SAD: Long Way from Home

Problem Statement

Subterranean Antisocial Demons (SADs) live and roam in a network of connected caves. They move from cave to cave following very strict rules:

- Only one SAD may move at a time.
- Every time a SAD moves, it must move from one cave to an adjacent cave.
- No two SADs can occupy the same cave at the same time. Thus, if a cave is already occupied by a SAD, another SAD cannot move into it.
- A SAD may move out of its home cave to allow another SAD to pass through.
- Every SAD must be in its home cave at the end of the day.

The SADs have been busy roaming all day. Your task is to make the SADs happy. Help them find the fastest way for each one to return to its home.

Input Format

The first line of input will contain an integer t, $1 <= t <= 10$ that indicates how many test cases are present.

Next follow t test cases with the following format:

The first line of the test case is an integer n, $1 <= n <= 15$.

Next come n lines that give the current position of each SAD in the form:

$D_i\ C_j$

where D_i and C_j are integers between 1 and 16 inclusive. This indicates that the SAD with ID D_i is currently in cave with ID C_j. Note that the home cave for a SAD is the cave with an ID equal to the SAD's ID. Since a SAD can only move into an empty cave, there will always be more caves than SADs, and therefore the number of cave ID's will always be larger than the number of SAD ID's.

On the next line is an integer l, $n <= l <= 120$.

Next come l lines that give connection between caves in the form:

$C_i\ C_j$

where both of these IDs are integers between 1 and 20, inclusive. This line indicates that it is possible to get from the cave with ID C_i to the cave with ID C_j, and from the cave with ID C_j to the cave with ID C_i.

Output Format

For each test case, you should output, on a line by itself, a single integer equal to the **minimum** number of moves needed to get **every SAD** from its current location to its home cave.

Note: it will **always be possible for every SAD to reach its home**, and the minimum number of moves needed is never greater than 30.

Sample Input

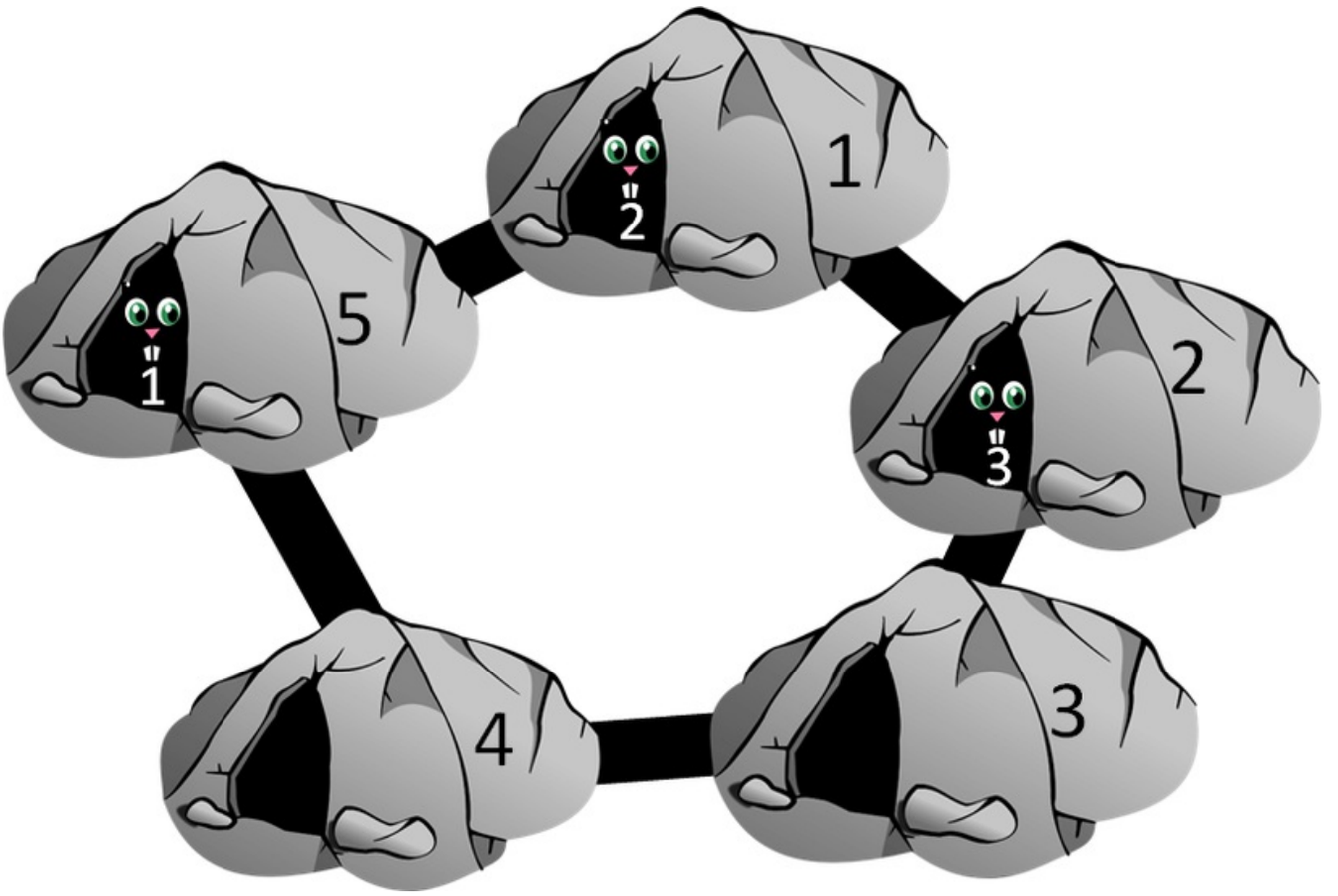
```
1
3
1 5
2 1
3 2
5
1 2
2 3
3 4
4 5
5 1
```

Sample Output

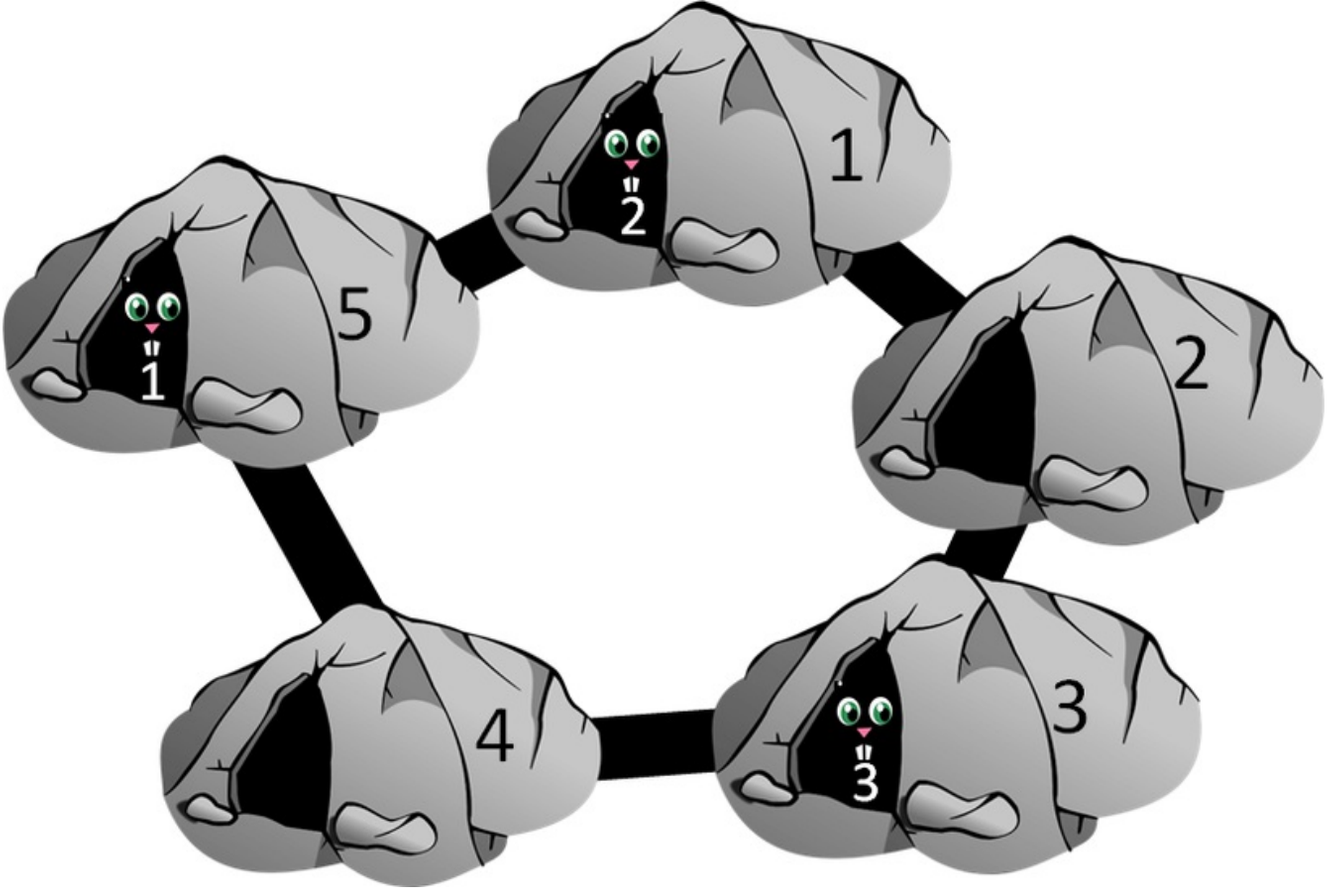
```
3
```

Explanation

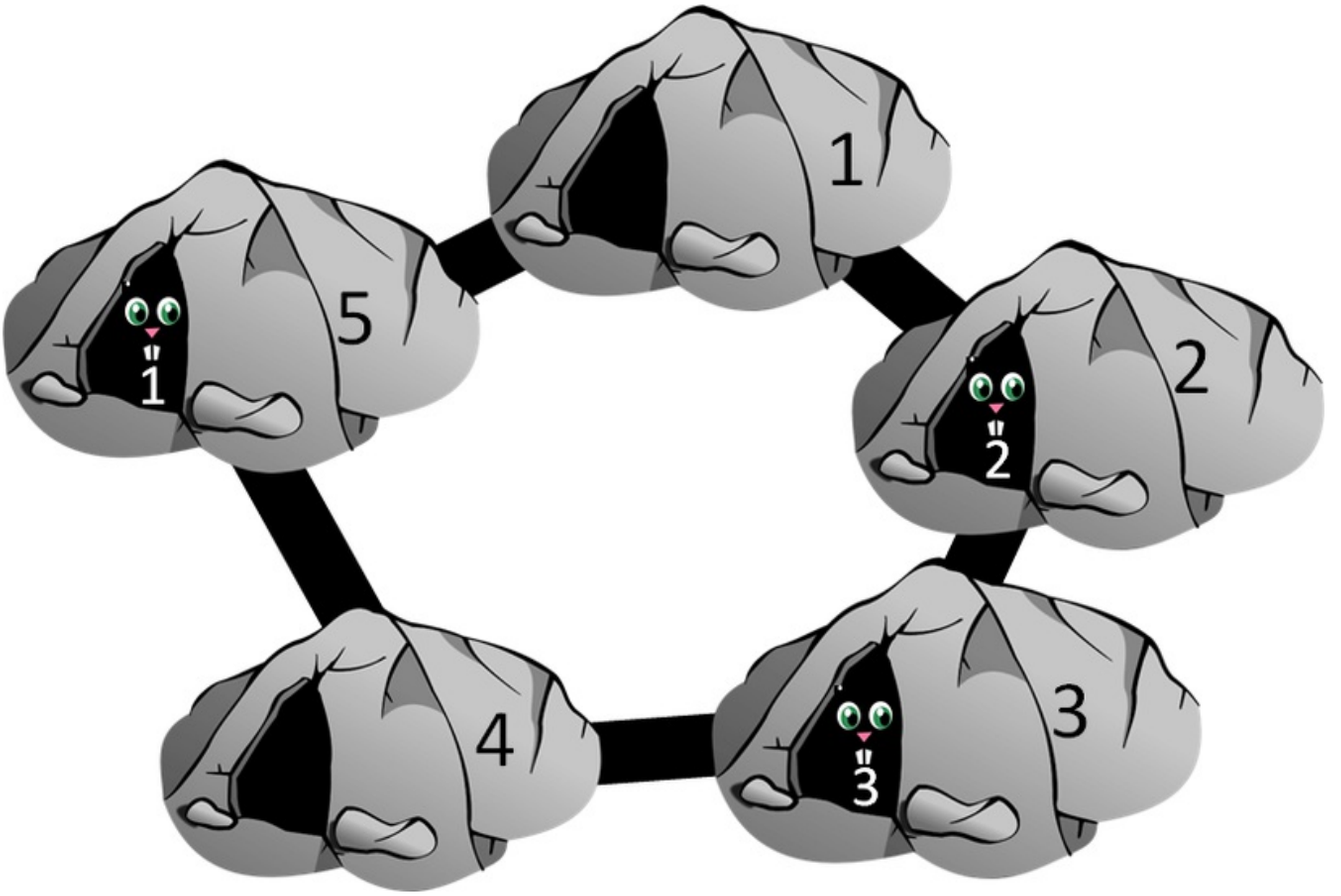
As shown in the next figure, at the beginning of the first test case, SAD 1 is in cave 5, SAD 2 is in cave 1, and SAD 3 is in cave 2. There are two legal moves in this scenario: SAD 1 could move to cave 4 or SAD 3 could move to cave 3.



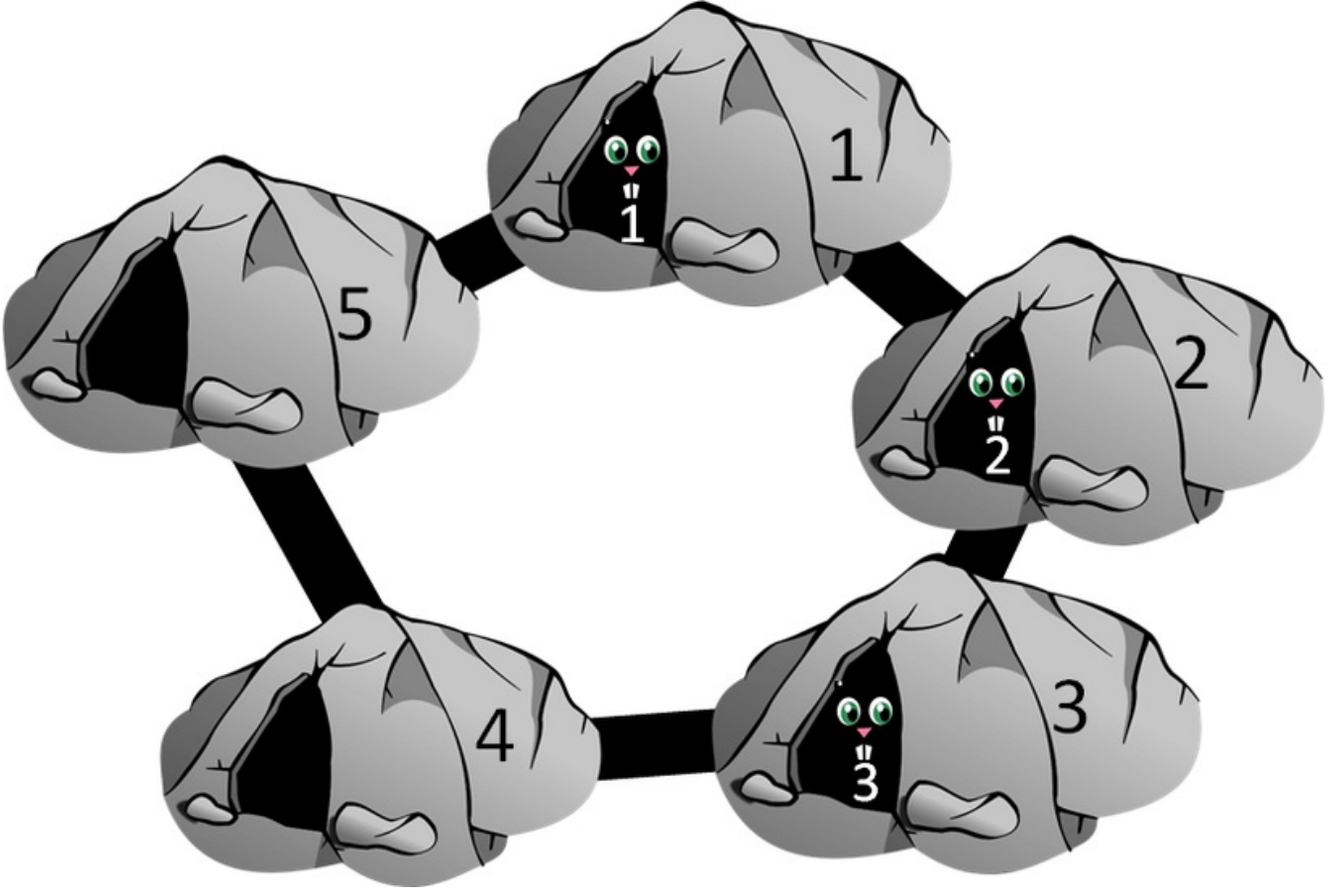
In the first move, then, SAD 3 moves to cave 3. As shown in the next figure, it is home. Now, for the second move, there are four legal moves: SAD 1 could move to cave 4, SAD 2 could move to cave 2, SAD 3 could move to cave 2, or SAD 3 could move to cave 4.



In the second move, then, SAD 2 moves to cave 2. As shown in the next figure, it is also home. For the third move, there are four legal moves: SAD 1 could move to cave 4, SAD 1 could move to cave 1, SAD 2 could move to cave 1, or SAD 3 could move to cave 4.



In the third and final move, SAD 1 moves to cave 1. As shown below, now all of the SADs are home, and it only took three moves!



Images generated from clipart from www.clker.com.