# Mathison and the divisors 2

Mathison has become tired of playing with circuits or trains and has decided to solve a maths problem.

You are given a **tree** with $N$ nodes. Each node contains a key.

Let's define:

- $D(n) =$ set of divisors of integer $n$
- $Count(D(n)) =$ number of divisors of integer $n$
- $Sum(D(n)) =$ sum of divisors of integer $n$
- $Prod(u, v) =$ the product of all keys on the unique path between nodes $u$ and $v$, including $u$ and $v$
- $Q1(u, v) = Count(D(Prod(u, v)))$ modulo $(10^9 + 9)$
- $Q2(u, v) = Sum(D(Prod(u, v)))$ modulo $(10^9 + 9)$

For $M$ given pairs of nodes $(u, v)$ you are to find $Q1(u, v)$ and $Q2(u, v)$.

# Standard input

The first line will contain one integer $N$, the number of nodes in the tree.

The second line will contain $N$ space-separated integers, the keys associated with the nodes.

Each of the next $N - 1$ lines will contain a pair of integers $s$ and $t$, denoting an **edge** between $s$ and $t$. They form a tree.

The next line will contain one integer $M$, the number of queries you need to answer.

Each of the next $M$ lines will contain a pair of integers $u$ and $v$, the parameters of the queries you need to compute.

# Standard output

The output file will contain $M$ lines, each containing two integers representing, in order, $Q1(u, v)$ and $Q2(u, v)$ for every pair $(u, v)$ of nodes given in the input.

# Constraints and notes

- $1 \leq N \leq 4 \cdot 10^4$
- $1 \leq M \leq 6 \cdot 10^4$
- All keys will be integers between $1$ and $10^6$
- $1 \leq u, v \leq N$
- $1 \leq s, t \leq N, s \neq t$

# Subtasks

Test cases will be scored ***individually***.

| Subtask | Percentage of test cases | Additional input constraints |
|---|---|---|
| 1 | $20\%$ | $N \leq 100$ |

| Subtask | Percentage of test cases | Additional input constraints |
|---|---|---|
| 2 | $30\%$ | all keys $\leq 100$ |
| 3 | $50\%$ | none |

For each test you may receive ***partial scoring***.

| Value of the test awarded | Condition to award the points |
|---|---|
| $80\%$ | $Q1(u, v)$ must be computed correctly and a wrong value ***must be supplied*** for $Q2(u, v)$ for all $M$ pairs of $(u, v)$ |
| $20\%$ | $Q2(u, v)$ must be computed correctly and a wrong value ***must be supplied*** for $Q1(u, v)$ for all $M$ pairs of $(u, v)$ |
| $100\%$ | $Q1(u, v)$ and $Q2(u, v)$ must be computed correctly for all $M$ pairs of $(u, v)$ |

# Examples

| Input | Output | Explanation |
|---|---|---|
| 5<br>3 4 5 1 5<br>4 2<br>1 3<br>4 5<br>2 1<br>4<br>4 4<br>2 2<br>1 5<br>3 4 | 1 1<br>3 7<br>12 168<br>12 168 | • $Prod(4, 4) = 1, D(1) = \{1\}, Count(D(1)) = 1, Sum(D(1)) = 1$<br>• $Prod(2, 2) = 4, D(4) = \{1, 2, 4\}, Count(D(4)) = 3, Sum(D(4)) = 7$<br>• $Prod(1, 5) = 3 \cdot 4 \cdot 1 \cdot 5 = 60$,<br>$D(60) = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}, Count(D(60)) = 12$,<br>$Sum(D(60)) = 168$<br>• $Prod(3, 4) = 5 \cdot 3 \cdot 4 \cdot 1 = 60$,<br>$D(60) = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}, Count(D(60)) = 12$,<br>$Sum(D(60)) = 168$ |