



## Construction of Highway

There are  $N$  cities in JOI Kingdom, which are indexed by the numbers from 1 to  $N$ . City 1 is the capital city. Each city has a value called **liveliness** and the initial value of liveliness of city  $i$  ( $1 \leq i \leq N$ ) is  $C_i$ .

Road in JOI Kingdom connects two different cities bidirectionally. Initially, there is no road in JOI Kingdom. You have planned  $N - 1$  constructions of roads. The  $j$ -th construction ( $1 \leq j \leq N - 1$ ) is planned to be done in the following way.

- Two cities,  $A_j$  and  $B_j$ , are appointed, when one can go from city 1 to city  $A_j$  and cannot go from city 1 to city  $B_j$  by using only roads constructed at that time.
- You construct a road connecting city  $A_j$  and city  $B_j$ . The cost of this construction is the number of pairs of cities  $(s, t)$  satisfying the following conditions:

City  $s$  and City  $t$  lie on the shortest path between city 1 and city  $A_j$ , and when one goes from city 1 to city  $A_j$  he arrives city  $s$  before city  $t$ , and the value of liveliness of city  $s$  is strictly larger than that of city  $t$ .

Here, cities lying on the path between city 1 and city  $A_j$  include city 1 and city  $A_j$ . Notice that the shortest path between city 1 and city  $A_j$  is unique.

- The values of liveliness of all cities lying on the path between city 1 and city  $A_j$  change to the value of liveliness of city  $B_j$ .

You want to know the cost of each construction.

### Task

Given the data of cities and constructions of roads, write a program which calculates the cost of each construction.

### Input

Read the following data from the standard input.

- The first line of input contains a integer  $N$ . This means there are  $N$  cities in JOI Kingdom.
- The second line of input contains  $N$  space separated integers  $C_1, C_2, \dots, C_N$ . This means the initial value of liveliness of city  $i$  ( $1 \leq i \leq N$ ) is  $C_i$ .
- The  $j$ -th line ( $1 \leq j \leq N - 1$ ) of following  $N - 1$  lines contains two space separated integers  $A_j, B_j$ . This means city  $A_j$  and city  $B_j$  are appointed for the  $j$ -th construction of road.



## Output

Write  $N - 1$  lines to the standard output. The  $j$ -th line ( $1 \leq j \leq N - 1$ ) of output contains the cost of the  $j$ -th construction of road.

## Constraints

All input data satisfy the following conditions.

- $1 \leq N \leq 100\,000$ .
- $1 \leq C_i \leq 1\,000\,000\,000$  ( $1 \leq i \leq N$ ).
- $1 \leq A_j \leq N$  ( $1 \leq j \leq N - 1$ ).
- $1 \leq B_j \leq N$  ( $1 \leq j \leq N - 1$ ).
- By using roads constructed before the  $j$ -th construction, one can go from city 1 to city  $A_j$  and cannot go from city 1 to city  $B_j$  ( $1 \leq j \leq N - 1$ ).

## Subtask

There are 3 subtasks. The score and additional constraints of each subtask are as follows:

### Subtask 1 [7 points]

- $N \leq 500$ .

### Subtask 2 [9 points]

- $N \leq 4000$ .

### Subtask 3 [84 points]

There are no additional constraints.



## Sample Input and Output

Sample Input 1	Sample Output 1
5	0
1 2 3 4 5	0
1 2	0
2 3	2
2 4	
3 5	

In Sample Input 1, constructions are done as follows:

- In the first construction, there are no pairs  $(s, t)$  satisfying the conditions, so the cost is 0. A road connecting city 1 and city 2 is constructed and the value of liveliness of city 1 changes to 2.
- In the second construction, there are no pairs  $(s, t)$  satisfying the conditions too, so the cost is 0. A road connecting city 2 and city 3 is constructed and the values of liveliness of city 1 and city 2 change to 3.
- In the third construction, there are no pairs  $(s, t)$  satisfying the conditions too, so the cost is 0. A road connecting city 2 and city 4 is constructed and the values of liveliness of city 1 and city 2 change to 4.
- In the fourth construction, two pairs  $(s, t) = (1, 3), (2, 3)$  satisfy the conditions, so the cost is 2. A road connecting city 3 and city 5 is constructed and the values of liveliness of city 1, city 2 and city 3 change to 5.

Sample Input 2	Sample Output 2
10	0
1 7 3 4 8 6 2 9 10 5	0
1 2	0
1 3	1
2 4	1
3 5	0
2 6	1
3 7	2
4 8	3
5 9	
6 10	