

Project Euler #253: Tidying up

This problem is a programming version of [Problem 253](#) from [projecteuler.net](#)

A small child has a “number caterpillar” consisting of forty jigsaw pieces, each with one number on it, which, when connected together in a line, reveal the numbers 1 to 40 in order.

Every night, the child's father has to pick up the pieces of the caterpillar that have been scattered across the play room. He picks up the pieces at random and places them in the correct order.

As the caterpillar is built up in this way, it forms distinct segments that gradually merge together. The number of segments starts at zero (no pieces placed), generally increases up to about eleven or twelve, then tends to drop again before finishing at a single segment (all pieces placed).

For example:

Piece Placed	Segments So Far
12	1
4	2
29	3
6	4
34	5
5	4
35	4
...	...

Let M be the maximum number of segments encountered during a random tidy-up of the caterpillar. For a caterpillar of ten pieces, the number of possibilities for each M is

M	Possibilities
1	512
2	250912
3	1815264
4	1418112
5	144000

so the most likely value of M is 3 and the average value is $\frac{385643}{113400} = 3.400732$, rounded to six decimal places.

Given the n -piece caterpillar, what is the average value of M ? Give your answer modulo mod . As the average value of M is obviously rational and could be represented as $\frac{p}{q}$, print $p \times q^{-1} \pmod{mod}$.

Input Format

The first line of each test file contains exactly two numbers separated by a single space, n and mod .

Constraints

- $1 \leq n \leq 1000$
- $2^{26} \leq mod \leq 2^{30}$
- mod is prime.

Output Format

Print exactly one number: the average value of M modulo mod .

Sample Input 0

```
1 1000000007
```

Sample Output 0

```
1
```

Explanation 0

The only valid permutation allows only one segment of length **1**.

Sample Input 1

```
10 1000000009
```

Sample Output 1

```
283712528
```

Explanation 1

$$385643 \times 113400^{-1} \pmod{1000000009} = 385643 \times 902213412 \pmod{1000000009} = 283712528$$