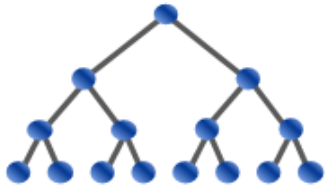

USACO 2023 US Open Contest, Bronze
Problem 3. Rotate and Shift

Return to Problem List

Contest has ended.

Log in to allow submissions in analysis mode

English (en)

****Note: The time limit for this problem is 4s, 2x the default.****

To celebrate the start of spring, Farmer John's N cows ($1 \leq N \leq 2 \cdot 10^5$) have invented an intriguing new dance, where they stand in a circle and re-order themselves in a predictable way.

Specifically, there are N positions around the circle, numbered sequentially from 0 to $N-1$, with position 0 following position $N-1$. A cow resides at each position. The cows are also numbered sequentially from 0 to $N-1$. Initially, cow i starts in position i. You are told a set of K positions $0 = A_1 < A_2 < \ldots < A_K < N$ that are "active", meaning the cows in these positions are the next to move ($1 \leq K \leq N$).

In each minute of the dance, two things happen. First, the cows in the active positions rotate: the cow at position A_1 moves to position A_2, the cow at position A_2 moves to position A_3, and so on, with the cow at position A_K moving to position A_1. All of these K moves happen simultaneously, so the after the rotation is complete, all of the active positions still contain exactly one cow. Next, the active positions themselves shift: A_1 becomes $A_1 + 1$, A_2 becomes $A_2 + 1$, and so on (if $A_i = N - 1$ for some active position, then A_i circles back around to 0).

Please calculate the order of the cows after T minutes of the dance ($1 \leq T \leq 10^9$).

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains three integers N, K, and T.

The second line contains K integers representing the initial set of active positions $A_1, A_2, \ldots A_K$. Recall that $A_1 = 0$ and that these are given in increasing order.

OUTPUT FORMAT (print output to the terminal / stdout):

Output the order of the cows after T minutes, starting with the cow in position 0, separated by spaces.

SAMPLE INPUT:

```
5 3 4
0 2 3
```

SAMPLE OUTPUT:

```
1 2 3 4 0
```

For the example above, here are the cow orders and A for the first four timesteps:

```
Initial, T = 0: order = [0 1 2 3 4], A = [0 2 3]
T = 1: order = [3 1 0 2 4]
T = 1: A = [1 3 4]
T = 2: order = [3 4 0 1 2]
T = 2: A = [2 4 0]
T = 3: order = [2 4 3 1 0]

T = 3: A = [3 0 1]
T = 4: order = [1 2 3 4 0]
```

SCORING:

- Inputs 2-7: $N \leq 1000, T \leq 10000$

- Inputs 8-13: No additional constraints.

Problem credits: Claire Zhang

Contest has ended. No further submissions allowed.