F. Juan's Colorful Tree

time limit per test: 3 seconds
memory limit per test: 1024 megabytes

Juan has a beautiful tree with n nodes numbered from 1 to n. There are also k distinct colors numbered from 1 to k. Each node u in the tree has its own set C_u which contains colors. Let's denote with s the quantity $\sum_{i=1}^{n} |C_i|$.

There are q queries where you will be given nodes u and v. Let P denote the set of all nodes in the simple path between u and v, inclusive. You are asked to calculate for each query the following quantity:

$$\left| \bigcap_{w \in P} C_w \right|$$

That is, the cardinality of the intersection of the sets of all the nodes in the path from u to v. In other words, calculate how many colors appear in every set on the path from u to v.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \le t \le 10^4$). The description of the test cases follows.

The first line of each test case contains four integers n, k, s, and q ($1 \le n, k, q \le 3 \cdot 10^5, 1 \le s \le \min(nk, 3 \cdot 10^5)$) — the number of nodes in the tree, the number of distinct colors, the sum of the cardinalities of all sets of colors, and the number of queries, respectively.

The next $n - 1$ lines each contain two integers u, v ($1 \le u, v \le n$), indicating that there's an edge between nodes u and v.

The next s lines each contain two integers v and x ($1 \le v \le n, 1 \le x \le k$) indicating that color x is in C_v. All s lines are pairwise distinct.

The next q lines each contain two integers u and v ($1 \le u, v \le n$), indicating a query between nodes u and v.

It is guaranteed that the sum of n over all test cases does not exceed $3 \cdot 10^5$.

It is guaranteed that the sum of k over all test cases does not exceed $3 \cdot 10^5$.

It is guaranteed that the sum of s over all test cases does not exceed $3 \cdot 10^5$.

It is guaranteed that the sum of q over all test cases does not exceed $3 \cdot 10^5$.

Output

For each test case, output a line: the answer to all queries in the order they appear in the input, separated by spaces.

Example

input

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

```
2 3
1 2
1 1
9 3 12 10
7 2
2 4
6 8
9 6
2 1
5 8
2 5
3 9
1 3
6 1
9 3
9 1
5 1
2 3
8 1
4 3
5 3
8 3
7 3
3 1
4 7
1 4
4 5
5 5
4 2
9 9
2 2
2 2
5 2
7 3
```

output   Copy

```
2 2 3 5
1 1 1 2 1 2 1 1 1 0
```

Note

In the first test case, there is a tree of 3 nodes with edges $(1, 3)$ and $(2, 1)$. The colors in the sets of each node are:

- $C_1 = \{1, 2, 3, 4, 5\}$
- $C_2 = \{1, 2, 5\}$
- $C_3 = \{1, 2\}$

The 4 queries are between the pairs of nodes $(1, 3)$, $(2, 3)$, $(1, 2)$, $(1, 1)$ and correspond to calculating the following quantities respectively:

- $|C_1 \cap C_3| = |\{1, 2\}| = 2$
- $|C_2 \cap C_1 \cap C_3| = |\{1, 2\}| = 2$
- $|C_2 \cap C_1| = |\{1, 2, 5\}| = 3$
- $|C_1| = |\{1, 2, 3, 4, 5\}| = 5$