

## 4201 Switch Bulbs

You are given  $n$  bulbs and  $m$  switches. Each of the switches toggles a list of bulbs. Initially all the bulbs are turned off. Now for a set of desired states of the bulbs calculate the minimum number of switch presses required to reach that state.

### Input

Input contains multiple test cases. First line contains an integer  $T$  the number of test cases. Each test case starts with a line containing 2 integers  $n$  ( $1 \leq n \leq 15$ ) and  $m$  ( $1 \leq m \leq 40$ ). Next  $m$  line contains the description of  $m$  switches. Each of these lines starts with an integer  $k$  denoting the number of bulbs that toggles their states after pressing this switch. The rest of the line contains  $k$  distinct integers denoting the indices of the bulbs. The bulbs are numbered from 0 to  $n - 1$ . The next line contains an integer  $q$  ( $1 \leq q \leq 5000$ ) that denotes the number of queries. Each of the following  $q$  line contains a binary string of length  $n$  denoting the desired states of the  $n$  bulbs: 1 means the bulb must be on and 0 means the bulb must be off. The rightmost character is the state of bulb 0 and the leftmost character is the state of bulb  $n - 1$ .

### Output

For each test case output contains  $q + 2$  lines. First line contains 'Case  $x$ :' where  $x$  is the number of test cases. Each of the next  $q$  lines contains one integer denoting the minimum number of switch presses required to reach the bulb states in the  $i$ th query. If the state cannot be reachable by a series of switch presses output '-1'.

The last line will be a blank line.

### Sample Input

```
2
3 3
3 0 1 2
2 1 2
1 2
3
101
010
111
4 5
1 0
1 1
2 2 3
3 0 1 3
2 2 3
3
1111
1010
0101
```

**Sample Output**

Case 1:

3

2

1

Case 2:

3

2

3