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Algorithms Lab

Exercise – *False Coin*

The "Gold Bar" bank received information from reliable sources that in their last group of n coins exactly one coin is false and differs in weight from other coins (while all other coins are equal in weight). After the economic crisis they have only a simple balance available. Using this balance, one can only determine if the weight of objects in the left pan is less than, greater than, or equal to the weight of objects in the right pan.

In order to detect the false coin the bank employees numbered all coins by the integers from 1 to n, thus assigning each coin a unique integer identifier. After that they carried out various weighings, where in each weighing they placed *the same number of coins* in both pans. (Needless to say, a single coin can not appear in both pans at the same time.) The identifiers of coins and the results of the weighings were carefully recorded. You are to write a program that will help the bank employees to determine the identifier of the false coin using the results of these weighings.

Input The first line of the input contains the number $1 \leq t \leq 15$ of test cases. Each of the t test cases is described as follows.

- The first line of each test case contains two integers n and k, separated by a space, such that $1 \leq n \leq 1000$ and $1 \leq k \leq 1000$. Here, n is the number of coins and k is the number of weighings.
- The following $2k$ lines describe all weighings. Each weighing is described by two consecutive lines.

  The first of these lines contains a single number P_i, where $1 \leq P_i \leq n/2$, representing the number of coins placed in each pan.

  The second line contains the P_i identifiers of the coins placed in the left pan, followed by the P_i identifiers of the coins placed in the right pan, followed by a single character describing the outcome of the weighing: '<', '>', or '=' depending on whether the total weight of the coins in the left pan is less than, greater than, or equal to the total weight of the coins in the right pan. The individual numbers and character describing the outcome are separated by spaces, and the coins are numbered from 1 to n.

Output For each test set, output the identifier of the false coin in a line of its own. If the given weighings do not determine the false coin uniquely, output a line containing '0'.

Points There are three test sets, worth 100 points in total.

1. For the first test set, worth 30 points, you may assume that $1 \leq n, k \leq 200$. Furthermore, it is guaranteed that each coin will appear in at least one of the weighings.
2. For the second test set, worth 50 points, you may assume that $1 \leq n, k \leq 1000$. Furthermore, it is guaranteed that each coin will appear in at least one of the weighings.
3. For the third test set, worth 20 points, there are no additional assumptions.

Corresponding sample test sets are contained in `test`i`.in/out`, for $i \in \{1, 2, 3\}$.

Hint: Put `std::ios_base::sync_with_stdio(false)` as the first line of the main procedure for faster I/O.

Sample Input

```
1
5 3
2
1 2 3 4 <
1
1 4 =
1
2 5 =
```

Sample Output

```
3
```