Problem I
Critical Structures

Time limit: 3 seconds

Memory limit: 1024 megabytes

Problem Description

Intelligence Cloud Privacy Company (ICPC) is a world famous cloud service company that aims at developing secure and powerful cloud computing environments for users. Engineers in the ICPC construct a data center with n computing nodes, denoted by $1, 2, \ldots, n$, and m communication links. We can model this data center as an undirected graph $G = (V, E)$, in which n vertices represent n computing nodes and an edge between Node i to Node j if there is a communication link between them; we also call i and j are two end-nodes of this link. In addition, for two arbitrary nodes i and j in G, there is at most one communication link between i and j, and there is no communication link between the same node.

A *linear array structure* in a data center G is a sequence of nodes $\langle v_0, v_1, \ldots, v_{k-1} \rangle$, where $k \geq 2$, such that any two consecutive v_{i-1} and v_i for $1 \leq i \leq k-1$ have a communication link, and v_i for $0 \leq i \leq k-1$ are all distinct. A *ring structure* is a sequence of nodes $\langle v_0, v_1, \ldots, v_{k-1} \rangle$, where $k \geq 4$, such that any two consecutive v_{i-1} and v_i for $1 \leq i \leq k-1$ have a communication link, $v_0 = v_{k-1}$ and v_i for $0 \leq i \leq k-2$ are all distinct. A data center G is *connected* if there is a linear array between any two nodes; otherwise, it is *disconnected*. Using some elegant resource allocation algorithm, a research team of the ICPC needs to find the following critical structures for enhancing the privacy and security:

1. Critical node: a node in G whose removal disconnects G.
2. Critical link: a communication link in G whose removal disconnects G.
3. Critical component: a maximal set of communication links in G such that any two communication links in the set lie on a common ring.
4. Largest critical component: a critical component with the maximum number of communication links.

Given a connected data center G, your task is to write a computer program for computing the number of critical nodes, the number of critical links, and

$$\begin{aligned} \mu^* &= \frac{\text{the number of critical components}}{\text{the number of communication links in a largest critical component}} \\ &= \frac{p}{q}, \end{aligned}$$

where $\frac{p}{q}$ is an irreducible form of μ^*.

Input Format

The first line of the input file contains an integer L ($L \leq 10$) that indicates the number of test cases as follows. For each test case, the first line contains two integers (separated by a space) representing n and m. Then it is immediately followed by m lines, in which each line contains two integers that represent two end-nodes of a communication link; moreover, any two consecutive integers are separated by a space.

Output Format

The output contains one line for each test case. Each line contains four positive integers representing the number of critical nodes, the number of critical links, p, and q, where $\frac{p}{q}$ is an irreducible form of μ^*. Note that any two consecutive integers are separated by a space.

Technical Specification

- $3 \leq n \leq 1000$ for each test case.
- $n - 1 \leq m \leq \frac{n(n-1)}{2}$.
- The sum of m in all L tests is smaller than 10^6.

Sample Input 1

```
1
6 6
1 2
2 3
3 4
4 5
5 6
6 1
```

Sample Output 1

```
0 0 1 6
```

Sample Input 2

```
1
6 7
1 2
2 3
3 1
4 5
5 6
6 4
1 4
```

Sample Output 2

```
2 1 1 1
```