Challenges of urban planning

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	256 megabytes

Citizens of Byteland have started building a new city Bittown by all of the modern standards of urban planning. Two famous urbanists — Adilkhan Paradoxny and Temirlan Bitihirovich were hired to design a new city's plan.

Bittown will have n crossroads and $n-1$ bidirectional streets connecting them. It is also guaranteed, that one can get from any crossroad to any other crossroad moving along the Bittown streets. Also, a single-family house will be built on each crossroad.

According to the plan, two schools will be built in Bittown. However, urbanists still need to choose two crossroads to build those schools. Notice that, if a school is built on a crossroad, a house with one family will still be built on that crossroad. It is also possible to build both schools on one crossroad.

Of course, it is important for urbanists, that new city locals will get to schools as quickly as possible. Each family will drive to school which is closest to their house.

Let's number crossroads from 1 to n and let $d(v, u)$ be the minimum number of streets required to get from crossroad v to crossroad u. Suppose, schools are built on crossroads with numbers a and b. Then, the level of inconvenience of schools $f(a, b)$ is defined as the sum of distances to the closest school over each household. Formally, $f(a, b) = \sum_{v=1}^{n} \min[d(a, v), d(b, v)]$.

Both urbanists are very proud and are not willing to discuss the design with each other. So, each of them will independently choose a future location of one of the schools.

Consider 3 possible scenarios:

1. You are responsible for choosing crossroads for both schools. In this case, find the smallest possible level of inconvenience $f(a, b)$ where $1 \le a, b \le n$.
2. Temirlan Bitihirovich wants to build a school on the crossroad $a = 1$, while Adilkhan Paradoxny asks you for help. Find the smallest possible level of inconvenience $f(a, b)$ when $1 \le b \le n$ and $a = 1$.
3. Adilkhan Paradoxny asks you for help, but Temirlan Bitihirovich did not disclose his plans. In this case, you need to find the smallest possible level of inconvenience $f(a, b)$, where $1 \le b \le n$ for each value of a from 1 to n.

Write a program that finds the smallest level of inconvenience in one of the described scenarios.

Input

The first line contains one integer t ($1 \le t \le 1000$) — number of test cases.

In following lines, descriptions of test cases are given.

First line of each test case contains two numbers n and p ($1 \le n \le 10^5$, $1 \le p \le 3$) — number of crossroads in Bittown and scenario number you are facing.

Following $n - 1$ lines contain pairs (u_i, v_i) ($1 \le u_i, v_i \le n$, $u_i \ne v_i$, here $1 \le i \le n - 1$) — indices of crossroads, connected by i-th road.

It is guaranteed, that the sum of values of n over all test cases does not exceed 10^5.

Output

For each test case given in input, in separate lines, print the answer in following format.

- If $p = 1$, print a single integer — the smallest possible value of $f(a, b)$.
- If $p = 2$, print a single integer — the smallest possible value of $f(a, b)$ when $a = 1$.
- If $p = 3$, print n integers $(e_1, \ldots, e_n)$, where e_i — the smallest possible value of $f(a, b)$ when $a = i$.

Scoring

Define S as the sum of n over all of test cases.

Subtask	Additional Constraints	Score	Necessary subtasks
0	Examples	0	—
1	$S \leq 500$	7	0
2	$(u_i, v_i) = (i, i + 1)$ for all $1 \leq i \leq n - 1$, $p = 3$	6	—
3	$S \leq 4000$	15	1
4	$p = 2$	11	—
5	$p = 1$	22	—
6	$S \leq 30000$	21	3
7	—	18	2, 4, 5, 6

Example

standard input	standard output
3 6 1 1 2 2 3 2 4 4 5 4 6 7 2 1 2 2 3 3 4 3 5 2 6 1 7 7 3 1 2 2 3 3 4 3 5 2 6 1 7	4 6 6 6 6 7 7 8 6

Note

In the first test case $p = 1$, the smallest value $f(a, b)$ is reached when $(a, b) = (2, 4)$. In this case, the level of inconvenience is equal to $1 + 0 + 1 + 0 + 1 + 1 = 4$.

In the second test case $p = 2$ and $a = 1$ is fixed, so the smallest value $f(a, b)$ is reached when $b = 3$. In this case, the level of inconvenience is equal to $0 + 1 + 0 + 1 + 1 + 2 + 1 = 6$.