beCP
2020
Task 1: Magic Trick (magictrick)

Author: Robin Jadoul

Time limit: 0.5 s   Memory limit: 64 MB

Note: This task is interactive. Please look at the special instructions to implement, compile and test your program. Don't hesitate to ask the staff for help.

You've recently developed a new magic trick involving $N = 3k$ coins. You prepare the coins by placing $2k$ of them showing heads and the remaining k showing tails, all together on a single line. A member of the audience is then allowed to shuffle all of these coins around and organize them however they want. Once the audience is satisfied with how the coins look, your assistant takes away k out of the $2k$ coins that show heads, and covers all the remaining coins with individual caps, so that it's impossible to see whether they show heads or tails. During all this time, you remain blindfolded. Once your assistant is done, your blindfold is removed, and you telepathically determine which of the covered coins are the remaining heads, by dramatically uncovering them one by one.

You want to convince your audience that this would normally be impossible, as each coin has exactly a 50% chance of being either heads or tails, but of course you've discussed a trick with your assistance beforehand.

Your task is to implement both the strategy your assistant will take, and your own strategy to reveal the correct coins.

Functions to call

- When filling the role of assistant, you should call the provided function `remove(i)` to remove the coin at index $0 \le i < N$. This should be a coin that shows heads.

- When revealing the coins, you should call the function `reveal(i)` to reveal the coint at index $0 \le i < N$. This index should have a coin and should be heads.

Functions to implement

- To simulate the assistant, you should implement the required function `void assistant(vector<int> coins)`. A coin that shows heads is represented as the number 1, a coin that shows tails is represented as the number 2.

- To simulate the magician, you should implement the required function `void magician(vector<int> coins)`. Coins that are present, are represented with a 1, and removed coins are represented as the number 0.

General limits

- $3 \le N = 3k \le 10^5$
- Exactly $2k$ coins start as heads and k coins start as tails

Additional constraints

Subtask	Points	Constraints
A	10	$N = 3$
B	35	$N \le 30$
C	55	No additional constraint

Example 1

Suppose that 9 coins are presented to the assistant as follows:

1	2	1	1	2	1	1	1	2

The assistant then makes the following calls to the remove function:

remove	0
remove	5
remove	6

This means that the state that will be visible to the magician is this:

0	1	1	1	1	0	0	1	1

With the following calls, the magician can then successfully complete the magic trick.

reveal	2
reveal	3
reveal	6