AI Lab 1

1. A button is a cylindrical object which has a name written at the top. A button-holder is another cylindrical object which holds several buttons. The buttons are inserted from the top of the button holder and if you need a button, you take it out from the bottom of the holder. An initial configuration gives the current holding of every button holder, from the bottom to the top. Calculate the number of button removals and inserts required such that every button holder has the specified set of buttons in the same order. Since you can only hold 1 piece at a time, the actions will always be interleaving removes and inserts of the same buttons. Since goal has all buttons, the costs shall always be in multiples of 2. Print -1 in case no solution exists.

Note:

- **i.** For full marks use only the A* algorithm as a graph search with the best heuristic function possible for the problem.
- **ii.** At least one test case has exactly 5 buttons numbered 0 to 4, and 3 button holders. The time is enough for it to be solved in the absence of any heuristics.
- **iii.** Solutions will be manually processed in addition.

Input Format

The first line is *T*, the number of test cases. Each test case starts with *N*, the number of button holders. The button holders are integers numbered 0 to *N*-1. The source configuration follows. The next *N* lines start with the number of buttons in the button holder, followed by the list of buttons separated by a space. The names of button holders are integers.

The goal configuration follows. The next *N* lines start with the number of buttons in the button holder, followed by the list of buttons separated by a space.

Output Format

For every test case, print the total number of moves. Taking a button out is 1 move. Inserting a button is another move.

Sample Input

```
1
3
1 0
1 1
1 2
3 1 2 0
0
0
```

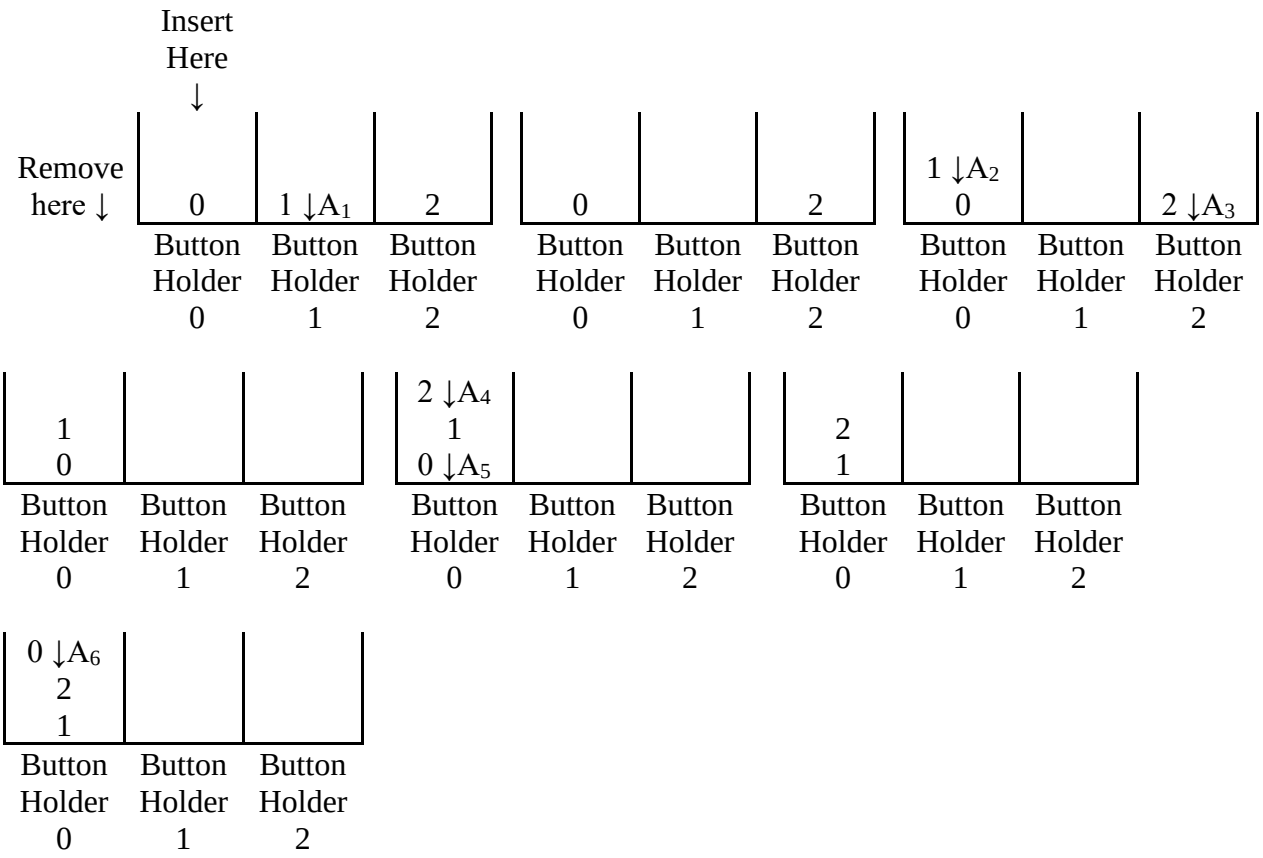
Sample Output

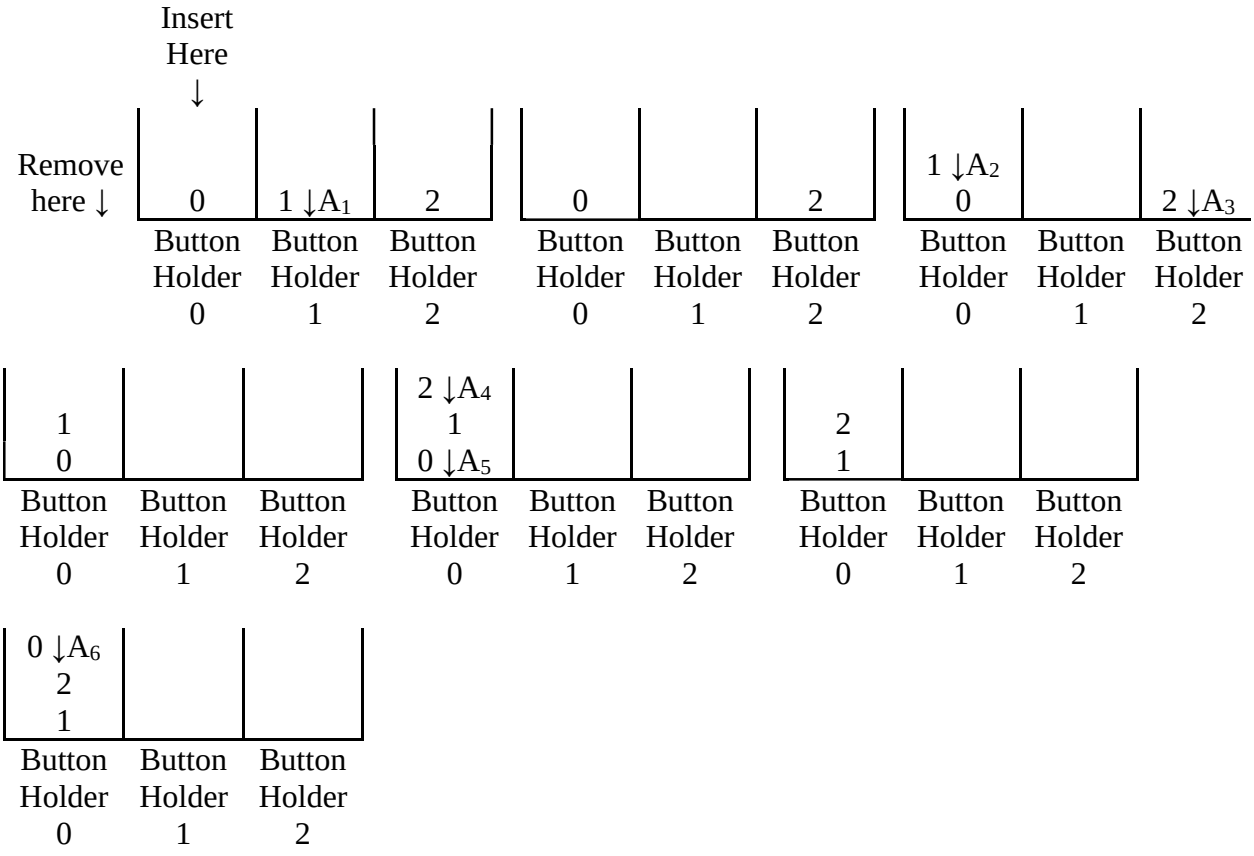
```
6
```

Explanation

A_1: remove out 1 from 1

A_2: insert 1 in 0
A_3: remove out 2 from 2
A_4: insert 2 in 0
A_5: remove out 0 from 0
A_6: insert 0 in 0





2. For question 1, print the path instead of the cost only. In case multiple paths are possible, print the alphabetically smallest one.

Output Format
For every test case a variable number of lines stating “take out <button name> from <holder name>” or “insert <button name> in <holder name>”.

Sample Input
1
3
1 0
1 1
1 2
3 1 2 0
0
0

Sample Out
remove out 1 from 1
insert 1 in 0
remove out 2 from 2
insert 2 in 0

remove out 0 from 0
insert 0 in 0