A. Advising

1 second, 1024 megabytes

In this problem, there are **N** courses in the curriculum and **M** requirements of the form "Course **A** has to be completed before course **B**".

Your task is to find an order in which you can complete the courses. If there are multiple valid order, you may print any of them. If no such sequence exists, then print -1.

Input

The first line contains two integers N, M $(1 \le N \le 2 \times 10^5, 1 \le M \le 3 \times 10^5)$ — the number of courses and total requirements.

The next M lines will contain two integers $A_i, B_i (1 \le A_i, B_i \le N)$ — Course A has to be completed before course B.

Output

Print an order in which you can complete the courses. Please note, that there could be multiple correct sequences. You can print any valid order that includes all the courses.

If there is no valid sequence, print -1.

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

input
```
8 8
6 4
6 2
4 2
2 1
1 7
7 5
5 8
8 3
```
output
```
6 4 2 1 7 5 8 3
```

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

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

B. A Football Match

2 seconds, 1024 megabytes

There is an intense football match going on between Robots and Humans. However, things aren't as simple as they seem — the Robots have disguised themselves to look exactly like Humans! From the outside, it's impossible to tell who is a Robot and who is a Human.

The audience know only one important information — the Robots tackles only the Humans, and the Humans tackles only the Robots.

Now, you are given a list of tackles, each involving two players. Based on this information, find the maximum possible number of Robots or Humans.

Input

The first line contains two integers N and M $(1 \le N \le 2 \times 10^5, 1 \le M \le 3 \times 10^5)$ — the number of players in the match and the number of tackles occurred during the match respectively.

The next M lines will contain two integers $u_i, v_i (1 \le u_i, v_i \le N)$ — player u_i tackled player v_i. Each tackle between two players will be reported at most once.

Output

Print the maximum possible number of Robots or Humans.

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

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

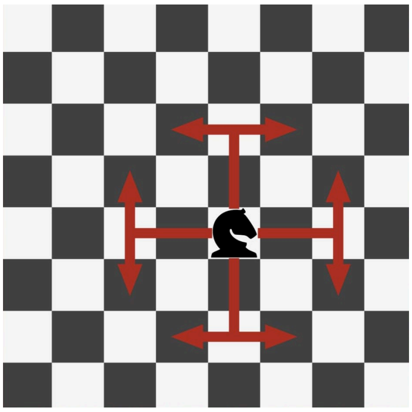
input
```
4 1
1 3
```
output
```
3
```

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

C. The Knight of Königsberg

1 second, 256 megabytes

You are given an $N \times N$ chessboard and the initial position (x_1, y_1) of a Knight piece. You need to find the minimum number of moves the Knight needs to reach the target position (x_2, y_2). If it is not possible to reach the target, print -1.



Moves of a Knight in Chess

The Knight can move one step in any of the 8 possible directions as shown in the picture.

Input

The first line contains an integer $(1 \le N \le 2 \times 10^3)$ — the size of the chessboard.

The second line contains four integers $(1 \le x_1, y_1, x_2, y_2 \le N)$ — the initial position (x_1, y_1) and the target position (x_2, y_2) of the Knight on the chessboard.

Output

Print the minimum number of moves the Knight needs to reach the target position. If it's not possible, print -1.

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

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

input
```
10
8 4 3 1
```
output
```
4
```

D. What's the Diameter?

1 second, 1024 megabytes

You are given an **undirected connected** graph with N nodes and $N-1$ edges. Your task is to find two nodes such that the path between those two nodes is the longest possible in the graph.

Input

The first line contains one integer N $(2 \le N \le 200000)$ — the number of nodes.

The next $N-1$ lines will contain two integers u_i, v_i $(1 \le ui, vi \le N)$ — denoting there is a bidirectional road between u_i and v_i.

Output

On the first line, print a single integer — the length of the longest path.

On the second line, print two integers A and B — the nodes that form this longest path. If multiple pairs exist, you may print any one.

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

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

input
```
8
1 7
7 3
3 6
6 5
5 2
2 8
8 4
```
output
```
7
4 1
```

input
```
7
7 5
5 6
6 1
1 3
3 4
4 2
```
output
```
6
7 2
```

E. An Ancient Ordering

1 second, 256 megabytes

You have found an old dictionary containing **N** words. The words are stored in an order that is different from the regular Latin lexicographic order.

Your task is to determine the order of the alphabet that satisfies the lexicographic order of this dictionary. If there are multiple valid orders, print the **lexicographically smallest** one. For example, the sequence $S_1 = "\text{d x i k}"$ is lexicographically smaller than the sequence $S_2 = "\text{d x p a k}"$.

If no such valid sequence exists, print -1. A valid ordering is not possible if the characters create cyclic dependencies or if a longer word appears before a shorter word that is a prefix of it.

Input

The first line contains an integer N $(1 \le N \le 1000)$ — the number of words in the dictionary.

The next N line contains a string S $(1 \le |S| \le 100)$. Each word consists of only lowercase Latin letters $a - z$.

Output

Find out the order of the alphabets that satisfy the sorting order of the words in the given dictionary. If there are multiple valid orders, print the **lexicographically smallest** one. If no such valid sequence exists, print -1.

input

```
3
eat
tea
ate
```

output

```
eta
```

input

```
9
error
tooth
tot
teeth
their
there
thi
tie
hit
```

output

```
oethir
```

input

```
6
gef
gie
hf
hd
hc
ha
```

output

```
efdcaghi
```

input

```
5
cmwaqe
yent
jtdgx
wlp
xufjpf
```

output

```
acdefglmnpqtuyjwx
```

input

```
6
abc
ab
p
pq
pqr
pqrs
```

output

```
-1
```

input

```
2
pigeon
pigeons
```

output

```
eginops
```

input

```
4
ab
bc
ca
ac
```

output

```
-1
```

F. Nearest Tour Destination

1 second, 256 megabytes

You are given an **undirected unweighted** graph with N nodes and M edges. The nodes are numbered from 1 to N. The graph contains no self-loops and no multiple edges.

There are S sources and Q destinations. For each destination node, find the length of the shortest path from any source node to that destination. If a destination is unreachable from all sources, output -1.

Input

The first line contains four integers N, M, S, Q
$1 \le N \le 2 \times 10^5,\ 0 \le M \le 3 \times 10^5,\ 1 \le S \le N,\ 1 \le Q \le N$ — the number of nodes, the number of edges, the number of source nodes, and the number of destination nodes.

The next M lines will contain two integers $u_i, v_i (1 \le u_i, v_i \le N)$ — denoting there is an edge from node u_i to node v_i.

The next line contains S $(1 \le S_i \le N)$ integers representing the source nodes, and the final line contains Q $(1 \le Q_i \le N)$ integers representing the destination nodes. A node may appear both as a source and as a destination.

Output

The output should consist of Q integers separated by spaces. The j-th integer denotes the length of the shortest path from any source node to the j-th destination node. If no such path exists for a destination node, print -1 for that destination. A node may be both a source and a destination, in which case the answer for that destination is 0.

input

```
8 6 2 4
1 2
2 3
4 5
6 7
7 8
2 6
1 6
3 5 6 8
```

output

```
2 -1 0 2
```

input

```
18 17 4 10
1 2
2 3
3 4
4 1
3 5
5 6
6 7
8 9
9 10
10 8
10 11
11 12
9 13
13 14
15 16
16 17
17 15
15 1 6 8
14 3 10 7 1 12 11 5 18 16
```

output
3 2 1 1 0 3 2 1 -1 1