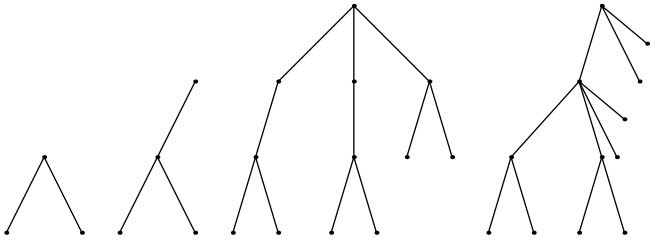
Problem B. Tree Product

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Given n rooted trees $T_1, T_2, \ldots, T_n$, find two permutations $p_1, p_2, \ldots, p_n$ and $q_1, q_2, \ldots, q_n$ such that the diameter of $T_{p_1} \times T_{p_2} \times \ldots \times T_{p_n}$ is maximum and the diameter of $T_{q_1} \times T_{q_2} \times \ldots \times T_{q_n}$ is minimum.

For two rooted trees A and B, their *tree product* $T = A \times B$ is defined as follows: copy tree A, and then for each vertex x in it, make a copy of B and merge its root with vertex x. See the table below for an example:

A	B	$A \times B$	$B \times A$



It can be shown that tree product is associative: $(A \times B) \times C = A \times (B \times C)$. So the parentheses in a product of three or more trees can be omitted.

Recall that:

- A tree is a connected graph without cycles. A rooted tree has a special vertex called the root. The parent of a vertex v is the last vertex different from v on the path from the root to v.
- The diameter of a rooted tree is the length of the longest simple path in the tree, where the length of a path is the number of edges in the path.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains an integer n ($1 \le n \le 10^6$), indicating the number of rooted trees.

Each of the next n lines starts from an integer m_i ($1 \le m_i \le 10^5$), indicating the number of vertices in the i-th rooted tree. It is followed by m_i integers $p_{i,1}, p_{i,2}, \ldots, p_{i,m_i}$ ($0 \le p_{i,j} \le m_i$) on the same line, where the j-th of them denotes the parent of the j-th vertex. The root of the tree has 0 as parent.

It is guaranteed that the sum of m_i over all test cases does not exceed 10^6.

Output

For each test case, output two integers: the maximum and the minimum diameter, in that order.

Example

standard input	standard output
2 3 5 0 1 2 1 4 3 2 0 2 2 2 0 2 1 0 1 0	8 7 0 0

Note

For the first sample test case, $T_1 \times T_2 \times T_3$ will provide the maximum diameter, while $T_3 \times T_2 \times T_1$ will provide the minimum diameter.