



# Problem H

## The Ministers' Major Mess

Input file: major.in

The ministers of the remote country of Stanistan are having severe problems with their decision making. It all started a few weeks ago when a new process for deciding which bills to pass was introduced. This process works as follows. During each voting session, there are several bills to be voted on. Each minister expresses an opinion by voting either “yes” or “no” for some of these bills. Because of limitations in the design of the technical solution used to evaluate the actual voting, each minister may vote on only at most four distinct bills (though this does not tend to be a problem, as most ministers only care about a handful of issues). Then, given these votes, the bills that are accepted are chosen in such a way that each minister gets more than half of his or her opinions satisfied.

As the astute reader has no doubt already realized, this process can lead to various problems. For instance, what if there are several possible choices satisfying all the ministers, or even worse, what if it is impossible to satisfy all the ministers? And even if the ministers' opinions lead to a unique choice, how is that choice found?

Your job is to write a program to help the ministers with some of these issues. Given the ministers' votes, the program must find out whether all the ministers can be satisfied, and if so, determine the decision on those bills for which, given the constraints, there is only one possible choice.

### Input

Input consists of multiple test cases. Each test case starts with integers  $B$  ( $1 \leq B \leq 100$ ), which is the number of distinct bills to vote on, and  $M$  ( $1 \leq M \leq 500$ ), which is the number of ministers. The next  $M$  lines give the votes of the ministers. Each such line starts with an integer  $1 \leq k \leq 4$ , indicating the number of bills that the minister has voted on, followed by the  $k$  votes. Each vote is of the format  $\langle \text{bill} \rangle \langle \text{vote} \rangle$ , where  $\langle \text{bill} \rangle$  is an integer between 1 and  $B$  identifying the bill that is voted on, and  $\langle \text{vote} \rangle$  is either  $y$  or  $n$ , indicating that the minister's opinion is “yes” or “no.” No minister votes on the same bill more than once. The last test case is followed by a line containing two zeros.

### Output

For each test case, print the test case number (starting with 1) followed by the result of the process. If it is impossible to satisfy all ministers, the result should be `impossible`. Otherwise, the result should be a string of length  $B$ , where the  $i^{\text{th}}$  character is  $y$ ,  $n$ , or  $?$ , depending on whether the decision on the  $i^{\text{th}}$  bill should be “yes,” whether it should be “no,” or whether the given votes do not determine the decision on this bill.

#### Sample Input

```
5 2
4 2 y 5 n 3 n 4 n
4 4 y 3 y 5 n 2 y
4 2
4 1 y 2 y 3 y 4 y
3 1 n 2 n 3 n
0 0
```

#### Output for the Sample Input

```
Case 1: ?y??n
Case 2: impossible
```

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