

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<sup>†</sup> 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  $1 \leq v \leq n$ , 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.

<sup>†</sup> A tree is an undirected connected graph without cycles.

**Input**

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

The first line of each test case contains a single integer  $n$  ( $5 \leq n \leq 2 \cdot 10^5$ ) — 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  $v_i$  ( $1 \leq u_i, v_i \leq n$ ) — 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  $b$  ( $1 \leq a, b \leq n, a \neq v, b \neq v, a \neq b$ ) — 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
```

Copy

Codeforces Round 932 (Div. 2)

Finished

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Start virtual contest

→ 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

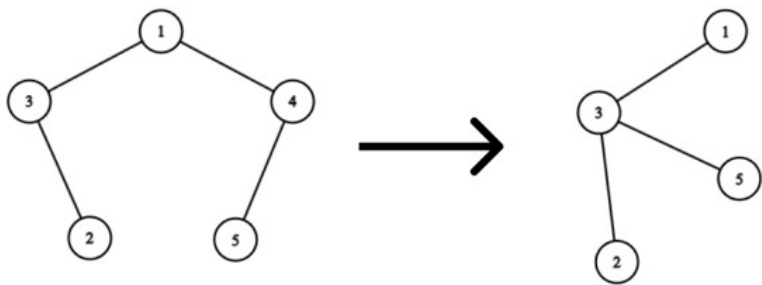
0 0

0 0

0 0
```

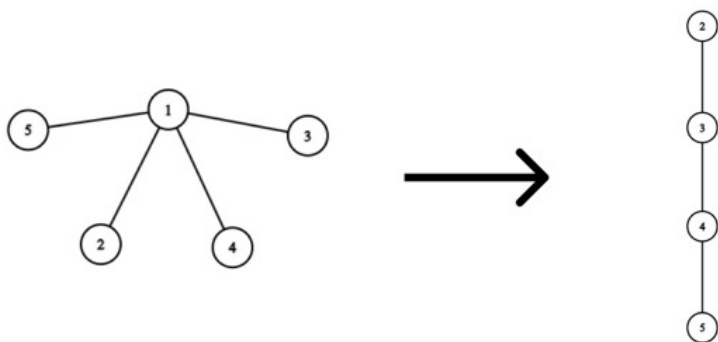
**Note**

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:

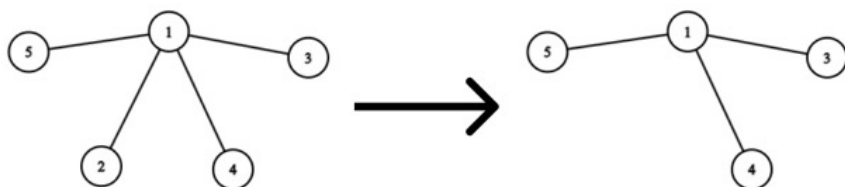


The optimal solution would be:

- 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.

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