Codeforces Round #589 (Div. 2)

A. Distinct Digits

1 second, 256 megabytes

You have two integers l and r. Find an integer x which satisfies the conditions below:

- $l \le x \le r$.
- All digits of x are different.

If there are multiple answers, print any of them.

Input

The first line contains two integers l and r ($1 \le l \le r \le 10^5$).

Output

If an answer exists, print any of them. Otherwise, print -1.

input
```
121 130
```
output
```
123
```

input
```
98766 100000
```
output
```
-1
```

In the first example, 123 is one of the possible answers. However, 121 can't be the answer, because there are multiple 1s on different digits.

In the second example, there is no valid answer.

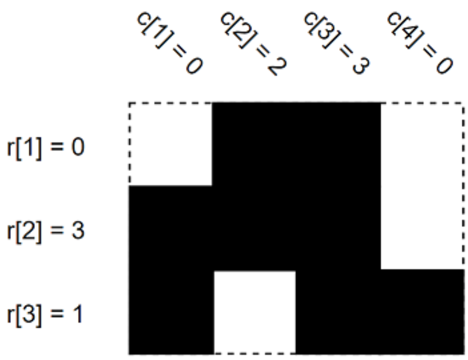
B. Filling the Grid

1 second, 256 megabytes

Suppose there is a $h \times w$ grid consisting of empty or full cells. Let's make some definitions:

- r_i is the number of consecutive full cells connected to the left side in the i-th row ($1 \le i \le h$). In particular, $r_i = 0$ if the leftmost cell of the i-th row is empty.
- c_j is the number of consecutive full cells connected to the top end in the j-th column ($1 \le j \le w$). In particular, $c_j = 0$ if the topmost cell of the j-th column is empty.

In other words, the i-th row starts exactly with r_i full cells. Similarly, the j-th column starts exactly with c_j full cells.



These are the r and c values of some 3×4 grid. Black cells are full and white cells are empty.

You have values of r and c. Initially, all cells are empty. Find the number of ways to fill grid cells to satisfy values of r and c. Since the answer can be very large, find the answer modulo 1000000007 $(10^9 + 7)$. In other words, find the remainder after division of the answer by 1000000007 $(10^9 + 7)$.

Input

The first line contains two integers h and w ($1 \le h, w \le 10^3$) — the height and width of the grid.

The second line contains h integers $r_1, r_2, \ldots, r_h$ ($0 \le r_i \le w$) — the values of r.

The third line contains w integers $c_1, c_2, \ldots, c_w$ ($0 \le c_j \le h$) — the values of c.

Output

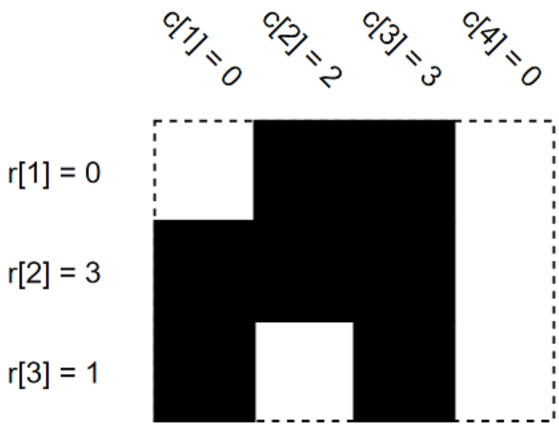
Print the answer modulo 1000000007 $(10^9 + 7)$.

input
```
3 4
0 3 1
0 2 3 0
```
output
```
2
```

input
```
1 1
0
1
```
output
```
0
```

input
```
19 16
16 16 16 16 15 15 0 5 0 4 9 9 1 4 4 0 8 16 12
6 12 19 15 8 6 19 19 14 6 9 16 10 11 15 4
```
output
```
797922655
```

In the first example, this is the other possible case.



In the second example, it's impossible to make a grid to satisfy such r, c values.

In the third example, make sure to print answer modulo $(10^9 + 7)$.

C. Primes and Multiplication

1 second, 256 megabytes

Let's introduce some definitions that will be needed later.

Let $prime(x)$ be the set of prime divisors of x. For example, $prime(140) = \{2, 5, 7\}$, $prime(169) = \{13\}$.

Let $g(x, p)$ be the maximum possible integer p^k where k is an integer such that x is divisible by p^k. For example:

- $g(45, 3) = 9$ (45 is divisible by $3^2 = 9$ but not divisible by $3^3 = 27$),
- $g(63, 7) = 7$ (63 is divisible by $7^1 = 7$ but not divisible by $7^2 = 49$).

Let $f(x, y)$ be the product of $g(y, p)$ for all p in $prime(x)$. For example:

- $f(30, 70) = g(70, 2) \cdot g(70, 3) \cdot g(70, 5) = 2^1 \cdot 3^0 \cdot 5^1 = 10$,
- $f(525, 63) = g(63, 3) \cdot g(63, 5) \cdot g(63, 7) = 3^2 \cdot 5^0 \cdot 7^1 = 63$.

You have integers x and n. Calculate $f(x, 1) \cdot f(x, 2) \cdot \ldots \cdot f(x, n) \bmod (10^9 + 7)$.

Input

The only line contains integers x and n ($2 \le x \le 10^9$, $1 \le n \le 10^{18}$) — the numbers used in formula.

Output

Print the answer.

input
```
10 2
```
output
```
2
```

input
```
20190929 1605
```
output
```
363165664
```

input
```
947 987654321987654321
```
output
```
593574252
```

In the first example, $f(10, 1) = g(1, 2) \cdot g(1, 5) = 1$, $f(10, 2) = g(2, 2) \cdot g(2, 5) = 2$.

In the second example, actual value of formula is approximately $1.597 \cdot 10^{171}$. Make sure you print the answer modulo $(10^9 + 7)$.

In the third example, be careful about overflow issue.

D. Complete Tripartite

2 seconds, 256 megabytes

You have a simple undirected graph consisting of n vertices and m edges. The graph doesn't contain self-loops, there is at most one edge between a pair of vertices. The given graph can be disconnected.

Let's make a definition.

Let v_1 and v_2 be two some nonempty subsets of vertices that do not intersect. Let $f(v_1, v_2)$ be true if and only if all the conditions are satisfied:

1. There are no edges with both endpoints in vertex set v_1.
2. There are no edges with both endpoints in vertex set v_2.
3. For every two vertices x and y such that x is in v_1 and y is in v_2, there is an edge between x and y.

Create three vertex sets (v_1, v_2, v_3) which satisfy the conditions below;

1. All vertex sets should not be empty.
2. Each vertex should be assigned to only one vertex set.
3. $f(v_1, v_2)$, $f(v_2, v_3)$, $f(v_3, v_1)$ are all true.

Is it possible to create such three vertex sets? If it's possible, print matching vertex set for each vertex.

Input

The first line contains two integers n and m ($3 \le n \le 10^5$, $0 \le m \le \min(3 \cdot 10^5, \frac{n(n-1)}{2})$) — the number of vertices and edges in the graph.

The i-th of the next m lines contains two integers a_i and b_i ($1 \le a_i < b_i \le n$) — it means there is an edge between a_i and b_i. The graph doesn't contain self-loops, there is at most one edge between a pair of vertices. The given graph can be disconnected.

Output

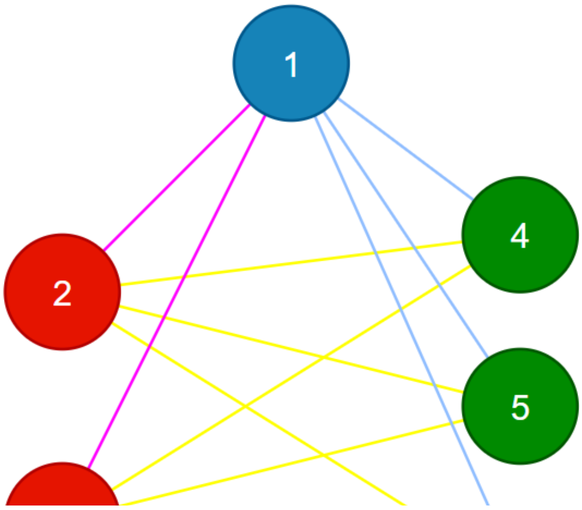
If the answer exists, print n integers. i-th integer means the vertex set number (from 1 to 3) of i-th vertex. Otherwise, print -1.

If there are multiple answers, print any.

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

input
```
4 6
1 2
1 3
1 4
2 3
2 4
3 4
```
output
```
-1
```

In the first example, if $v_1 = \{1\}$, $v_2 = \{2, 3\}$, and $v_3 = \{4, 5, 6\}$ then vertex sets will satisfy all conditions. But you can assign vertices to vertex sets in a different way; Other answers like "2 3 3 1 1 1" will be accepted as well.



In the second example, it's impossible to make such vertex sets.

E. Another Filling the Grid

1 second, 256 megabytes

You have $n \times n$ square grid and an integer k. Put an integer in each cell while satisfying the conditions below.

- All numbers in the grid should be between 1 and k inclusive.
- Minimum number of the i-th row is 1 $(1 \le i \le n)$.
- Minimum number of the j-th column is 1 $(1 \le j \le n)$.

Find the number of ways to put integers in the grid. Since the answer can be very large, find the answer modulo $(10^9 + 7)$.

Valid

Min 1	2	1
Min 1	1	2
	Min 1	Min 1

Invalid

1	1	Min 1
2	2	Min 2
Min 1	Min 1	

These are the examples of valid and invalid grid when $n = k = 2$.

Input

The only line contains two integers n and k $(1 \le n \le 250, 1 \le k \le 10^9)$.

Output

Print the answer modulo $(10^9 + 7)$.

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

input
```
123 456789
```
output
```
689974806
```

In the first example, following 7 cases are possible.

1	1
1	1

2	1
1	2

1	2
2	1

2	1
1	1

1	2
1	1

1	1
2	1

1	1
1	2

In the second example, make sure you print the answer modulo $(10^9 + 7)$.

F. One Node is Gone

1 second, 256 megabytes

You have an integer n. Let's define following tree generation as *McDic's generation*:

1. Make a complete and full binary tree of $2^n - 1$ vertices. Complete and full binary tree means a tree that exactly one vertex is a root, all leaves have the same depth (distance from the root), and all non-leaf nodes have exactly two child nodes.
2. Select a non-root vertex v from that binary tree.
3. Remove v from tree and make new edges between v's parent and v's direct children. If v has no children, then no new edges will be made.

You have a tree. Determine if this tree can be made by McDic's generation. If yes, then find the parent vertex of removed vertex in tree.

Input

The first line contains integer n $(2 \le n \le 17)$.

The i-th of the next $2^n - 3$ lines contains two integers a_i and b_i $(1 \le a_i < b_i \le 2^n - 2)$ — meaning there is an edge between a_i and b_i. It is guaranteed that the given edges form a tree.

Output

Print two lines.

In the first line, print a single integer — the number of answers. If given tree cannot be made by McDic's generation, then print 0.

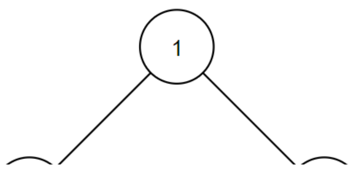
In the second line, print all possible answers in ascending order, separated by spaces. If the given tree cannot be made by McDic's generation, then don't print anything.

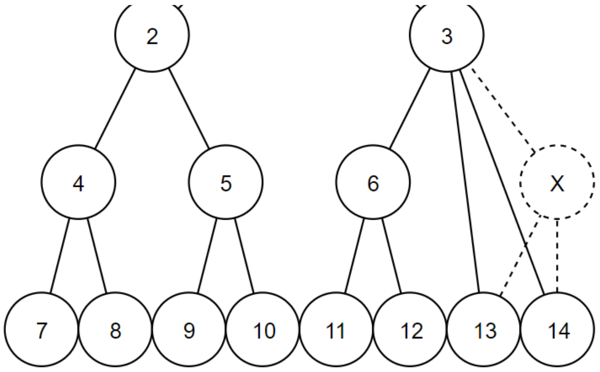
input
```
4
1 2
1 3
2 4
2 5
3 6
3 13
3 14
4 7
4 8
5 9
5 10
6 11
6 12
```
output
```
1
3
```

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

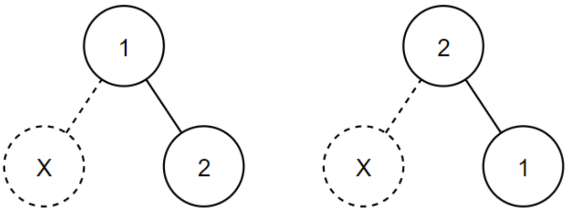
input
```
3
1 2
2 3
3 4
4 5
5 6
```
output
```
0
```

In the first example, 3 is the only possible answer.





In the second example, there are 2 possible answers.



In the third example, the tree can't be generated by McDic's generation.