Xorability P43845_en

Consider a tree with n nodes numbered from 1 to n, rooted at 1. Each node i has a natural label ℓ_i. Given two nodes u and v, define $X(u, v)$ as the exclusive or (`^` in C++) of all the ℓ_i in the path from u to v.

Let L be the set of leaves of the tree. Please compute $\sum_{v \in L} X(1, v)$.

Input

Input consists of several trees, each with the number of nodes n, followed by $\ell_1, \ldots, \ell_n$, followed by $n - 1$ pairs of nodes describing the edges of the tree. Assume $2 \leq n \leq 10^5$, and $0 \leq l_i \leq 10^9$.

Output

For each tree, print the required sum.

Sample input 1

```
3
2 7 3
1 2  2 3
6
18 6 9 12 15 3
1 6  6 5  3 6  2 3  3 4
7
1 2 3 4 5 6 7
1 4  1 5  2 1  4 6  2 3  2 7
4
1000000000 0 0 0
2 1  3 1  4 1
```

Sample output 1

```
6
80
11
3000000000
```

Problem information

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