Problem A
Maximum Diameter

Time Limit: 2 seconds

Let $X = (x_1, x_2, \ldots, x_{n-1})$ be any integer sequence of length $n-1$ whose elements are between 1 and n, inclusive. Consider all trees satisfying the following condition. At least one such tree always exists. Define $f(X)$ as the maximum diameter among these trees.

- The tree consists of n nodes numbered 1 through n. Edges are numbered 1 through $n-1$. For each i $(1 \leq i \leq n-1)$, one of the endpoints of edge i is x_i.

Here, the diameter of a tree is the maximum number of edges on a path between two nodes.

You are given two integer sequences, $A = (a_1, a_2, \ldots, a_{n-1})$ and $B = (b_1, b_2, \ldots, b_{n-1})$. Each element in A is between 1 and n, inclusive. Each element in B is positive. You can assume that the pairs $(a_1, b_1), (a_2, b_2), \ldots, (a_{n-1}, b_{n-1})$ are distinct.

For each $d = 2, 3, \ldots, n-1$, solve the following problem:

> Choose an integer sequence $X = (x_1, x_2, \ldots, x_{n-1})$ whose elements are between 1 and n, inclusive, and that satisfies $f(X) = d$. Such a sequence always exists. For each i $(1 \leq i \leq n-1)$, you pay a cost of 2^{b_i} if and only if $x_i \neq a_i$. Find the minimum possible total cost.

Because each answer may be large, output it modulo 998 244 353.

Input

The input consists of a single test case of the following format.

> n
> $a_1\ a_2\ \cdots\ a_{n-1}$
> $b_1\ b_2\ \cdots\ b_{n-1}$

The first line contains an integer n $(3 \leq n \leq 2 \times 10^5)$. The second line contains $n-1$ integers in the sequence A $(1 \leq a_i \leq n)$. The third line contains $n-1$ integers in the sequence B $(1 \leq b_i \leq 10^9)$. It is guaranteed that $(a_i, b_i) \neq (a_j, b_j)$ if $i \neq j$.

Output

Output $n-2$ lines. The k-th line should contain the answer for $d = k+1$, i.e., the minimal possible total cost for a sequence X such that $f(X) = k+1$, modulo 998 244 353.

Sample Input 1

```
5
2 4 3 4
1 2 4 8
```

Sample Output 1

```
18
2
0
```

Sample Input 2

```
10
6 2 1 6 10 4 6 10 4
1 1 7 8 1 5 5 5 10
```

Sample Output 2

```
454
196
68
36
4
2
0
2
```

Sample Input 3

```
9
1 1 1 1 1 1 1 1
24 27 30 33 36 39 42 45
```

Sample Output 3

```
0
16777216
150994944
226492415
830472183
671088562
394263947
```