DMOPC '21 Contest 7 P6 - Rainbow Subgraphs

Time limit: 2.0s   **Memory limit:** 256M

You are given positive integers N, M, and MOD.

Let V be the set of points (x, y) in the plane such that x and y are integers, $y \geq 0$, and $N^2 \leq x^2 + y^2 < (N + M)^2$. Let E be a set of undirected edges between elements of V, where $(u, v) \in E$ if point u and point v are distance 1 apart.

Calculate the number of subgraphs of the graph $G = (V, E)$, modulo MOD. That is, the number of pairs (V', E') such that $V' \subseteq V$, $E' \subseteq E$, and $u, v \in V'$ for all $(u, v) \in E'$. Note that V' and/or E' are allowed to be empty or equal to V or E respectively.

Constraints

$1 \leq N \leq 300$

$1 \leq M \leq 16$

$10^8 \leq MOD \leq 10^9$

Subtask 1 [20%]

$1 \leq N \leq 10$

$1 \leq M \leq 5$

Subtask 2 [20%]

$1 \leq N \leq 35$

$1 \leq M \leq 5$

Subtask 3 [20%]

$1 \leq N \leq 100$

$1 \leq M \leq 5$

Subtask 4 [20%]

$1 \leq N \leq 200$

$1 \leq M \leq 10$

Subtask 5 [20%]

No additional constraints.

Input Specification

The first and only line of input contains three space-separated integers: N, M, and MOD.

Output Specification

Output the number of subgraphs modulo MOD.
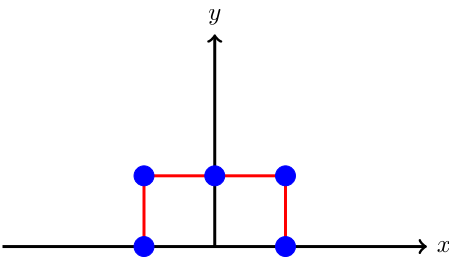
Sample Input 1

```
1 1 998244352
```

Sample Output 1

```
89
```

Explanation for Sample 1

The graph G looks like the following:
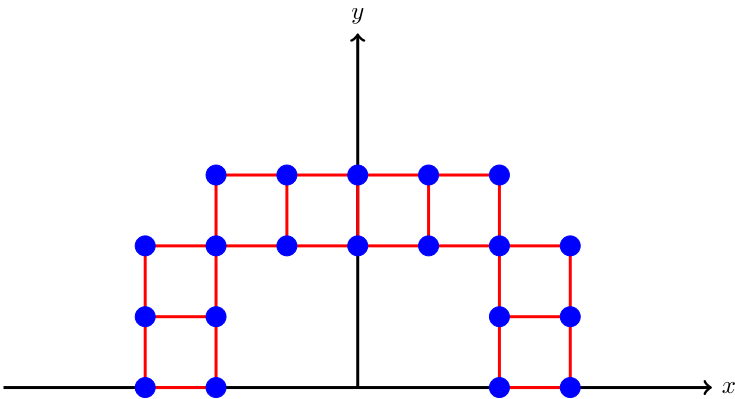

Sample Input 2

```
2 2 998244352
```

Sample Output 2

```
41377047
```

Explanation for Sample 2

The graph G looks like the following:

Sample Input 3

```
31 4 159265358
```

Sample Output 3

```
54714600
```