

Monyo

SEASON 10 - SECOND ROUND



Today Monyo the milkman is going to load the trunk of his car with milk and go sell it in the villages nearby. There are N houses living in those villages and $N-1$ bidirectional roads connecting them. There is a path consisting of some of those roads between every pair of houses. The houses are numbered from 1 to N such that Monyo's house is number one. There is one potential customer living in every other house. Monyo has two types of customers: loyal and not so loyal. A loyal customer will definitely buy one bottle of milk the first time Monyo passes by their house. "Not so loyal" customers buy milk only if Monyo tries to sell them, but they also don't refuse to buy, because everyone has heard of how delicious his milk is. Loyal customers are useful, because they recommend Monyo's milk to others and thus help him expand his business. That's why he always wants to attract more customers and have more loyal ones. In order to do this, he wants to sell as much milk as possible to people who are not loyal customers yet, even if he has to avoid loyal ones (after all, they all love him and won't get angry at him for this), but he must still sell to loyal customers if he passes by their houses.

Monyo will proceed the following way: he starts from his own house and every minute he goes to another one, which is connected by a road to the one he's currently in. If he hasn't visited that house before, he will sell one bottle of milk to the person who lives there (if it's a loyal customer, Monyo is obliged to sell to him, otherwise Monyo will sell to him, because he wants to attract him as a loyal customer). If he has visited the house before, he won't do anything there. When he has no milk left, he will go home. Help him find the maximum number of "not so loyal" customers he can sell to, depending on how many bottles of milk he has.

Input (monyo.in)

On the first line of the input you are given the number of houses N . Each of the next $N - 1$ lines contains two numbers A and B - the indices of two houses connected by a road. The last line contains a string of length $N-1$, consisting only of zeros and ones. If the i -th character of the string is 1, the person living in house with number $i+1$ is a loyal customer, otherwise not.

Output (monyo.out)

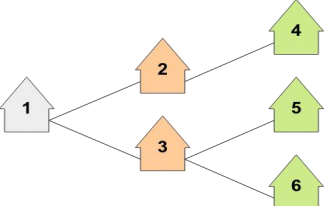
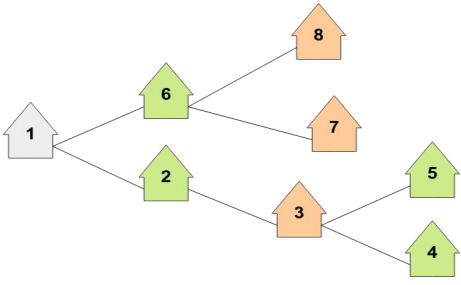
Output $N-1$ numbers on separate lines: the i -th number should be equal to the maximum number of "not so loyal" customers Monyo can sell milk to, if he has loaded i bottles of milk in his trunk.

Constraints

$$1 \leq N \leq 1\,000\,000$$

The number of loyal customers is not greater than 1 000.

Examples

Input	Output	Explanation
6 1 2 1 3 2 4 3 5 3 6 11000	0 1 2 2 3	 <p>On the picture Monyo's house is in gray, loyal customers' houses are in orange and other customers' houses are in green. If Monyo has only one bottle, he has to sell it either in house 2 or in house 3. If he has 2 bottles, he can sell them for example in houses 2 and 4. If he has 3 bottles, he will sell them in houses 3, 5 and 6. If he has 4 bottles, he has to sell two of them in houses 2 and 3 and there will be only two left for not loyal customers. If he has 5 bottles, he will sell one in each house.</p>
8 1 2 2 3 3 4 3 5 1 6 6 7 6 8 0100011	1 2 2 3 4 4 4	 <p>If Monyo has 1 or 2 bottles, he can sell them in houses 2 and 6. If he has 3, 4 or 5 bottles, he can sell them by visiting only one loyal customer (the one in house 3). If he has 6 or 7 bottles, he will sell the last ones in houses 7 and 8.</p>