

## Problem C. Mansur vs Tima

Input file:            **standard input**  
Output file:           **standard output**  
Time limit:            **1 second**  
Memory limit:         **256 megabytes**

Tima came back from his journey to Xorland and brought back an array of  $n$  integers. Xorland is a small country known for its food, music, and games on arrays. A peculiarity of Xorland's games is that there is no winner: friendship always wins! One of such games is "Xor-Mat".

Rules of "Xor-Mat" are simple. Two players, before the start of the game, choose an array  $a$  and an integer  $k$ . Then, the first player paints each number in the array with one of the  $k$  colors. Let  $c_i$  be the color of  $i$ -th number in the array if we order the colors from 1 to  $k$ . Second player, then, chooses a pair of indices  $(i, j)$  such that  $i \neq j$  and  $c_i = c_j$ .

The goal of the first player is to maximize  $a_i \oplus a_j$ , while, second player tries to minimize  $a_i \oplus a_j$ . Here,  $\oplus$  is a bitwise "XOR" operation.

Mansur challenged Tima for a "Xor-Mat" game. They are playing on Tima's array. Mansur goes first and Tima is second. Print the value of  $a_i \oplus a_j$  when both players play optimally. Also, find out an optimal coloring of the array that Mansur might choose.

### Input

The first line contains one integer  $t$  ( $1 \leq t \leq 5 \cdot 10^4$ ) — the number of test cases.

The  $2 \cdot t$  lines follow in following pattern:

The first line of each test case contains two integers  $n$  ( $2 \leq n \leq 5 \cdot 10^4$ ) and  $k$  ( $1 \leq k \leq \min(n - 1, 50)$ ).

Second line of each test case contains  $n$  integers  $a_1, a_2, \dots, a_n$  ( $1 \leq a_i \leq 10^9$ ) — Tima's array.

It is guaranteed, that the sum of  $n$  across all test cases does not exceed  $5 \cdot 10^4$ .

### Output

For each test case in input print two lines:

- In the first line, print the value of  $a_i \oplus a_j$  when both players play optimally.
- In the second line, print  $n$  integers  $c_1, c_2, \dots, c_n$  ( $1 \leq c_i \leq k$ ), where  $c_i$  is equal to the color that Mansur chooses for  $i$ -th number of the array. If there are more than one possible ways to color the array optimally, print any of them.

### Scoring

Let  $S$  be the sum of  $n$  over all test cases.

Subtask	Additional constraints	Points	Necessary subtasks
0	Example	0	—
1	$S \leq 10, k \leq 5$	6	0
2	$S \leq 50000, k = 1$	10	
3	$S \leq 1000, k \leq 2$	10	—
4	$S \leq 50000, k \leq 2$	20	2, 3
5	$S \leq 50000, k \leq 4$	22	1, 4
6	—	32	5

### Example

standard input	standard output
2	1
3 1	1 1 1
1 2 3	3
3 2	1 1 2
1 2 3	