Task 4: `Coins`

Benson has n coins of different weights, and a weighing balance. Whenever he puts two coins x and y on the weighing balance, the relative weights between the coins is revealed, so that he knows which of x and y is heavier.

The rank of coin x is equal to the number of coins not heavier than coin x (including itself), so that the lightest coin has rank 1, second lightest coin has rank 2, etc. and the heaviest coin has rank n.

A coin has a determined rank, based on the existing weighings, if there is only one possible rank for the coin.

For each of the n coins, help Benson determine the first weighing which makes the coin's rank determined, or decide that the coin's rank is never determined.

Input format

Your program must read from standard input.

The first line of input will contain 2 spaced integers n and m.

The next m lines of input will contain 2 integers, x and y, indicating that coin x is lighter than coin y.

Output format

Output n integers. If coin i does not have a determined rank after all m measurements, the i-th integer should be -1. Else, there exists some k in which coin i has a determined rank after k weighings, but does not have a determined rank after $k-1$ weighings. Output this value of k.

Subtasks

For all subtasks, it is guaranteed that:

- $2 \leq n \leq 200\,000$
- $1 \leq m \leq 800\,000$

- $1 \leq x[i], y[i] \leq n$ for all $1 \leq i \leq m$
- There exists a set of weights such that coin $x[i]$ is lighter than coin $y[i]$ (for all $1 \leq i \leq m$).

Your program will be tested on input instances that satisfy the following restrictions:

Subtask	Marks	Additional Constraints
0	0	Sample Testcases
1	6	$1 \leq n \leq 7, 1 \leq m \leq 20$
2	16	$1 \leq n \leq 100, 1 \leq m \leq 400$
3	10	$1 \leq n \leq 1000, 1 \leq m \leq 4000$
4	68	No additional constraints

For each subtask, you will get 50% of the points if your program correctly determines whether each coin is determined at the end of all m weighings.

Specifically, if you output n integers such that

- If the i-th coin's rank is not determined at the end of m measurements, the i-th integer is -1
- If the i-th coin's rank is determined at the end of m measurements, the i-th integer is any integer from 1 to m inclusive,

then you will score 50% of the points for that subtask.

Sample Testcase 1

Input	Output
4 4 2 4 3 1 4 1 2 3	3 4 -1 -1

Explanation for sample testcase 1

We can determine after the first 3 measurements that coin 1 is the heaviest coin, but we are unable to do so by looking at only the first 2 measurements. Therefore, the first integer in the correct output is 3.

Similarly, we can determine that coin 2 is the lightest coin after 4 measurements, but not after 3 measurements. So, the second integer in the correct output is 4.

Observe that both orderings 2,4,3,1 and 2,3,4,1 are both valid orderings of the coin weights. Thus the coin 3 can have rank 2 or 3, both consistent with all weighings, and thus coin 3 never has a determined rank. Similarly, coin 4 never has a determined rank.

If your output was `1 1 -1 -1`, you would score 50% of the points for this subtask.

Sample Testcase 2

Input	Output
6 8 1 5 5 4 6 2 2 5 4 3 6 1 6 5 2 1	8 8 5 5 5 6