

2026 Canadian Computing Olympiad
Day 2, Problem 2
Tree Traversals

Time Limit: 4 seconds

Memory Limit: 512 MB

Yevin Kang has a tree with N vertices that are labelled with integers from 1 to N . A tree is an undirected connected graph that does not contain a cycle.

Let K be a positive integer. We define $f(K)$ as follows.

For any two vertices $1 \leq u, v \leq N$, let $d(u, v)$ denote the number of edges on the simple path connecting vertex u and vertex v . In particular, $d(u, u) = 0$ for all $1 \leq u \leq N$.

A permutation p_1, \dots, p_N of $1, \dots, N$ is *good* if all of the following conditions are satisfied.

- $d(p_{i-1}, p_i) \leq K$ for all $i = 2, \dots, N$.
- $d(1, p_i) \leq d(1, p_j)$ for all pairs of integers (i, j) with $1 \leq i < j \leq N$.

Then, $f(K)$ is the number of good permutations.

Yevin thinks this problem is too easy, so he gives you Q positive integers K_1, \dots, K_Q . He asks you to print the values of $f(K_1), f(K_2), \dots, f(K_Q)$, mod $10^9 + 7$.

It may also be useful to note that “mod” corresponds to the % operator in most programming languages, indicating the remainder after division. For example, $5 \bmod 3 = 2$ and $17 \bmod 4 = 1$.

Input Specification

Each test has multiple test cases.

The first line of the test contains one integer T ($1 \leq T \leq 5 \times 10^5$) — the number of test cases.

The first line of each test case contains two space-separated integers N, Q ($1 \leq Q \leq N \leq 5 \times 10^5$).

Each of the next $N - 1$ lines contains two space-separated integers u, v — indicating that there is an edge connecting u and v in the tree. It is guaranteed that the $N - 1$ edges form a tree.

The next line contains Q integers, K_1, \dots, K_Q — denoting the Q queries.

It is guaranteed that the sum of N over all test cases in a test (denoted by $\sum N$) does not exceed 5×10^5 .

The following table shows how the 25 available marks are distributed:

Marks Awarded	Bounds on $\sum N$	Bounds on Q	Bounds on K_i
2 marks	$1 \leq \sum N \leq 10$	$1 \leq Q \leq N$	$1 \leq K_i \leq N$
3 marks	$1 \leq \sum N \leq 5 \times 10^5$	$1 \leq Q \leq \min(2, N)$	$1 \leq K_i \leq \min(2, N)$
5 marks	$1 \leq \sum N \leq 3000$	$1 \leq Q \leq \min(5, N)$	$1 \leq K_i \leq N$
7 marks	$1 \leq \sum N \leq 5 \times 10^5$		
8 marks		$1 \leq Q \leq N$	

Output Specification

For each test case, output one line with Q space-separated integers — the values of $f(K_1), f(K_2), \dots, f(K_Q)$, mod $10^9 + 7$.

Sample Input

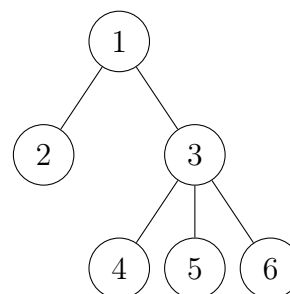
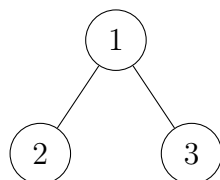
```
2
3 3
1 2
1 3
1 2 3
6 3
1 2
1 3
3 4
3 5
3 6
1 2 3
```

Output for Sample Input

```
0 2 2
0 6 12
```

Explanation of Output for Sample Input

The two trees in the sample input are shown below.



In the first test case, for $K = 2$ or $K = 3$, both $[1, 2, 3]$ and $[1, 3, 2]$ are good permutations. $[2, 1, 3]$ is not a good permutation for all values of K because

$$d(1, p_1) = 1 \not\leq 0 = d(1, p_2)$$

violates the second condition.

It can be shown that no permutation is good for $K = 1$.

In the second test case, $[1, 3, 2, 4, 5, 6]$ is a good permutation for $K = 3$ but not a good permutation for $K = 2$ because $d(2, 4) = 3 \not\leq 2$.