A Average distance

Given a tree, calculate the average distance between two vertices in the tree. For example, the average distance between two vertices in the following tree is $(d_{01} + d_{02} + d_{03} + d_{04} + d_{12} + d_{13} + d_{14} + d_{23} + d_{24} + d_{34})/10 = (6+3+7+9+9+13+15+10+12+2)/10 = 8.6$.

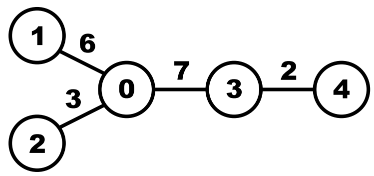


Figure 1: The first sample case

Input

On the first line an integer t ($1 \leq t \leq 100$): the number of test cases. Then for each test case:

- One line with an integer n ($2 \leq n \leq 10\,000$): the number of nodes in the tree. The nodes are numbered from 0 to $n-1$.
- $n-1$ lines, each with three integers a ($0 \leq a < n$), b ($0 \leq b < n$) and d ($1 \leq d \leq 1\,000$). There is an edge between the nodes with numbers a and b of length d. The resulting graph will be a tree.

Output

For each testcase:

- One line with the average distance between two vertices. This value should have either an absolute or a relative error of at most 10^{-6}.

Sample in- and output

Input	Output
1 5 0 1 6 0 2 3 0 3 7 3 4 2	8.6

B. Duff in the Army

time limit per test: 4 seconds
memory limit per test: 512 megabytes
input: standard input
output: standard output

Recently Duff has been a soldier in the army. Malek is her commander.

Their country, Andarz Gu has n cities (numbered from 1 to n) and n - 1 bidirectional roads. Each road connects two different cities. There exist a unique path between any two cities.

There are also m people living in Andarz Gu (numbered from 1 to m). Each person has and ID number. ID number of i - th person is i and he/she lives in city number c_i. Note that there may be more than one person in a city, also there may be no people living in the city.

Malek loves to order. That's why he asks Duff to answer to q queries. In each query, he gives her numbers v, u and a.

To answer a query:

Assume there are x people living in the cities lying on the path from city v to city u. Assume these people's IDs are $p_1, p_2, ..., p_x$ in increasing order.

If $k = min(x, a)$, then Duff should tell Malek numbers $k, p_1, p_2, ..., p_k$ in this order. In the other words, Malek wants to know a minimums on that path (or less, if there are less than a people).

Duff is very busy at the moment, so she asked you to help her and answer the queries.

Input

The first line of input contains three integers, n, m and q ($1 \le n, m, q \le 10^5$).

The next n - 1 lines contain the roads. Each line contains two integers v and u, endpoints of a road ($1 \le v, u \le n$, $v \ne u$).

Next line contains m integers $c_1, c_2, ..., c_m$ separated by spaces ($1 \le c_i \le n$ for each $1 \le i \le m$).

Next q lines contain the queries. Each of them contains three integers, v, u and a ($1 \le v, u \le n$ and $1 \le a \le 10$).

Output

For each query, print numbers $k, p_1, p_2, ..., p_k$ separated by spaces in one line.

Examples

input

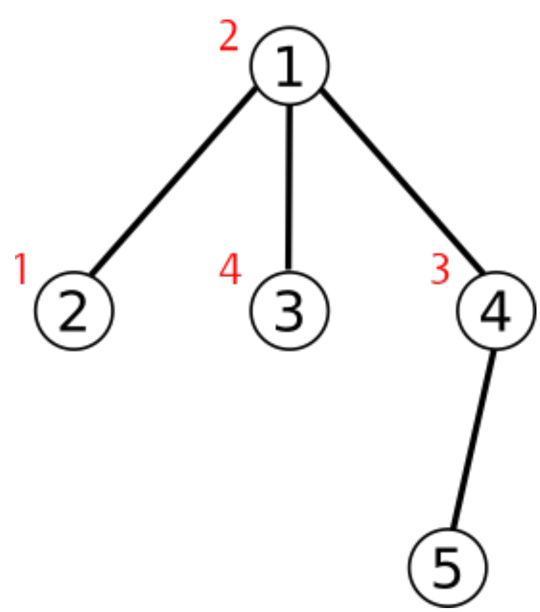
```
5 4 5
1 3
1 2
1 4
4 5
2 1 4 3
4 5 6
1 5 2
5 5 10
2 3 3
5 3 1
```

output

```
1 3
2 2 3
0
3 1 2 4
1 2
```

Note

Graph of Andarz Gu in the sample case is as follows (ID of people in each city are written next to them):



C. New Year Santa Network

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

New Year is coming in Tree World! In this world, as the name implies, there are n cities connected by $n - 1$ roads, and for any two distinct cities there always exists a path between them. The cities are numbered by integers from 1 to n, and the roads are numbered by integers from 1 to $n - 1$. Let's define $d(u, v)$ as total length of roads on the path between city u and city v.

As an annual event, people in Tree World repairs exactly one road per year. As a result, the length of one road decreases. It is already known that in the i-th year, the length of the r_i-th road is going to become w_i, which is shorter than its length before. Assume that the current year is year 1.

Three Santas are planning to give presents annually to all the children in Tree World. In order to do that, they need some preparation, so they are going to choose three distinct cities c_1, c_2, c_3 and make exactly one warehouse in each city. The k-th ($1 \leq k \leq 3$) Santa will take charge of the warehouse in city c_k.

It is really boring for the three Santas to keep a warehouse alone. So, they decided to build an only-for-Santa network! The cost needed to build this network equals to $d(c_1, c_2) + d(c_2, c_3) + d(c_3, c_1)$ dollars. Santas are too busy to find the best place, so they decided to choose c_1, c_2, c_3 randomly uniformly over all triples of distinct numbers from 1 to n. Santas would like to know the expected value of the cost needed to build the network.

However, as mentioned, each year, the length of exactly one road decreases. So, the Santas want to calculate the expected after each length change. Help them to calculate the value.

Input

The first line contains an integer n ($3 \leq n \leq 10^5$) — the number of cities in Tree World.

Next $n - 1$ lines describe the roads. The i-th line of them ($1 \leq i \leq n - 1$) contains three space-separated integers a_i, b_i, l_i ($1 \leq a_i, b_i \leq n$, $a_i \neq b_i$, $1 \leq l_i \leq 10^3$), denoting that the i-th road connects cities a_i and b_i, and the length of i-th road is l_i.

The next line contains an integer q ($1 \leq q \leq 10^5$) — the number of road length changes.

Next q lines describe the length changes. The j-th line of them ($1 \leq j \leq q$) contains two space-separated integers r_j, w_j ($1 \leq r_j \leq n - 1$, $1 \leq w_j \leq 10^3$). It means that in the j-th repair, the length of the r_j-th road becomes w_j. It is guaranteed that w_j is smaller than the current length of the r_j-th road. The same road can be repaired several times.

Output

Output q numbers. For each given change, print a line containing the expected cost needed to build the network in Tree World. The answer will be considered correct if its absolute and relative error doesn't exceed 10^{-6}.

Examples

input

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

output

```
14.0000000000
12.0000000000
8.0000000000
6.0000000000
4.0000000000
```

input

```
6
1 5 3
5 3 2
6 1 7
1 4 4
5 2 3
5
1 2
2 1
3 5
4 1
5 2
```

output

```
19.6000000000
18.6000000000
16.6000000000
13.6000000000
12.6000000000
```

Note

Consider the first sample. There are 6 triples: $(1, 2, 3)$, $(1, 3, 2)$, $(2, 1, 3)$, $(2, 3, 1)$, $(3, 1, 2)$, $(3, 2, 1)$. Because $n = 3$, the cost needed to build the network is always $d(1, 2) + d(2, 3) + d(3, 1)$ for all the triples. So, the expected cost equals to $d(1, 2) + d(2, 3) + d(3, 1)$.

D. Book of Evil

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Paladin Manao caught the trail of the ancient Book of Evil in a swampy area. This area contains n settlements numbered from 1 to n. Moving through the swamp is very difficult, so people tramped exactly $n - 1$ paths. Each of these paths connects some pair of settlements and is bidirectional. Moreover, it is possible to reach any settlement from any other one by traversing one or several paths.

The *distance* between two settlements is the minimum number of paths that have to be crossed to get from one settlement to the other one. Manao knows that the Book of Evil has got a damage range d. This means that if the Book of Evil is located in some settlement, its damage (for example, emergence of ghosts and werewolves) affects other settlements at distance d or less from the settlement where the Book resides.

Manao has heard of m settlements affected by the Book of Evil. Their numbers are $p_1, p_2, ..., p_m$. Note that the Book may be affecting other settlements as well, but this has not been detected yet. Manao wants to determine which settlements may contain the Book. Help him with this difficult task.

Input

The first line contains three space-separated integers n, m and d ($1 \le m \le n \le 100000$; $0 \le d \le n - 1$). The second line contains m distinct space-separated integers $p_1, p_2, ..., p_m$ ($1 \le p_i \le n$). Then $n - 1$ lines follow, each line describes a path made in the area. A path is described by a pair of space-separated integers a_i and b_i representing the ends of this path.

Output

Print a single number — the number of settlements that may contain the Book of Evil. It is possible that Manao received some controversial information and there is no settlement that may contain the Book. In such case, print 0.

Examples

input Copy

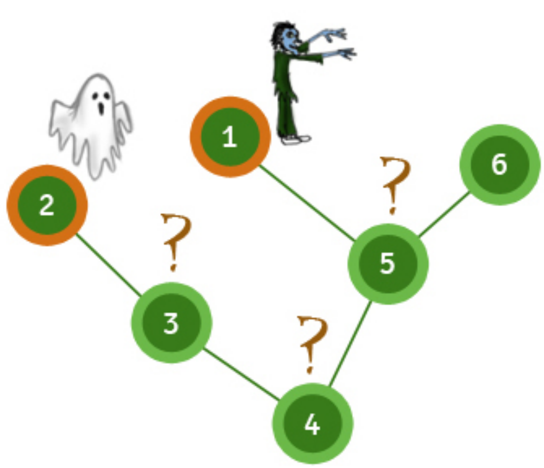
```
6 2 3
1 2
1 5
2 3
3 4
4 5
5 6
```

output

```
3
```

Note

Sample 1. The damage range of the Book of Evil equals 3 and its effects have been noticed in settlements 1 and 2. Thus, it can be in settlements 3, 4 or 5.



E. Civilization

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Andrew plays a game called "Civilization". Dima helps him.

The game has n cities and m bidirectional roads. The cities are numbered from 1 to n. Between any pair of cities there either is a single (unique) path, or there is no path at all. A path is such a sequence of distinct cities $v_1, v_2, ..., v_k$, that there is a road between any contiguous cities v_i and v_{i+1} $(1 \le i < k)$. The length of the described path equals to $(k - 1)$. We assume that two cities lie in the same region if and only if, there is a path connecting these two cities.

During the game events of two types take place:

1. Andrew asks Dima about the length of the longest path in the region where city x lies.
2. Andrew asks Dima to merge the region where city x lies with the region where city y lies. If the cities lie in the same region, then no merging is needed. Otherwise, you need to merge the regions as follows: choose a city from the first region, a city from the second region and connect them by a road so as to minimize the length of the longest path in the resulting region. If there are multiple ways to do so, you are allowed to choose any of them.

Dima finds it hard to execute Andrew's queries, so he asks you to help him. Help Dima.

Input

The first line contains three integers n, m, q $(1 \le n \le 3 \cdot 10^5; 0 \le m < n; 1 \le q \le 3 \cdot 10^5)$ — the number of cities, the number of the roads we already have and the number of queries, correspondingly.

Each of the following m lines contains two integers, a_i and b_i $(a_i \ne b_i; 1 \le a_i, b_i \le n)$. These numbers represent the road between cities a_i and b_i. There can be at most one road between two cities.

Each of the following q lines contains one of the two events in the following format:

- $1\ x_i$. It is the request Andrew gives to Dima to find the length of the maximum path in the region that contains city x_i $(1 \le x_i \le n)$.
- $2\ x_i\ y_i$. It is the request Andrew gives to Dima to merge the region that contains city x_i and the region that contains city y_i $(1 \le x_i, y_i \le n)$. Note, that x_i can be equal to y_i.

Output

For each event of the first type print the answer on a separate line.

Examples

input

```
6 0 6
2 1 2
2 3 4
2 5 6
2 3 2
2 5 3
1 1
```

output

```
4
```

F. A and B and Lecture Rooms

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

A and B are preparing themselves for programming contests.

The University where A and B study is a set of rooms connected by corridors. Overall, the University has n rooms connected by $n - 1$ corridors so that you can get from any room to any other one by moving along the corridors. The rooms are numbered from 1 to n.

Every day A and B write contests in some rooms of their university, and after each contest they gather together in the same room and discuss problems. A and B want the distance from the rooms where problems are discussed to the rooms where contests are written to be equal. The distance between two rooms is the number of edges on the shortest path between them.

As they write contests in new rooms every day, they asked you to help them find the number of possible rooms to discuss problems for each of the following m days.

Input

The first line contains integer n $(1 \le n \le 10^5)$ — the number of rooms in the University.

The next $n - 1$ lines describe the corridors. The i-th of these lines $(1 \le i \le n - 1)$ contains two integers a_i and b_i $(1 \le a_i, b_i \le n)$, showing that the i-th corridor connects rooms a_i and b_i.

The next line contains integer m $(1 \le m \le 10^5)$ — the number of queries.

Next m lines describe the queries. The j-th of these lines $(1 \le j \le m)$ contains two integers x_j and y_j $(1 \le x_j, y_j \le n)$ that means that on the j-th day A will write the contest in the room x_j, B will write in the room y_j.

Output

In the i-th $(1 \le i \le m)$ line print the number of rooms that are equidistant from the rooms where A and B write contest on the i-th day.

Examples

input

```
4
1 2
1 3
2 4
1
2 3
```

output

```
1
```

input

```
4
1 2
2 3
2 4
2
1 2
1 3
```

output

```
0
2
```

Note

in the first sample there is only one room at the same distance from rooms number 2 and 3 — room number 1.