Problem B

We have n cities joined by $n-1$ highways into a tree. For each highway, we know the time (in minutes) it takes to drive over it. Zombie outbreaks are occurring in the cities (the outbreaks do not end). After each outbreak, we want to determine how safe some of the cities are, that is, what is their distance from the cities with outbreaks.

Input and output

The first line of the input contains an integer n ($1 \le n \le 10^5$), the number of cities. The cities are numbered from 1 to n. The i-th of the following $n-1$ lines contains two integers v and d ($1 \le v \le i$, $1 \le d \le 10^9$), indicating that the city number $i+1$ is joined to the city number v by a highway that takes d minutes to traverse. Each of the following lines contains either `O` c ($1 \le c \le n$), indicating that an outbreak starts in the city c (you can assume there has not been an outbreak in the city c before), or `S` c ($1 \le c \le n$), instructing us to output the minimum distance from the city c to a cities with an outbreak (you can assume there is at least one outbreak at this point).

Example

Input:

```
4
1 6
2 6
3 4
O 2
S 1
S 2
S 3
S 4
O 3
S 1
S 2
S 3
S 4
```

Output:

```
6
0
6
10
6
0
```

```
0
4
```