Question 2 Periodic strings

A *string* is any nonempty sequence of 0s and 1s. Examples of strings are 00, 101, 111000, 1, 0, 01. The *length* of a string is the number of symbols in it. For example, the length of 111000 is 6. If u and v are strings, then uv is the string obtained by concatenating u and v. For example if $u = 110$ and $v = 0010$ then $uv = 1100010$.

A string w is *periodic* if there exists a string v such that $w = v^n = vv\cdots v$ (n times), for some $n \geq 2$. Note that in this case the length of v is strictly less than that of w. For example, 110110 is periodic, because it is vv for $v = 110$.

Given a positive integer N, find the number of strings of length N which are *not* periodic. Report the answer modulo M. The non-periodic strings of length 2 are 10 and 01. The non-periodic strings of length 3 are 001, 010, 011, 100, 101, and 110.

Input format

A single line, with two space-separated integers, N and M.

Output format

A single integer, the number of non-periodic strings of length N, modulo M.

Test Data

In all subtasks, $2 \leq M \leq 10^8$. The testdata is grouped into 4 subtasks.

Subtask 1 (10 marks) $1 \leq N \leq 4000$. N is the product of two distinct prime numbers.
Subtask 2 (20 marks) $1 \leq N \leq 4000$. N is a power of a prime number.
Subtask 3 (35 marks) $1 \leq N \leq 4000$.
Subtask 4 (35 marks) $1 \leq N \leq 150000$.

Example

Sample input

3 176

Sample output

6

Time and memory limits

The time limit for this task is 3 seconds. The memory limit is 512 MB.

Note: Your program should not print anything other than what is specified in the output format. Please remove all diagnostic print statements before making your final submission. A program with extraneous output will be treated as incorrect!

Important

Indicate the location of the source code file for your solution to Question 2 in the box below.
If you fail to do this, your solution cannot be evaluated!

> **Source file:**