Well-hidden in the atrium of an abandoned house, you have found an ancient book that uncovers the most well-kept secret of the city of Bonn. في علية بيت قديم مهجور، وجدتي كتاب قديم يكشف سرًا خفيًا من أسرار مدينة بون.

Deep below the city, there is a system of N caves, connected by M water channels. تحت المدينة توجد شبكة من الكهوف عددها N والتي ترتبط مع بعضها البعض بقنوات مائيه عددها M . Within each water channel there's a one-directional magical current that can quickly transport a boat along the channel. في كل قناة مائية يوجد تيار مائي سحري احادي الاتجاه والذي يستطيع حمل قارب صغير بسرعة في اتجاه التيارعبر القناه

The cave system currently has exactly one exit that is located in cave $N-1$. يوجد في شبكة الكهوف مخرج واحد فقط والموجود دائمًا في الكهف رقم $N-1$.

You are very excited about your discovery and cannot wait to explore the caves! أنتِ متحمسة جدًا لاكتشافك، ولا تطيقين الانتظار لاستكشاف الكهوف!

However, the cave system is inhabited by a troll who likes to have some fun with uninvited visitors. The troll has some limited magical power - which he can use **at most once** during your visit - to modify the cave system and make it harder for you to reach the exit.

مع ذلك، يسكن شبكة الكهوف كائن يدعى Troll، الذي يحب قضاء وقت ممتع مع الزوار غير المدعوين.

يمتلك Troll قوة سحرية محدودة - يمكنه استخدامها مرة واحدة على الأكثربمعنى اخر **بحد أعلى لا يتجاوز المرة الواحدة فقط** حيث يستخدمها لتعديل شبكة الكهوف ليصعب على الزائر الوصول للمخرج

Your visit to the cave will consist of a sequence of rounds. Each round will be as follows:

1. First, the troll gets to choose whether or not he uses his magical power. If he does, his spell:
   - reverses the direction of the magical current in every channel: $a \to b$ will change to $b \to a$ immediately;
   - closes the exit in cave $N-1$; and
   - opens a new exit in cave 0.
2. Then, you choose a magical current that flows from your present cave, and use your boat to travel to another cave. For simplicity, we will call the use of a boat a "move".

Additionally, whenever you are in the same room as the exit, you will **immediately** use it to leave the cave system. Note that this can even happen during a round if you're in cave 0 and the troll decides to use his magical power.

Your goal is to leave the cave system as quickly as possible to be in time for the closing ceremony of the EGOI. The troll's goal is exactly the opposite; he wants to keep you in his caves for as long as possible. The troll always knows your location and he will pick the moment at which to use his magical power in a way that serves his goal the best.

Separately for each cave c ($0 \leq c \leq N-2$) consider the scenario in which you start in cave c. For each of these scenarios, determine the **smallest number of moves in which you can definitely reach an exit from cave c, no matter when the troll chooses to use his power**.

Initially, every cave is reachable from cave 0, and cave $N-1$ is reachable from every cave.

Input

The first line of the input contains two integers, N and M, where N is the number of caves and M is the number of water channels. The next M lines of the input each contain two integers, a_i and b_i, representing a channel that right now can be used to travel from cave a_i to cave b_i. There is no channel connecting a cave to itself. For each pair of caves there is at most one channel in each direction.

Output

Output a line with $N-1$ integers, where the ith integer, $0 \leq i \leq N-2$, is the smallest number of moves within which you can definitely reach an exit if starting from cave i.

Note that you do not output the time for cave $N-1$ (as you would just exit this cave immediately).

Constraints and Scoring

- $2 \leq N \leq 200\,000$.
- $1 \leq M \leq 500\,000$.
- $0 \leq a_i, b_i \leq N-1$.

Your solution will be tested on a set of test groups, each worth a number of points. Each test group contains a set of test cases. To get the points for a test group, you need to solve all test cases in the test group.

Group	Score	Limits
1	12	$M = N - 1,\ b_i = a_i + 1$. In other words, the cave system forms a path $0 \to 1 \to 2 \to \ldots \to N - 1$
2	15	Each cave has a direct channel to cave $N - 1$. Note there can be additional channels.
3	20	$N, M \leq 2\,000$
4	29	After leaving any cave, it is not possible to travel back to it (until the direction reversal). In other words, the channels form a directed acyclic graph.
5	24	No additional constraints

Examples

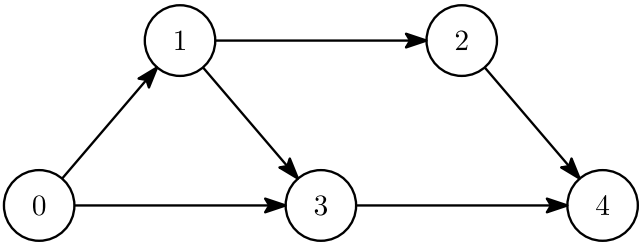
For the first sample, consider the case in which you start in cave 1. Since you do not know when the direction reversal will happen, you should start moving towards the exit at cave 4. You could do that via either cave 2 or cave 3. Going via cave 3 is the better option here since in case the direction reversal happens while you are there, you will now have a channel you can use to travel from cave .3 directly to cave 0 where you'll exit the cave system

More precisely, there are only three possibilities for when the troll will decide to use his magical :power

- If the troll uses his power immediately when you're in cave 1, you can then travel from cave 1 .directly to cave 0 and exit
- If the troll uses his power after you went from cave 1 to cave 3, you can then travel from cave .3 directly to cave 0 and exit
- If the troll decides not to use his power in either of those two situations, you will travel from .cave 3 to cave 4 and exit

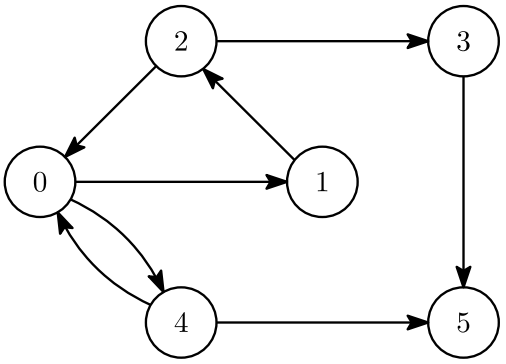
In the first option you only had to make one move, in each of the other options you made two .$\max(1, 2, 2) = 2$ moves. This means the answer for this case is

.Note that if you choose to go from cave 1 to cave 2, the troll can force you to make three moves



The first and second samples satisfy the constraints of test groups 3, 4 and 5. The third sample satisfies the constraints of all test groups. The fourth sample satisfies the constraints of test

.groups 3 and 5, and is illustrated below



Input	Output
5 6 0 1 1 2 1 3 2 4 3 4 0 3	2 2 2 1
7 10 2 6 5 3 4 2 1 6 2 3 3 6 4 5 0 4 4 1 0 1	2 1 2 3 2 4
2 1 0 1	1
6 8 0 1 4 0 1 2 2 3 3 5 0 4 4 5 2 0	2 4 3 3 1