Problem K. Game: Battle of Menjis

Huangmenji is a popular Chinese dish known for its rich flavor and aromatic qualities. Originating from Shandong province, it has gained widespread popularity throughout China and beyond. The dish primarily consists of chicken braised in a savory and slightly sweet soy sauce-based sauce, accompanied by various vegetables such as mushrooms, bell peppers, and bamboo shoots.

Figure 3: A huangmenji with rice. CC-BY-SA-4.0

Little Cyan Fish recently found a game called *Battle of Menjis*. Now, Alice and Bob are playing this game.

The game starts with a sequence of n non-negative integers, $a_1, \cdots, a_n$. Alice and Bob take turns, Alice goes first.

In Alice's turn, she can choose an index i ($1 \le i \le n$), and replace a_i by $a_i + 1$.

In Bob's turn, he can choose an index i ($1 \le i \le n$) satisfying $a_i > 0$ (we can prove that such i must exist), and replace a_i by $a_i - 1$.

The game ends when both Alice and Bob have taken k turns.

Alice wants to maximize $\bigoplus_{i=1}^{n} a_i$, and Bob wants to minimize $\bigoplus_{i=1}^{n} a_i$. Here $\bigoplus_{i=1}^{n} a_i$ represents the bitwise exclusive or of the sequence a.

It can be proved that an optimal strategy for each of the two players exists. Please determine $\bigoplus_{i=1}^{n} a_i$ when the two players play optimally.

Input

The first line contains a single integer T ($1 \le T \le 10^5$), representing the number of testcases.

For each testcase, the first line contains two integers n, k ($1 \le n \le 10^5, 1 \le k \le 10^9$), and the second line contains n integers $a_1 \ldots a_n$ ($0 \le a_i \le 10^9$).

It is guaranteed that the sum of n in all testcases does not exceed 5×10^5.

Output

For each testcase, output one integer, $\bigoplus_{i=1}^{n} a_i$ when the two players play optimally, in a single line.

Example

standard input	standard output
4 2 3 1 1 4 4 0 0 0 0 4 1 1 2 4 8 13 5 1 1 4 5 1 4 1 9 1 9 8 1 0	0 0 9 11