Task: WIE
Polynomial

Olimpiada Informatyczna

XXV OI, Stage III, Day two. Source file `wie.*` Available memory: 128 MB. *12.04.2018*

Byteasar was misbehaving in mathematics class, and for punishment he is to evaluate a very long polynomial W with n integer coefficients

$$W(x) = a_0 + a_1x + a_2x^2 + \ldots + a_{n-2}x^{n-2} + a_{n-1}x^{n-1}$$

at points $q^1, q^2, \ldots, q^n$. To help the teacher verify his results quickly, Byteasar should first provide the remainder modulo m of the sum of these values, and then provide the remainders modulo m of all the successive values.

Not only does he misbehave frequently, Byteasar is also rather lazy, so he asked you (surprisingly politely) for help in this task right before heading out to a party. To his credit, Byteasar is quite bright, only too lazy to follow up his ideas. Saying his goodbyes, he shared his hunch that the following properties could drastically reduce the amount of calculations necessary to get the results: n is a power of two, and the remainder of q^n modulo m is 1 (i.e., $q^n \bmod m = 1$).

Input

In the first line of the standard input, there are three integers n, m and q ($n \geq 1$, n is a power of two, $2 \leq m \leq 10^9$, $1 \leq q < m$, $q^n \bmod m = 1$), separated by single spaces.

In the second line, there is a sequence of n integers, separated by single spaces, specifying successive coefficients of the polynomial in this order: $a_0, a_1, \ldots, a_{n-1}$ ($0 \leq a_i \leq 10^9$).

Output

A singe integer should be printed to the first line of the standard output – the remainder modulo m of the sum of values of the polynomial W at the points $q^1, q^2, q^3, \ldots, q^n$. In the second line the remainders modulo m of $W(q^1)$, $W(q^2)$, $W(q^3)$, …, $W(q^n)$ should be printed, separated by single spaces.

Example

For the input data:	the correct result is:
`4 13 5` `3 2 2 1`	`12` `6 2 9 8`

Explanation for the example: The polynomial is $W(x) = 3 + 2x + 2x^2 + x^3$, so its values at successive points are $W(5) = 188$, $W(5^2) = 16\,928$, $W(5^3) = 1\,984\,628$, $W(5^4) = 244\,923\,128$. The number in the first output line is the remainder modulo 13 of $188 + 16\,928 + 1\,984\,628 + 244\,923\,128 = 246\,924\,872$, which is 12. The second line provides the remainders modulo 13 of aforementioned summands.

Sample grading tests:

`1ocen:` $n = 8$, $m = 10$, $q = 3$;
`2ocen:` $n = 256$, $m = 10^9$, $q = 10^9 - 1$;
`3ocen:` $n = 2^{13}$, $m = 17$, $q = 6$;
`4ocen:` $n = 2^{20}$, $m = 1\,114\,129$, $q = 2$.

Grading

The set of tests consists of the following subsets. Within each subset, there may be several unit tests.

If the sum's remainder is correct but one of the successive values is not, your program will be awarded up to 40% of the test's score, provided that all the n numbers in the second line are in the range from 0 to $m-1$.

Subset	Property	Score
1	$n \leq 2^{10}$	17
2	$n \leq 2^{15}$	9
3	$n \leq 2^{20}$	74