OSU Practice Nov 20 2019

A. Tile Painting

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Ujan has been lazy lately, but now has decided to bring his yard to good shape. First, he decided to paint the path from his house to the gate.

The path consists of n consecutive tiles, numbered from 1 to n. Ujan will paint each tile in some color. He will consider the path *aesthetic* if for any two **different** tiles with numbers i and j, such that $|j-i|$ is a divisor of n greater than 1, they have the same color. Formally, the colors of two tiles with numbers i and j should be the same if $|i-j| > 1$ and $n \bmod |i-j| = 0$ (where $x \bmod y$ is the remainder when dividing x by y).

Ujan wants to brighten up space. What is the maximum number of different colors that Ujan can use, so that the path is aesthetic?

Input

The first line of input contains a single integer n ($1 \le n \le 10^{12}$), the length of the path.

Output

Output a single integer, the maximum possible number of colors that the path can be painted in.

Examples

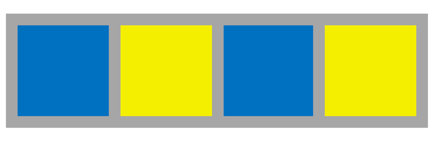
input
```
4
```
output
```
2
```

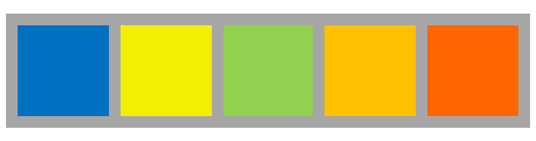
input
```
5
```
output
```
5
```

Note

In the first sample, two colors is the maximum number. Tiles 1 and 3 should have the same color since $4 \bmod |3-1| = 0$. Also, tiles 2 and 4 should have the same color since $4 \bmod |4-2| = 0$.

In the second sample, all five colors can be used.





C. Make Them Similar

time limit per test: 4 seconds
memory limit per test: 1024 megabytes
input: standard input
output: standard output

Let's call two numbers *similar* if their binary representations contain the same number of digits equal to 1. For example:

- 2 and 4 are similar (binary representations are 10 and 100);
- 1337 and 4213 are similar (binary representations are 10100111001 and 1000001110101);
- 3 and 2 are not similar (binary representations are 11 and 10);
- 42 and 13 are similar (binary representations are 101010 and 1101).

You are given an array of n integers a_1, a_2, ..., a_n. You may choose a non-negative integer x, and then get another array of n integers b_1, b_2, ..., b_n, where $b_i = a_i \oplus x$ ($\oplus$ denotes bitwise XOR).

Is it possible to obtain an array b where all numbers are similar to each other?

Input

The first line contains one integer n ($2 \le n \le 100$).

The second line contains n integers a_1, a_2, ..., a_n ($0 \le a_i \le 2^{30}-1$).

Output

If it is impossible to choose x so that all elements in the resulting array are similar to each other, print one integer -1.

Otherwise, print **any** non-negative integer not exceeding $2^{30}-1$ that can be used as x so that all elements in the resulting array are similar.

Examples

input
```
2
7 2
```
output
```
1
```

input
```
4
3 17 6 0
```
output
```
5
```

input
```
3
1 2 3
```
output
```
-1
```

input
```
3
43 12 12
```
output
```
1073709057
```

D. 0-1 MST

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Ujan has a lot of useless stuff in his drawers, a considerable part of which are his math notebooks: it is time to sort them out. This time he found an old dusty graph theory notebook with a description of a graph.

It is an undirected weighted graph on n vertices. It is a complete graph: each pair of vertices is connected by an edge. The weight of each edge is either 0 or 1; exactly m edges have weight 1, and all others have weight 0.

Since Ujan doesn't really want to organize his notes, he decided to find the weight of the minimum spanning tree of the graph. (The weight of a spanning tree is the sum of all its edges.) Can you find the answer for Ujan so he stops procrastinating?

Input

The first line of the input contains two integers n and m ($1 \le n \le 10^5$, $0 \le m \le \min(\frac{n(n-1)}{2}, 10^5)$), the number of vertices and the number of edges of weight 1 in the graph.

The i-th of the next m lines contains two integers a_i and b_i ($1 \le a_i, b_i \le n$, $a_i \ne b_i$), the endpoints of the i-th edge of weight 1.

It is guaranteed that no edge appears twice in the input.

Output

Output a single integer, the weight of the minimum spanning tree of the graph.

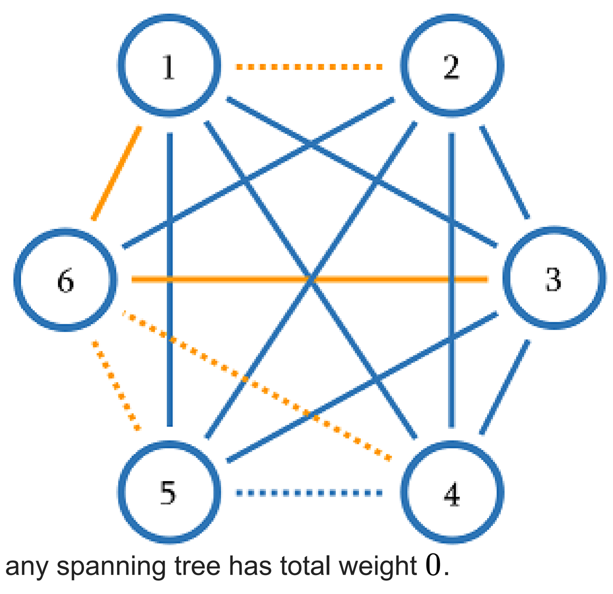
Examples

input
```
6 11
1 3
1 4
1 5
1 6
2 3
2 4
2 5
2 6
3 4
3 5
3 6
```
output
```
2
```

input
```
3 0
```
output
```
0
```

Note

The graph from the first sample is shown below. Dashed edges have weight 0, other edges have weight 1. One of the minimum spanning trees is highlighted in orange and has total weight 2.



In the second sample, all edges have weight 0 so any spanning tree has total weight 0.