8 Minimum Diameter

8.1 Problem Description

The following is the **minimum diameter problem**.

- You are given a forest (an acyclic undirected graph) with n vertices. Consider adding some edges to the forest to turn it into a tree. Find the minimum possible diameter of the resulting tree.

Here the diameter of a tree is defined as the maximum distance among all pairs of vertices. The distance of two vertices in a tree is defined as the number of edges on the shortest path between them.

You are given a forest of n vertices and m edges. The edges are numbered from $1, 2, ..., m$. For each $i = 1, 2, ..., m$, consider the forest only containing the first i edges, and compute the answer to the **minimum diameter problem** on this forest.

8.2 Input

The first line contains a single integer T ($1 \leq T \leq 10^3$) - the number of test cases.

For each test case, the first line contains two integers n, m ($2 \leq n \leq 10^5, 1 \leq m < n$).

Each of next m lines contains two integers u and w ($1 \leq u, w \leq n$) - describes the i-th edge of the forest.

It's guarantee that the sum of n among all test cases is not greater than 10^6 and m edges form a forest.

8.3 Output

For each test case, output m lines. The i-th of these lines should contain a single integer, indicating the answer to the **minimum diameter problem** on the forest only containing the first i edges of the original forest.

8.4 Sample Input

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

8.5 Sample Output

```
2
2
```

```
3
4
```