

CSE221 Assignment 06 Summer 2025

A. Advising

time limit per test: 1 second
memory limit per test: 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 ($1 \leq N \leq 2 \times 10^5, 1 \leq M \leq 3 \times 10^5$) — the number of courses and total requirements.

The next M lines will contain two integers A_i, B_i ($1 \leq A_i, B_i \leq N$) — 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 .

Examples

input	Copy
5 4	
2 4	
2 5	
4 3	
1 5	
output	Copy
2 4 3 1 5	

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

input	Copy
2 1	
1 2	
output	Copy
1 2	

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

B. A Football Match

time limit per test: 2 seconds
memory limit per test: 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 ($1 \leq N \leq 2 \times 10^5, 1 \leq M \leq 3 \times 10^5$) — 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 ($1 \leq u_i, v_i \leq N$) — 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.

Examples

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

input	Copy
5 4	
4 3	
1 3	
3 2	
3 5	
output	Copy
4	

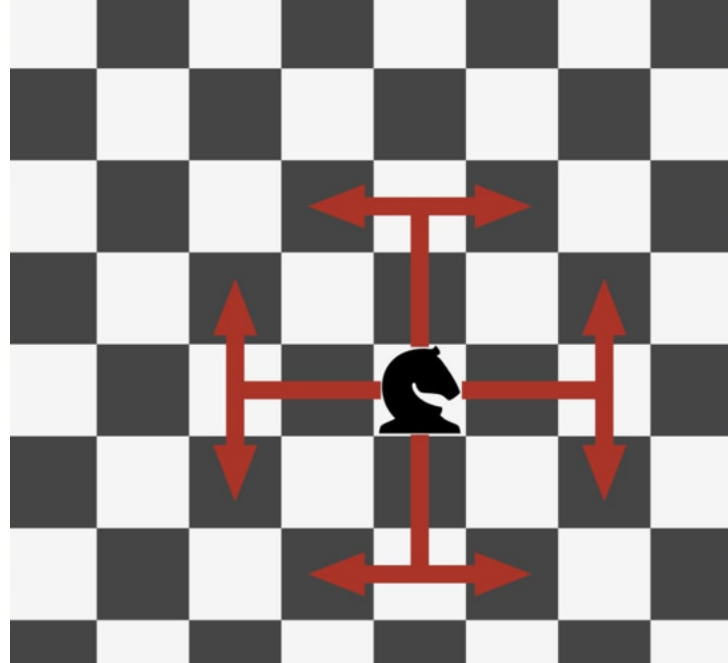
input	Copy
4 1	
1 3	
output	Copy
3	

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

C. The Knight of Königsberg

time limit per test: 1 second
memory limit per test: 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 N ($1 \leq N \leq 2 \times 10^3$) — the size of the chessboard.

The second line contains four integers $(1 \leq x_1, y_1, x_2, y_2 \leq N)$ — 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 .

Examples

input	Copy
3	
1 2 1 3	
output	Copy
3	

input	Copy
3	
1 1 2 2	
output	Copy
-1	

input	Copy
10	
8 4 3 1	
output	Copy
4	

D. What's the Diameter?

time limit per test: 1 second
memory limit per test: 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 ($2 \leq N \leq 200000$) — the number of nodes.

The next $N - 1$ lines will contain two integers u_i, v_i ($1 \leq u_i, v_i \leq N$) — 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.

Examples

input	Copy
5	
5 1	
1 4	
4 2	
3 2	
output	Copy
4	
3 5	

input	Copy
5	
1 2	
2 3	
3 4	
2 4	
output	Copy
3	
5 1	

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

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

E. An Ancient Ordering

time limit per test: 1 second
memory limit per test: 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 $S_1 = "d \times i k"$ is lexicographically smaller than the sequence $S_2 = "d \times p \times k"$.

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 ($1 \leq N \leq 1000$) — the number of words in the dictionary.

The next N line contains a string S ($1 \leq |S| \leq 100$). 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 .

Examples

input	Copy
3	
eat	
tea	
ate	
output	Copy
eta	

input	Copy
9	
error	
tooth	
tot	
teeth	
their	
there	
thi	
tie	
hit	
output	Copy
oethir	

input	Copy
6	
get	
gie	
if	
nd	
hc	
ha	
output	Copy
efdcaghi	

input	Copy
5	
cmwage	
yent	
tdaga	
wip	
xufjpf	
output	Copy
acdefglnmpqtuyjwx	

input	Copy
6	
abc	
ab	
p	
pq	
pqr	
pqrs	
output	Copy
-1	

input	Copy
2	
pigeon	
pigeons	
output	Copy
eglnops	

input	Copy
4	
ab	
bc	
ca	
ac	
output	Copy
-1	

F. Nearest Tour Destination

time limit per test: 1 second
memory limit per test: 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 ($1 \leq N \leq 2 \times 10^5, 0 \leq M \leq 3 \times 10^5, 1 \leq S \leq N, 1 \leq Q \leq N$) — 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 ($1 \leq u_i, v_i \leq N$) — denoting there is an edge from node u_i to node v_i .

The next line contains S ($1 \leq S_i \leq N$) integers representing the source nodes, and the final line contains Q ($1 \leq Q_i \leq N$) 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.

Examples

input	Copy
8 6 2 4	
1 2	
2 3	
4 1	
6 7	
7 8	
2 6	
1 6	
3 5 6 8	
output	Copy
2 -1 0 2	

input	Copy
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 10 16	
output	Copy
3 2 1 1 0 3 2 1 -1 1	