Problem A. And Xor Tree

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	256 megabytes

You are given a tree of n nodes. Each node has a non-negative integer value v_i.

Each path (from vertex i to vertex j) on the tree has an and-value A_{ij} which is the bitwise-and of the values of all nodes on the path. Similarly, each path has an or-value O_{ij} and an xor-value X_{ij} corresponding to the bitwise-or and bitwise-xor of the values of the nodes on the path respectively.

Compute the following three values:

$$\sum_{i,j} A_{ij}^2, \sum_{i,j} O_{ij}^2, \sum_{i,j} X_{ij}^2$$

where each sum ranges over all n^2 paths on the tree.

As the answers may be large, report each sum modulo 998244353.

Input

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

The second line of input contains n integers $v_1, v_2, \ldots, v_n$ ($0 \le v < 2^{25}$) — the value of each node in the tree.

The following $n - 1$ lines each contain two integers a_i, b_i — the endpoints of edge i.

Output

Output 3 integers — the sum of squares of all and-values, or-values, and xor-values respectively. Each sum should be reported modulo 998244353.

Examples

standard input	standard output
2 14 2 2 1	208 592 488
5 3 9 14 7 12 4 1 4 3 4 5 3 2	769 4627 1697
12 10 3 8 13 6 2 3 14 1 5 10 6 10 1 6 2 2 10 9 7 2 9 9 11 3 7 8 2 5 7 4 7 12 2	825 20705 12035