Problem K. Knight of Nights

Time limit: 3 seconds
Memory limit: 1024 mebibytes

A kingdom has N towns, numbered from 1 to N, connected by $N-1$ bidirectional roads. Each road has length 1, and it is possible to travel between any two towns. In other words, a kingdom forms a tree. Let $\text{dist}(u, v)$ denote the distance between towns u and v.

There are two groups of knights, consisting of a and b knights, respectively. You must establish two camps: camp 1 for the first group and camp 2 for the second group. Each camp must be located at one of the N towns, and the two camps may be located at the same town. Camps cannot be placed in the interior of a road.

Each knight has a starting town p and a travel time w per unit distance. If the knight's group gathers at a camp located at town s, the knight takes $w \cdot \text{dist}(p, s)$ time to reach the camp.

A messenger must also travel from camp 1 to camp 2 to exchange information. However, the winter weather is getting worse, making the messenger's journey increasingly difficult. On day q, the messenger takes qv time per unit distance, where v is a fixed non-negative integer. Thus, if the camps are located at towns s_1 and s_2, the messenger's travel time is $qv \cdot \text{dist}(s_1, s_2)$.

The total cost on a given day is the sum of the travel times of all knights to their respective camps and the messenger's travel time between the camps.

For each day $q = 1, 2, \ldots, T$, choose the locations of the two camps to minimize the total cost. If multiple placements achieve the minimum cost, find the minimum possible distance between the two camps.

Input

Each test contains multiple test cases.

The first line contains an integer t — the number of test cases.

Each test case is described as follows.

The first line contains an integer N — the number of towns.

The i-th of the next $N-1$ lines contains two integers u_i and v_i, describing a bidirectional road between towns u_i and v_i.

The next line contains an integer a — the number of knights assigned to camp 1.

The i-th of the next a lines contains two integers $w_{1,i}$ and $p_{1,i}$ — the travel time per unit distance and the starting town of the i-th knight assigned to camp 1, respectively.

The next line contains an integer b — the number of knights assigned to camp 2.

The i-th of the next b lines contains two integers $w_{2,i}$ and $p_{2,i}$ — the travel time per unit distance and the starting town of the i-th knight assigned to camp 2, respectively.

The next line contains two integers v and T.

Output

For each test case, print T lines.

The q-th line ($1 \le q \le T$) must contain the minimum possible distance between the two camps among all placements that minimize the total cost on day q.

Constraints

- $1 \le t \le 4 \cdot 10^5$
- $1 \le N \le 2 \cdot 10^5$
- $1 \le a, b$

- $a + b \leq 4 \cdot 10^5$
- $1 \leq u_i, v_i \leq N$ $(1 \leq i \leq N - 1)$
- $1 \leq w_{1,i} \leq 10^5, 1 \leq p_{1,i} \leq N$ $(1 \leq i \leq a)$
- $1 \leq w_{2,i} \leq 10^5, 1 \leq p_{2,i} \leq N$ $(1 \leq i \leq b)$
- $0 \leq v \leq 10^5$
- $1 \leq T \leq 2 \cdot 10^5$
- All towns are connected by the given $N - 1$ roads.
- The sum of N over all test cases does not exceed $5 \cdot 10^5$.
- The sum of T over all test cases does not exceed $5 \cdot 10^5$.
- The sum of $a + b$ over all test cases does not exceed $8 \cdot 10^5$.

Examples

standard input	standard output
2 3 1 2 2 3 2 3 1 1 2 2 4 3 1 2 1 4 2 1 2 1 1 1 1 2 2 0 3	2 1 0 0 1 1 1
1 10 1 2 2 3 3 4 4 5 5 6 6 7 2 8 4 9 6 10 4 8 1 1 2 1 8 2 3 4 10 7 1 6 1 10 2 5 2 6	6 5 4 3 2 0

Note

In the first test case of the first example, the kingdom has 3 towns, with 2 knights in each group.

The camps can be placed as follows:

- On day 1, camp 1 is at town 1 and camp 2 is at town 3. The knights' total travel time is $1 + 1 = 2$, and the messenger's travel time is $1 \cdot 2 = 2$. Thus, the total cost is 4, and the distance between the camps is 2.
- On day 2, camp 1 is at town 2 and camp 2 is at town 3. The knights' total travel time is $3 + 1 = 4$,

and the messenger's travel time is $2 \cdot 1 = 2$. Thus, the total cost is 6, and the distance between the camps is 1.

- On day 3, both camps are at town 2. The knights' total travel time is $3+4 = 7$, and the messenger's travel time is 0. Thus, the total cost is 7, and the distance between the camps is 0.
- On day 4, both camps remain at town 2. The knights' total travel time is 7, and the messenger's travel time is 0. Thus, the total cost is 7, and the distance between the camps is 0.

In the second test case of the first example, the kingdom has 2 towns, with 1 knight in each group.

Since $v = 0$, the messenger's travel time is always 0. By placing camp 1 at town 1 and camp 2 at town 2, the knights' total travel time is also 0. Therefore, the minimum total cost is 0 on every day, and the distance between the camps is always 1.