Problem XORsecv

Input file	`stdin`
Output file	`stdout`

XORnelius is the greatest mathematician in the INFO(I)CUP KINGDOM. One day he stumbled upon a very interesting algorithmic task. But instead of solving it, which would have been easy for him, he decided to give it to you as a test.

You are given an array $a_0, a_1, \dots, a_{N-1}$ of numbers. For a contiguous subsequence (i, j) of this array, we calculate the *XORvalue* of the sequence using the following steps:

1. We create an array b of size $k = j - i + 1$, so that $b_0 = a_i, b_1 = a_{i+1}, \dots b_{k-1} = a_j$.
2. The XORvalue is equal to the sum of the values $(b_i \text{ XOR } i)^P$, for all $0 \le i < k$.[1]

Calculate the sum of the XORvalues of all contiguous subsequences of the array, modulo $10^9 + 7$.

Formally, if we let $f(i, j)$ denote the XORvalue of sequence (i, j), we have that

$$f(i,j) = \sum_{m=0}^{j-i} (a_{i+m} \text{ XOR } m)^P.$$

You are asked to find the following value

$$\sum_{i=0}^{N-1} \sum_{j=i}^{N-1} f(i,j) \pmod{10^9+7}.$$

Your task is to solve this problem and prove to XORnelius that you are as great of a mathematician as he is.

Input data

The first line of input contains N, denoting the size of the array, and P. The second line contains values $a_0, a_1, \dots, a_{N-1}$.

Output data

The only line of output must contain the required answer.

Restrictions

- $1 \le N \le 250\,000$
- $1 \le P \le 1\,000\,000\,000$
- $0 \le a_i < 2^{18}$, for all $0 \le i < N$

[1] The XOR operator is denoted by ^ in C++. Formally, we define it as follows. For $x, y \in \mathbb{N}$, let z be equal to $x \text{ XOR } y$. Then, the k-th bit of z is equal to 1 if and only if the k-th bit of x is equal to 1 or the k-th bit of y is equal to 1, but not both.

#	Points	Restrictions
1	7	$N \leq 100, P = 1$
2	8	$N \leq 1\,000, P = 1$
3	12	$N \leq 1\,000$
4	15	$P = 1$
5	12	$N \leq 50\,000$, $a_i < 8$, for all $0 \leq i < N$
6	14	$N \leq 50\,000, P = 2$
7	32	No further restrictions

Examples

Input file	Output file
3 3 3 2 4	556
7 1 4 2 3 6 5 7 11	379
6 2 1 3 15 7 15 31	9410

Explanations

First example The XORvalues of all the contiguous subsequences in the array are written below:

- $i = 0, j = 0$: $b = \{3\}, f(0,0) = (3 \text{ XOR } 0)^3 = 3^3 = 27$
- $i = 0, j = 1$: $b = \{3,2\}, f(0,1) = (3 \text{ XOR } 0)^3 + (2 \text{ XOR } 1)^3 = 3^3 + 3^3 = 27 + 27 = 54$
- $i = 0, j = 2$: $b = \{3,2,4\}, f(0,2) = (3 \text{ XOR } 0)^3 + (2 \text{ XOR } 1)^3 + (4 \text{ XOR } 2)^3 = 3^3 + 3^3 + 6^3 = 27 + 27 + 216 = 270$
- $i = 1, j = 1$: $b = \{2\}, f(1,1) = (2 \text{ XOR } 0)^3 = 2^3 = 8$
- $i = 1, j = 2$: $b = \{2,4\}, f(1,2) = (2 \text{ XOR } 0)^3 + (4 \text{ XOR } 1)^3 = 2^3 + 5^3 = 8 + 125 = 133$
- $i = 2, j = 2$: $b = \{4\}, f(2,2) = (4 \text{ XOR } 0)^3 = 4^3 = 64$

The sum of all these values is equal to 556 modulo $10^9 + 7$.