Problem F. Counting Paths on a Graph

Problem Description

Given integer n and a set of m edges $\{(u_i, v_i)\}_{i=1}^{m}$, construct the undirected simple graph G as below:

- Nodes are numbered $1, 2, \ldots, n$.
- Two node a and b has an edge if
  1. there exist $i \in [1, m]$ such that $(a, b) = (u_i, v_i)$, or
  2. $|a - b| = \gcd(a, b)$.

A route passing through node $(r_1, r_2, \ldots, r_k)$ is called *excited* if the difference between adjacent node is strictly increasing, that is,

- $|r_{i+1} - r_i| > |r_i - r_{i-1}|$ for $i = 2, 3, \ldots, k - 1$.

Please find the number of excited routes in G with length > 1, modulo p.

Input Format

The first line contains three integers n, m, and p.

Each of the next m lines contains two integers u_i and v_i.

Output Format

Print a single non-negative integer, the number of excited routes in G with length > 1, modulo p.

Constraints

- $1 \le n \le 3\,000\,000$.
- $0 \le m \le 500\,000$.
- $10^8 \le p \le 10^9$.
- $1 \le u_i < v_i \le n$ for $i = 1, 2, \ldots, m$.
- $(u_i, v_i) \neq (u_j, v_j)$ for $1 \le i < j \le m$.
- $|u_i - v_i| \neq \gcd(u_i, v_i)$ for $i = 1, 2, \ldots, m$.
- All inputs are integers.

Subtasks

1. (10 points) $n \leq 10$; $m = 0$.
2. (10 points) $n \leq 10$.
3. (20 points) $n \leq 80$.
4. (20 points) $n \leq 400$.
5. (20 points) $n \leq 3000$.
6. (10 points) $n \leq 100\,000$.
7. (10 points) No additional constraints.

No.	Testdata Range	Time Limit (ms)	Memory Limit (KiB)
Samples	1-5	4000	262144
1	1-14	4000	262144
2	1-22	4000	262144
3	1-28	4000	262144
4	1-34	4000	262144
5	1-41	4000	262144
6	1-47	4000	262144
7	1-53	4000	262144

Samples

Sample Input 1

```
5 0 1000000000
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 1

```
14
```

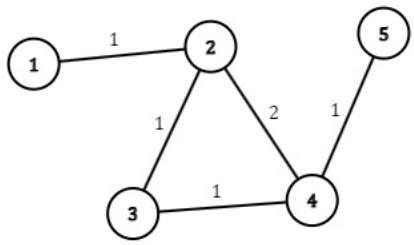

Figure 1: The graph in Sample Input 1.
Number on the edges show the difference between the two nodes they connect.

There are 10 excited routes with length 2:

- $(1, 2), (2, 1), (2, 3), (2, 4), (3, 2), (3, 4), (4, 2), (4, 3), (4, 5), (5, 4)$

There are 4 excited routes with length 3:

- $(1, 2, 4), (3, 2, 4), (3, 4, 2), (5, 4, 2)$

Sample Input 2

```
5 3 1000000000
1 4
2 5
1 5
```

This sample input satisfies the constraints of Subtasks 2, 3, 4, 5, 6, 7.

Sample Output 2

```
46
```

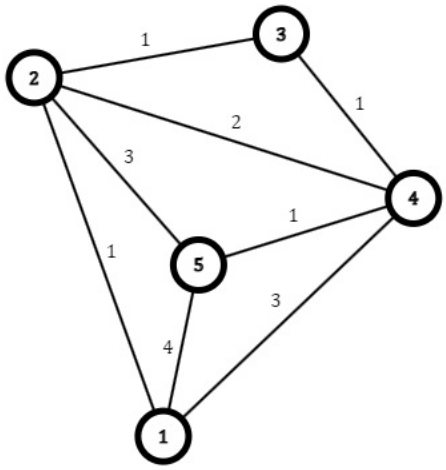

Figure 1: The graph in Sample Input 2.

For example, $(1, 2, 5)$ is an excited route of length 3, and $(1, 2, 4, 1, 5)$ is an excited route of length 5.

Sample Input 3

```
6 7 676767676
1 3
1 4
1 5
1 6
2 5
2 6
3 5
```

This sample input satisfies the constraints of Subtasks 2, 3, 4, 5, 6, 7.

Sample Output 3

```
170
```

The graph in Sample Input 3 is K_6, a complete graph.

Sample Input 4

```
2779 0 360565573
```

This sample input satisfies the constraints of Subtasks 5, 6, 7.

Sample Output 4

```
0
```

Make sure you output the answer modulo p. 🙂

Sample Input 5

```
100000 10 998244353
14608 28155
50059 70059
78848 96576
14982 72820
72663 82680
24809 50767
5371 69650
71737 86095
35624 82984
16759 20037
```

This sample input satisfies the constraints of Subtasks 6, 7.

Sample Output 5

```
964178665
```