

## Problem L. Lost Permutation

Time limit: 2 seconds  
 Memory limit: 512 megabytes

*This is an interactive problem.*

You once had a permutation  $\pi$  of size  $n$ . And now it's gone. All you have left is an old device you made while studying group theory. To try and recover  $\pi$  you can input a permutation  $f$  of size  $n$  into this device. This device will then display a permutation  $\pi^{-1} \circ f \circ \pi$ . Find  $\pi$  using at most two interactions with the device.

A permutation of size  $n$  is a sequence of  $n$  distinct integers from 1 to  $n$ . The *composition* of two permutations  $a$  and  $b$  is a permutation  $a \circ b$  such that  $(a \circ b)_i = b_{a_i}$ . That is, if we consider a permutation as an action on  $n$  elements, moving element at position  $i$  to  $a_i$ , then  $a \circ b$  is the action that applies  $a$ , then applies  $b$ , so that element at position  $i$  first moves to  $a_i$ , then moves to  $b_{a_i}$ . Note that some definitions of composition use the reverse order.

The inverse permutation  $\pi^{-1}$  is a permutation  $\sigma$  such that  $\sigma_{\pi_i} = i$ . The composition of a permutation and its inverse is equal to an identity permutation:  $(\pi \circ \pi^{-1})_i = (\pi^{-1} \circ \pi)_i = i$  for all  $i$  from 1 to  $n$ . For example, if  $a = (4, 1, 3, 2)$  and  $b = (3, 2, 1, 4)$ , then  $a \circ b = (4, 3, 1, 2)$ ,  $a^{-1} = (2, 4, 3, 1)$  and  $a^{-1} \circ b \circ a = (1, 2, 4, 3)$ .

### Interaction Protocol

Your program has to process multiple test cases in a single run. First, the testing system writes  $t$ , the number of test cases ( $t \geq 1$ ). Then,  $t$  test cases should be processed one by one.

In each test case your program should start by reading the integer  $n$  ( $3 \leq n \leq 10^4$ ), the size of permutation  $\pi$ . The sum of  $n$  over all test cases does not exceed  $10^4$ . Then, your program can make queries of two types:

- ?  $f_1 f_2 \dots f_n$ , values  $f_1, f_2, \dots, f_n$  form a permutation of  $1, 2, \dots, n$ . The testing system responds with a permutation  $g_1, g_2, \dots, g_n$ , where  $g = \pi^{-1} \circ f \circ \pi$ .
- !  $\pi_1 \pi_2 \dots \pi_n$  — your guess for the secret permutation.

You can use at most two queries of the first type in each test case. After your program makes a query of the second type, it should continue to the next test case (or exit if that test case was the last one).

### Example

standard input	standard output
2	
4	
	? 3 2 1 4
1 2 4 3	
	? 2 4 3 1
2 4 3 1	
	! 4 1 3 2
3	
	? 2 3 1
3 1 2	
	? 3 1 2
2 3 1	
	! 3 2 1

### Note

There are two test cases in the first test. In the first test case,  $\pi = (4, 1, 3, 2)$  is the only permutation that satisfies  $\pi^{-1} \circ (3, 2, 1, 4) \circ \pi = (1, 2, 4, 3)$  and  $\pi^{-1} \circ (2, 4, 3, 1) \circ \pi = (2, 4, 3, 1)$ . In the second test case, based on the interaction,  $\pi$  can be equal to either  $(1, 3, 2)$ ,  $(2, 1, 3)$ , or  $(3, 2, 1)$ . The solution got lucky and guessed the correct one:  $(3, 2, 1)$ .