F. Andrey's Tree

time limit per test: 4 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Master Andrey loves trees[†] very much, so he has a tree consisting of n vertices.

But it's not that simple. Master Timofey decided to steal one vertex from the tree. If Timofey stole vertex v from the tree, then vertex v and all edges with one end at vertex v are removed from the tree, while the numbers of other vertices remain unchanged. To prevent Andrey from getting upset, Timofey decided to make the resulting graph a tree again. To do this, he can add edges between any vertices a and b, but when adding such an edge, he must pay $|a - b|$ coins to the Master's Assistance Center.

Note that the resulting tree **does not contain** vertex v.

Timofey has not yet decided which vertex v he will remove from the tree, so he wants to know for each vertex $1 \le v \le n$, the minimum number of coins needed to be spent to make the graph a tree again after removing vertex v, as well as which edges need to be added.

[†]A tree is an undirected connected graph without cycles.

Input

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

The first line of each test case contains a single integer n ($5 \le n \le 2 \cdot 10^5$) — the number of vertices in Andrey's tree.

The next $n - 1$ lines contain a description of the tree's edges. The i-th of these lines contains two integers u_i and v_i ($1 \le u_i, v_i \le n$) — the numbers of vertices connected by the i-th edge.

It is guaranteed that the given edges form a tree.

It is guaranteed that the sum of n over all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, output the answer in the following format:

For each vertex v (in the order from 1 to n), in the first line output two integers w and m — the minimum number of coins that need to be spent to make the graph a tree again after removing vertex v, and the number of added edges.

Then output m lines, each containing two integers a and b ($1 \le a, b \le n, a \ne v, b \ne v$, $a \ne b$) — the ends of the added edge.

If there are multiple ways to add edges, you can output any solution with the minimum cost.

Example

input

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


→ Problem tags

binary search, constructive algorithms, data structures, dfs and similar, dsu, greedy, implementation, trees, *2800

No tag edit access

→ Contest materials

- Announcement (en)
- Tutorial (en)

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

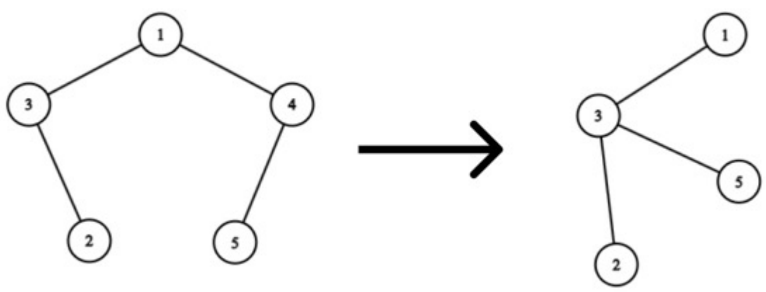
output

```
1 1
3 4

0 0

1 1
1 2

2 1
3 5

0 0

0 0

0 0

1 1
1 2

1 1
1 2

1 1
1 2

3 3
2 3
4 5
3 4

0 0

0 0

0 0

0 0
```

Note

In the first test case:

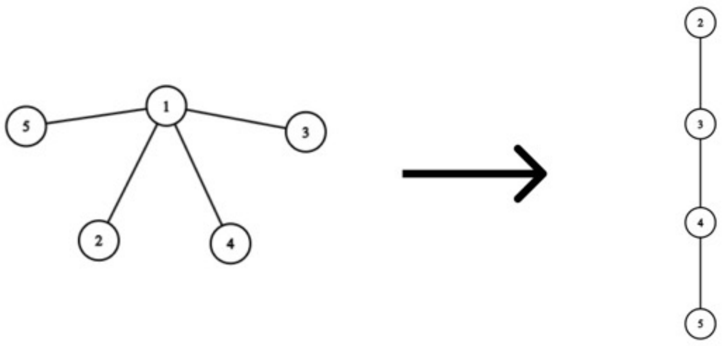
Consider the removal of vertex 4:



The optimal solution would be to add an edge from vertex 5 to vertex 3. Then we will spend $|5 - 3| = 2$ coins.

In the third test case:

Consider the removal of vertex 1:



The optimal solution would be:

- Add an edge from vertex 2 to vertex 3, spending $|2-3|=1$ coin.
- Add an edge from vertex 3 to vertex 4, spending $|3-4|=1$ coin.
- Add an edge from vertex 4 to vertex 5, spending $|4-5|=1$ coin.

Then we will spend a total of $1+1+1=3$ coins.

Consider the removal of vertex 2:

No edges need to be added, as the graph will remain a tree after removing the vertex.