2021 Canadian Computing Olympiad
Day 1, Problem 2
Weird Numeral System

Time Limit: 1.5 seconds

Problem Description

Alice enjoys thinking about base-K numeral systems (don't we all?). As you might know, in the standard base-K numeral system, an integer n can be represented as $d_{m-1}\ d_{m-2}\ \ldots\ d_1\ d_0$ where:

- Each digit d_i is in the set $\{0, 1, \ldots, K-1\}$, and
- $d_{m-1}K^{m-1} + d_{m-2}K^{m-2} + \cdots + d_1K^1 + d_0K^0 = n$.

For example, in standard base-3, you would write 15 as `1 2 0`, since $(1)\cdot 3^2 + (2)\cdot 3^1 + (0)\cdot 3^0 = 15$.

But standard base-K systems are too easy for Alice. Instead, she's thinking about **weird-base-K** systems.

A weird-base-K system is just like the standard base-K system, except that instead of using the digits $\{0, \ldots, K-1\}$, you use $\{a_1, a_2, \ldots, a_D\}$ for some value D. For example, in a weird-base-3 system with $a = \{-1, 0, 1\}$, you could write 15 as `1 -1 -1 0`, since $(1)\cdot 3^3 + (-1)\cdot 3^2 + (-1)\cdot 3^1 + (0)\cdot 3^0 = 15$.

Alice is wondering how to write Q integers, n_1 through n_Q, in a weird-base-K system that uses the digits a_1 through a_D. Please help her out!

Input Specification

The first line contains four space-separated integers, K, Q, D, and M ($2 \leq K \leq 1\,000\,000$, $1 \leq Q \leq 5$, $1 \leq D \leq 5001$, $1 \leq M \leq 2500$).

The second line contains D distinct integers, a_1 through a_D ($-M \leq a_i \leq M$).

Finally, the i-th of the next Q lines contains n_i ($-10^{18} \leq n_i \leq 10^{18}$).

For 8 of the 25 available marks, $M = K - 1 \leq 400$, $K = D \leq 801$.

Output Specification

Output Q lines, the i-th of which is a weird-base-K representation of n_i. If multiple representations are possible, any will be accepted. The digits of the representation should be separated by spaces. Note that 0 must be represented by a non-empty set of digits.

If there is no possible representation, output `IMPOSSIBLE`.

Sample Input 1

```
3 3 3 1
-1 0 1
15
8
-5
```

Output for Sample Input 1

```
1 -1 -1 0
1 0 -1
-1 1 1
```

Explanation of Output for Sample Input 1

We have:
$(1) \cdot 3^3 + (-1) \cdot 3^2 + (-1) \cdot 3^1 + (0) \cdot 3^0 = 15$,
$(1) \cdot 3^2 + (0) \cdot 3^1 + (-1) \cdot 3^0 = 8$, and
$(-1) \cdot 3^2 + (1) \cdot 3^1 + (1) \cdot 3^0 = -5$.

Sample Input 2

```
10 1 3 2
0 2 -2
17
```

Output for Sample Input 2

```
IMPOSSIBLE
```