-is-this-bitset-

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

Note the low memory limit!

You are given a binary tree with n nodes in it, rooted at node 1. This means that each node has at most 2 children. You are also given two arrays of n integers, a and b

The subset problem for node i is defined to be the question: Can you take a subset S of the ancestors of node i and itself, such that $\sum_{j \in S}(a_j) = b_i$

You can do at most 5000 operations on array a. In one operation you choose two integers i and x ($1 \leq i \leq n$, $0 \leq x \leq 2 \cdot 10^6$), and set $a_i := x$.

After these operations, solve the subset sum problem for each node i, and output the results as a bitstring.

Input

The first line contains the integer n ($1 \leq n \leq 300\,000$) — the size of the binary tree The next $n-1$ lines contain two integers u and v ($1 \leq u, v \leq n$, $u \neq v$) — nodes u and v are connected by an edge.

It is guaranteed that these edges form a binary tree rooted at node 1

The next line contains n integers $a_1, a_2, \ldots, a_n$ ($0 \leq a_i \leq 2 \cdot 10^6$) — the array a.

The last line of the input contains n integers $b_1, b_2, \ldots, b_n$ ($0 \leq b_i \leq 2 \cdot 10^6$) — the array b

Output

Output n integers $a'_1, a'_2, \ldots, a'_n$ ($0 \leq a'_i \leq 2 \cdot 10^6$) — the new array a', which is the array a after the operations were done on it.

On the next line, output a bitstring of length n, with a 1 on position i, if the subset problem on node i can be solved, and 0 otherwise.

Examples

standard input	standard output
5 2 1 1 3 3 4 5 4 1 3 11 12 6 0 5 12 13 18	1 3 11 12 0 10110
1 2000000 2000000	2000000 1

Note

In the sample output, it was decided to change the last number of array a into 0.