4201 - Switch Bulbs

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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 ($1 \le n \le 15$) and m ($1 \le m \le 40$). 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($1 \le q \le 5000$) 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 Input

Output for Sample

2	Case 1:
3 3	3
3 0 1 2	2
2 1 2	1
1 2	
3	Case 2:

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

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