B. Dynamic Diameter

time limit per test: 3 seconds

memory limit per test: 256 megabytes

You are given $n + 1$ nodes and $n - 1$ edges where the first n nodes are a tree and node $n + 1$ is in its own component. For each node i from $1 \ldots n$, answer the following question:

If an edge was added from node i to node $n + 1$, what would the diameter of the created tree be? (Notice that the $n + 1$ nodes will be a tree if this edge was added).

Input
The first line will contain a single integer n, the number of nodes in the tree initial tree. $n - 1$ lines follow, each containing two different integers, describing the edges initially in the tree. Additional constraint on input: these edges will form a tree on the first n nodes.
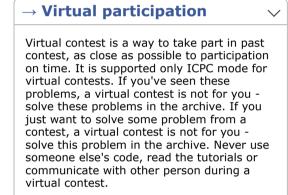
$1 \le n \le 3 * 10^5$

Output
Print n integers, each on their own line. The ith is the diameter of the new tree if you were to add an edge from node i to node $n + 1$.
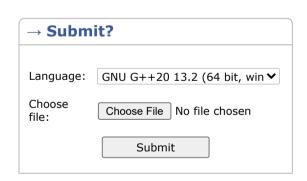
Examples

input

```
1
```

output

```
1
```

input

```
3
3 2
2 1
```

output

```
3
2
3
```

input

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

output

```
3
3
3
2
3
```