A. Finite or not?, 1 second, 256 megabytes, standard input, standard output

You are given several queries. Each query consists of three integers p, q and b. You need to answer whether the result of p/q in notation with base b is a finite fraction.

A fraction in notation with base b is finite if it contains finite number of numerals after the decimal point. It is also possible that a fraction has zero numerals after the decimal point.

Input

The first line contains a single integer n ($1 \le n \le 10^5$) — the number of queries.

Next n lines contain queries, one per line. Each line contains three integers p, q, and b ($0 \le p \le 10^{18}$, $1 \le q \le 10^{18}$, $2 \le b \le 10^{18}$). All numbers are given in notation with base 10.

Output

For each question, in a separate line, print Finite if the fraction is finite and Infinite otherwise.

input
```
2
6 12 10
4 3 10
```
output
```
Finite
Infinite
```

input
```
4
1 1 2
9 36 2
4 12 3
3 5 4
```
output
```
Finite
Finite
Finite
Infinite
```

$\frac{6}{12} = \frac{1}{2} = 0,5_{10}$

$\frac{4}{3} = 1,(3)_{10}$

$\frac{9}{36} = \frac{1}{4} = 0,01_2$

$\frac{4}{12} = \frac{1}{3} = 0,1_3$

B. XOR-pyramid, 2 seconds, 512 megabytes, standard input, standard output

For an array b of length m we define the function f as

$$f(b) = \begin{cases} b[1] & \text{if } m = 1 \\ f(b[1] \oplus b[2], b[2] \oplus b[3], \dots, b[m-1] \oplus b[m]) & \text{otherwise,} \end{cases}$$

where $\oplus$ is bitwise exclusive OR.

For example, $f(1,2,4,8) = f(1 \oplus 2, 2 \oplus 4, 4 \oplus 8) = f(3,6,12) = f(3 \oplus 6, 6 \oplus 12) = f(5,10) = f(5 \oplus 10) = f(15) = 15$

You are given an array a and a few queries. Each query is represented as two integers l and r. The answer is the maximum value of f on all continuous subsegments of the array $a_l, a_{l+1}, \ldots, a_r$.

Input

The first line contains a single integer n ($1 \le n \le 5000$) — the length of a.

The second line contains n integers $a_1, a_2, \dots, a_n$ ($0 \le a_i \le 2^{30} - 1$) — the elements of the array.

The third line contains a single integer q ($1 \le q \le 100\,000$) — the number of queries.

Each of the next q lines contains a query represented as two integers l, r ($1 \le l \le r \le n$).

Output

Print q lines — the answers for the queries.

input
```
3
8 4 1
2
2 3
1 2
```
output
```
5
12
```

input
```
6
1 2 4 8 16 32
4
1 6
2 5
3 4
1 2
```
output
```
60
30
12
3
```

In first sample in both queries the maximum value of the function is reached on the subsegment that is equal to the whole segment.

In second sample, optimal segment for first query are $[3,6]$, for second query — $[2,5]$, for third — $[3,4]$, for fourth — $[1,2]$.

C. Elevator, 3 seconds, 256 megabytes, standard input, standard output

You work in a big office. It is a 9 floor building with an elevator that can accommodate up to 4 people. It is your responsibility to manage this elevator.

Today you are late, so there are queues on some floors already. For each person you know the floor where he currently is and the floor he wants to reach. Also, you know the order in which people came to the elevator.

According to the company's rules, if an employee comes to the elevator earlier than another one, he has to enter the elevator earlier too (even if these employees stay on different floors). Note that the employees are allowed to leave the elevator in arbitrary order.

The elevator has two commands:

- Go up or down one floor. The movement takes 1 second.
- Open the doors on the current floor. During this operation all the employees who have reached their destination get out of the elevator. Then all the employees on the floor get in the elevator in the order they are queued up while it doesn't contradict the company's rules and there is enough space in the elevator. Each employee spends 1 second to get inside and outside the elevator.

Initially the elevator is empty and is located on the floor 1.

You are interested what is the minimum possible time you need to spend to deliver all the employees to their destination. It is not necessary to return the elevator to the floor 1.

Input

The first line contains an integer n ($1 \le n \le 2000$) — the number of employees.

The i-th of the next n lines contains two integers a_i and b_i ($1 \le a_i, b_i \le 9$, $a_i \ne b_i$) — the floor on which an employee initially is, and the floor he wants to reach.

The employees are given in the order they came to the elevator.

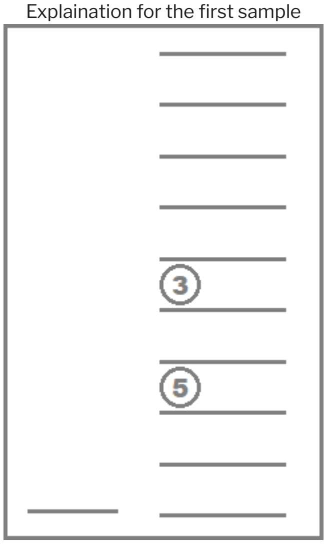
Output

Print a single integer — the minimal possible time in seconds.

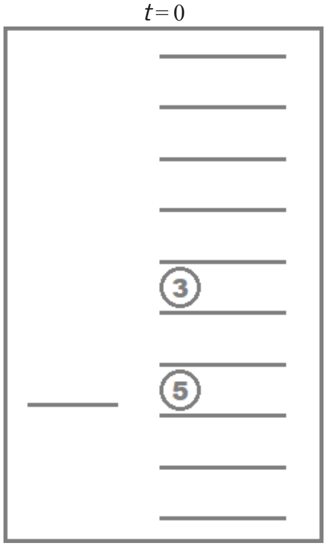
input
2 3 5 5 3
output
10

input
2 5 3 3 5
output
12

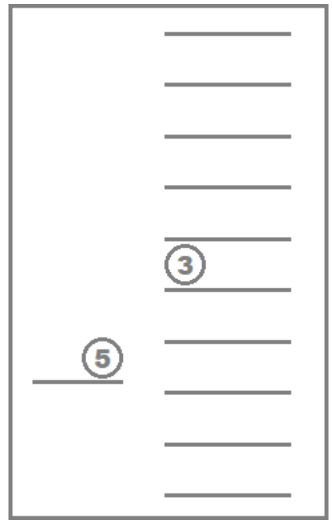
Explaination for the first sample



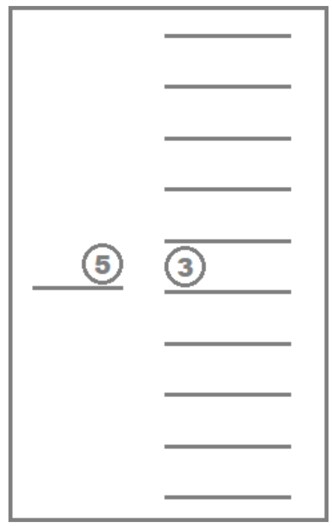
$t=0$



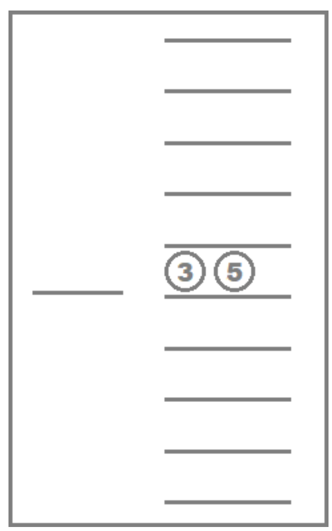
$t=2$



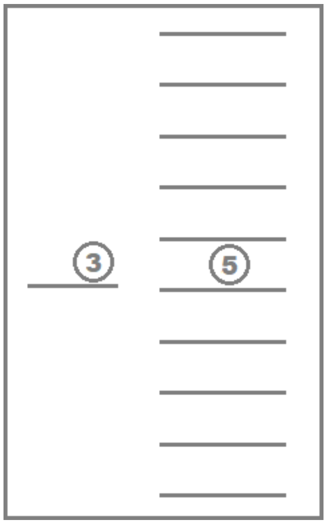
$t=3$



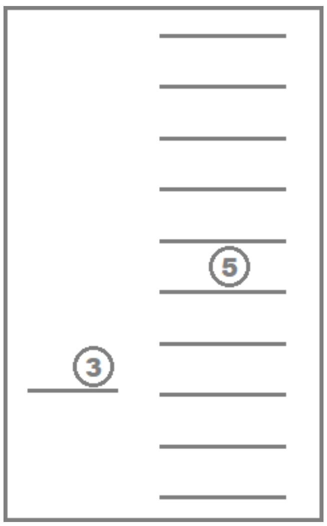
$t=5$



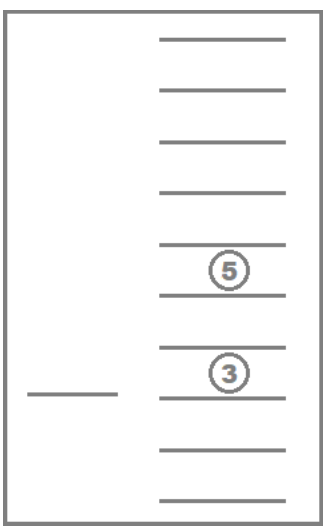
$t=6$



$t = 7$



$t = 9$



$t = 10$

D. Arkady and Rectangles,

4 seconds, 256 megabytes, standard input, standard output

Arkady has got an infinite plane painted in color 0. Then he draws n rectangles filled with paint with sides parallel to the Cartesian coordinate axes, one after another. The color of the i-th rectangle is i (rectangles are enumerated from 1 to n in the order he draws them). It is possible that new rectangles cover some of the previous ones completely or partially.

Count the number of different colors on the plane after Arkady draws all the rectangles.

Input

The first line contains a single integer n ($1 \le n \le 100\,000$) — the number of rectangles.

The i-th of the next n lines contains 4 integers x_1, y_1, x_2 and y_2 ($-10^9 \le x_1 < x_2 \le 10^9$, $-10^9 \le y_1 < y_2 \le 10^9$) — the coordinates of corners of the i-th rectangle.

Output

In the single line print the number of different colors in the plane, including color 0.

input

```
5
-1 -1 1 1
-4 0 0 4
0 0 4 4
-4 -4 0 0
0 -4 4 0
```

output

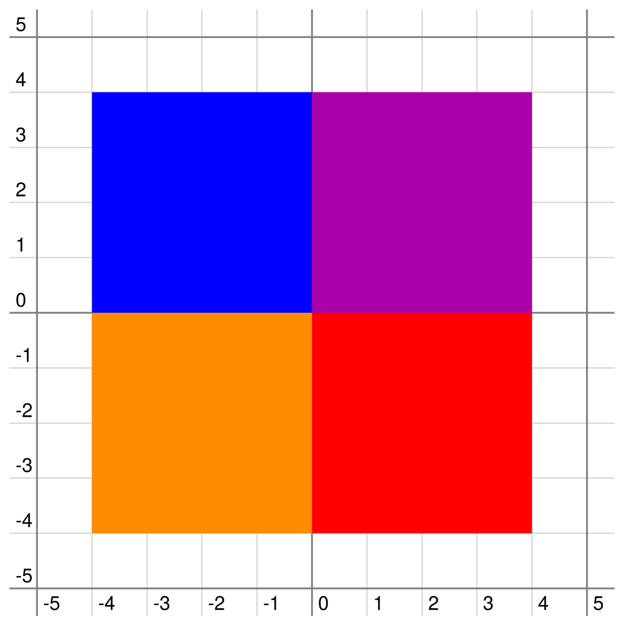
```
5
```

input

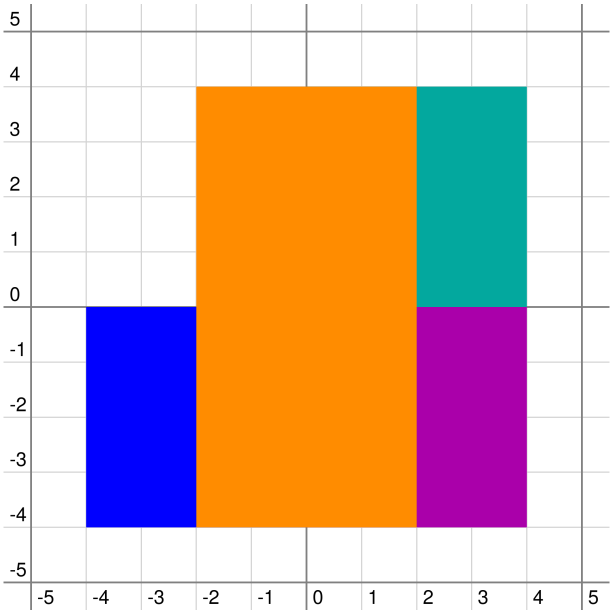
```
4
0 0 4 4
-4 -4 0 0
0 -4 4 0
-2 -4 2 4
```

output

```
5
```



That's how the plane looks in the first sample



That's how the plane looks in the second sample

0 = white, 1 = cyan, 2 = blue, 3 = purple, 4 = yellow, 5 = red.

E. NN country, 3 seconds, 256 megabytes, standard input, standard output

In the NN country, there are n cities, numbered from 1 to n, and $n-1$ roads, connecting them. There is a roads path between any two cities.

There are m bidirectional bus routes between cities. Buses drive between two cities taking the shortest path with stops in every city they drive through. Travelling by bus, you can travel from any stop on the route to any other. You can travel between cities only by bus.

You are interested in q questions: is it possible to get from one city to another and what is the minimum number of buses you need to use for it?

Input

The first line contains a single integer n ($2 \le n \le 2 \cdot 10^5$) — the number of cities.

The second line contains $n-1$ integers $p_2, p_3, \ldots, p_n$ ($1 \le p_i < i$), where p_i means that cities p_i and i are connected by road.

The third line contains a single integer m ($1 \le m \le 2 \cdot 10^5$) — the number of bus routes.

Each of the next m lines contains 2 integers a and b ($1 \le a, b \le n$, $a \neq b$), meaning that there is a bus route between cities a and b. It is possible that there is more than one route between two cities.

The next line contains a single integer q ($1 \le q \le 2 \cdot 10^5$) — the number of questions you are interested in.

Each of the next q lines contains 2 integers v and u ($1 \le v, u \le n$, $v \neq u$), meaning that you are interested if it is possible to get from city v to city u and what is the minimum number of buses you need to use for it.

Output

Print the answer for each question on a separate line. If there is no way to get from one city to another, print -1. Otherwise print the minimum number of buses you have to use.

input

```
7
1 1 1 4 5 6
4
4 2
5 4
1 3
6 7
6
4 5
3 5
7 2
4 5
3 2
5 3
```

output

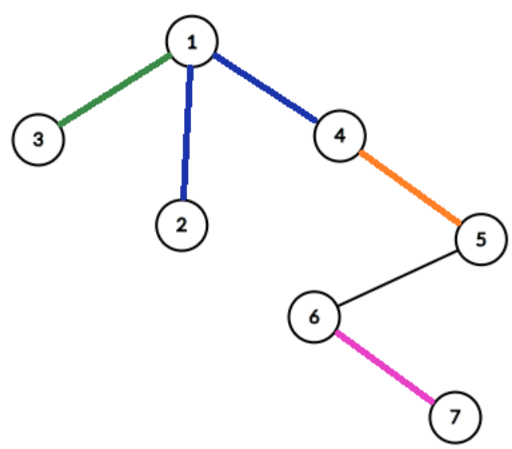
```
1
3
-1
1
2
3
```

input

```
7
1 1 2 3 4 1
4
4 7
3 5
7 6
7 6
6
4 6
3 1
3 2
2 7
6 3
5 3
```

output

```
1
-1
-1
1
-1
1
```



Routes for first sample are marked on the picture.