Mañusgo. However, Ignacio has created a new game for his cousin to play. Since in Spanish prime numbers are also called *cousin numbers*, the game will be about prime numbers!

Problem Statement

In *COUSINS,* the new game that Ignacio invented, two players are given a large positive integer x and take turns playing. In each turn a player can divide x by any power of any prime dividing x. More formally, if p is a prime number, $a \geq 1$ and p^a divides x, then the player can divide x by p^a. Afterwards, the new value of x will be x / p^a. A player loses if they can't divide the number any longer, in other words, when $x = 1$. Ignacio is always first to play and his cousin is second to play.

Since x could be very large, players aren't given x. Instead, *COUSINS* has a game board consisting of an array $\mathbf{A_1}\ \mathbf{A_2}\ \ldots\ \mathbf{A_N}$ containing $\mathbf{N}$ integers. A game is described by a pair of integers (L, R) with $1 \leq L \leq R \leq \mathbf{N}$. In each game, x is defined by the product of all $\mathbf{A_i}$ between one-indexed positions L and R of the board.

Given $\mathbf{M}$ different games and a game board $\mathbf{A_1}\ \mathbf{A_2}\ \ldots\ \mathbf{A_N}$, predict who will win each game considering that both players play optimally. If Ignacio wins, output `IGNACIO`. Otherwise, output `COUSIN`

[1] Note that this story is pure fiction. Ignacio's cousin is currently 13 years old, and making someone that age play this game would lead them to either becoming a Genshin Impact player and/or taking CS 152 and getting white hairs at 19, and no child was harmed during the creation of this problem.

Input Format

There is only one test case for each test case file:

- The first line of input contains two space-separated integers $\mathbf{N}$ $\mathbf{M}$ denoting the size of the game board and the number of games, respectively.
- The next line of input contains $\mathbf{N}$ space-separated integers $\mathbf{A_1}$ $\mathbf{A_2}$ … $\mathbf{A_N}$ describing the game board.
- The next $\mathbf{M}$ lines each contain two space-separated integers $\mathbf{L}_j$ $\mathbf{R}_j$ denoting the pair used for the j^{th} game.

Output Format

Output $\mathbf{M}$ lines, where the j^{th} line contains the winner of the j^{th} game, either `IGNACIO` or `COUSIN`

Constraints

Time Limit: 2 seconds

$1 \le \mathbf{N} \le 2 \times 10^4$
$1 \le \mathbf{M} \le 2 \times 10^4$
$1 \le \mathbf{A}_i \le 10^7$ for all $1 \le i \le \mathbf{N}$
$1 \le \mathbf{L}_j \le \mathbf{R}_j \le \mathbf{N}$ for all $1 \le j \le \mathbf{M}$

Sample Test Cases

Sample Input Download

```
10 6
1 2 3 4 5 6 7 8 9 10
6 6
5 5
1 10
3 6
7 9
5 8
```

Sample Output Download

```
COUSIN
IGNACIO
IGNACIO
COUSIN
COUSIN
IGNACIO
```

Sample Explanations

Game #1:

In the first game $x = 6$, so Ignacio can choose to divide x by either 2 or 3 in the first move. If Ignacio chooses to divide x by 2, the new x will be 3, and after his cousin divides x by 3 Ignacio loses. If Ignacio divides x by 3, his cousin will divide x by 2 and he will lose in this case as well. So, no matter what Ignacio plays, his cousin will win.

Game #2:

In the second game $x = 5$, so Ignacio can divide x by 5. After dividing x by 5, $x = 1$, so Ignacio wins.

Game #3:

In the third game $x = 3628800$. It can be proved that if both players play optimally, Ignacio will win.

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