Game

After discovering n planets, numbered from 0 to $n-1$, the Pharaohs have started to build a transportation system between them by **one-way teleporters**. Each teleporter has a starting planet and an ending planet. When a tourist uses a teleporter in the starting planet, the tourist is teleported to the ending planet. Note that the starting and ending planet of a teleporter may be the same. A teleporter with its starting planet u and ending planet v is denoted by (u, v).

To encourage widespread use of the teleportation system, the Pharaohs have created a game that can be played by tourists while travelling with the transportation system. A tourist can start the game from any planet. The planets $0, 1, \ldots, k-1$ ($k \leq n$) are called **special planets**. Every time a tourist enters a special planet, the tourist gets an stamp.

Currently, for each i ($0 \leq i \leq k-2$), there is a teleporter $(i, i+1)$. These $k-1$ teleporters are called **starting teleporters**.

New teleporters are added one by one. As new teleporters are added, it may become possible for a tourist to get infinite number of stamps. To be precise, this happens when there is a sequence of planets $w[0], w[1], \ldots, w[t]$ satisfying the following conditions:

- $1 \leq t$
- $0 \leq w[0] \leq k-1$
- $w[t] = w[0]$
- For each i ($0 \leq i \leq t-1$), there is a teleporter $(w[i], w[i+1])$.

Note that a tourist can use starting teleporters and **any** teleporters that have been added so far.

Your task is to help the Pharaohs verify, after the addition of each teleporter, whether a tourist can get infinite number of stamps or not.

Implementation details

You should implement the following procedures:

```
init(int n, int k)
```

- n: the number of planets.
- k: the number of special planets.
- This procedure is called exactly once, before any calls to `add_teleporter`.

```
int add_teleporter(int u, int v)
```

- u and v: the starting and the ending planet of the added teleporter.
- This function is called at most m times (for the value of m, see Constraints).
- This function should return 1 if, after the teleporter (u, v) is added, the tourist can get infinite number of stamps. Otherwise, this function should return 0.
- Once this function returns 1, your program will be terminated.

Examples

Example 1

Consider the following call:

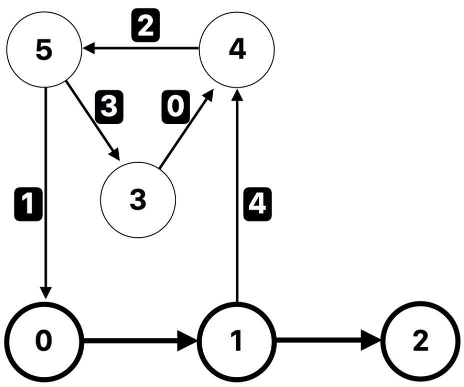
```
init(6, 3)
```

In this example, there are 6 planets and 3 special planets. The planets 0, 1, and 2 are special planets. The starting teleporters are $(0, 1)$ and $(1, 2)$.

Suppose that the grader calls:

- (0) `add_teleporter(3, 4)`: You should return 0.
- (1) `add_teleporter(5, 0)`: You should return 0.
- (2) `add_teleporter(4, 5)`: You should return 0.
- (3) `add_teleporter(5, 3)`: You should return 0.
- (4) `add_teleporter(1, 4)`: At this point it is possible to get infinite number of stamps. For example, the tourist starts in the planet 0, goes to the planets $1, 4, 5, 0, 1, 4, 5, 0, \ldots$ in this order. Hence, you should return 1, and your program will be terminated.

The following figure illustrates this example. The special planets and the starting teleporters are shown in bold. Teleporters added by `add_teleporter` are labeled from 0 through 4, in order.



Example 2

Consider the following call:

```
init(4, 2)
```

In this example, there are 4 planets and 2 special planets. The planets 0 and 1 are special planets. The starting teleporter is $(0, 1)$.

Suppose that the grader calls:

- `add_teleporter(1, 1)`: after adding the teleporter $(1, 1)$, it is possible to get infinite number of stamps. For example, the tourist starts in the planet 1, and enters the planet 1 infinitely many times using the teleporter $(1, 1)$. Hence, you should return 1, and your program will be terminated.

Another sample input/output is also available in the attachment package.

Constraints

- $1 \leq n \leq 300\,000$
- $1 \leq m \leq 500\,000$
- $1 \leq k \leq n$

For each call to the `add_teleporter` procedure:

- $0 \leq u \leq n-1$ and $0 \leq v \leq n-1$
- There is no teleporter from the planet u to the planet v before adding the teleporter (u, v).

Subtasks

1. (2 points) $n = k$, $n \leq 100$, $m \leq 300$
2. (10 points) $n \leq 100$, $m \leq 300$
3. (18 points) $n \leq 1\,000$, $m \leq 5\,000$
4. (30 points) $n \leq 30\,000$, $m \leq 50\,000$, $k \leq 1\,000$
5. (40 points) No additional constraints

Sample grader

The sample grader reads the input in the following format:

- line 1: $n\ m\ k$
- line $2 + i$ ($0 \leq i \leq m-1$): $u[i]\ v[i]$

The sample grader first calls `init`, and then `add_teleporter` for $u = u[i]$ and $v = v[i]$ for $i = 0, 1, \ldots, m-1$ in order.

It prints the index of the first call to `add_teleporter` which returns 1 (which is between 0 and $m-1$, inclusive), or m if all calls to `add_teleporter` return 0.

If some call to `add_teleporter` returns an integer other than 0 or 1, the sample grader prints -1 and your program is terminated immediately.