Bus Lines

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	1024 megabytes

In Byteopolis, there are n bus stops, numbered with integers from 1 to n, connected by $n-1$ bidirectional roads in such a way that one can travel from any stop to any other only via the roads. In other words, the bus stops and their connecting roads form a tree.

There are m bus lines operating in Byteopolis. The bus of the i-th of these lines continuously[1] shuttles back and forth along the shortest path between stops c_i and d_i. One can get on or off any bus at any stop along its route, including the terminal stops. The lines are planned such that one can get from any stop to any other using only the buses and not travelling any distance on the roads in any other way.

Let $f(i, j)$ where $(1 \leq i, j \leq n)$, denote the minimum number of bus lines needed to travel from stop i to stop j. Specifically, for every i, $f(i, i) = 0$, and for all pairs (i, j), $f(i, j) = f(j, i)$. Your task, for every stop i, is to compute the value of $\sum_{j=1}^{n} f(i, j)$.

Input

The first line of the standard input contains a single integer n $(2 \leq n \leq 200\,000)$, the number of bus stops in Byteopolis.

The next $n-1$ lines contain two integers a_i and b_i $(1 \leq a_i, b_i \leq n)$ indicating that bus stops a_i and b_i are connected by a road. It's guaranteed that the roads of Byteopolis describe a valid tree.

The subsequent line of the input contains a single integer m $(1 \leq m \leq 200\,000)$, the number of bus lines.

The next m lines contain two integers c_i and d_i $(1 \leq c_i, d_i \leq n; c_i \neq d_i)$ indicating that there's a bus shuttling between stops c_i and d_i. It's guaranteed that one can get from any stop to any other using only the buses.

Output

In a single output line, output n integers, where the i-th of them should be equal to $\sum_{j=1}^{n} f(i, j)$.

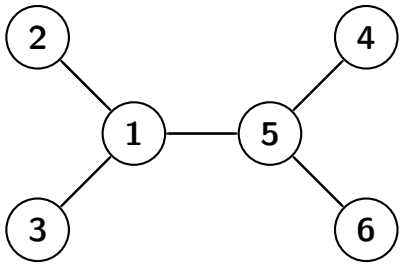
Example

standard input	standard output
6 1 2 5 4 6 5 3 1 1 5 3 6 1 2 3 6 4	6 9 9 10 7 7

Note

The layout of stops and roads in the sample test is represented as follows:

[1] Buses in Byteopolis are advanced and intelligent vehicles that don't need drivers and are powered by solar energy, so they never have to stop moving along their designated route.



If we wanted to travel from stop 2 to stop 4, we would first have to use the second bus line (operating between stops 2 and 3) and get off at stop 1. Next, we should use the first bus line (operating between stops 6 and 1) and get off at stop 5. Finally, we should reach our destination using the last bus line. It's not possible to move between these stops using only two lines, so $f(2, 4) = 3$.

All values of $f(i, j)$ in the sample test are presented in the matrix below, where the cell located in the i-th row and j-th column contains the value of $f(i, j)$. The numbers in the program's output should be equal to the sums of the values in consecutive rows:

	1	2	3	4	5	6
1	**0**	**1**	**1**	**2**	**1**	**1**
2	**1**	**0**	**1**	**3**	**2**	**2**
3	**1**	**1**	**0**	**3**	**2**	**2**
4	**2**	**3**	**3**	**0**	**1**	**1**
5	**1**	**2**	**2**	**1**	**0**	**1**
6	**1**	**2**	**2**	**1**	**1**	**0**