

# Explicit Formula

Consider 10 Boolean variables  $x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9,$  and  $x_{10}$ . Consider all pairs and triplets of distinct variables among these ten. (There are 45 pairs and 120 triplets.) Count the number of pairs and triplets that contain at least one variable equal to 1. Set  $f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}) = 1$  if this number is odd and  $f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}) = 0$  if this number is even.

Here's an explicit formula that represents the function  $f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10})$  correctly:

$$\begin{aligned} f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}) = & (x_1 \parallel x_2)^{\wedge} (x_1 \parallel x_3)^{\wedge} (x_1 \parallel x_4)^{\wedge} (x_1 \parallel x_5)^{\wedge} (x_1 \parallel x_6)^{\wedge} (x_1 \parallel x_7)^{\wedge} (x_1 \parallel x_8)^{\wedge} (x_1 \parallel x_9)^{\wedge} (x_1 \parallel x_{10})^{\wedge} (x_2 \parallel x_3)^{\wedge} (x_2 \parallel x_4)^{\wedge} (x_2 \parallel x_5)^{\wedge} (x_2 \parallel x_6)^{\wedge} (x_2 \parallel x_7)^{\wedge} (x_2 \parallel x_8)^{\wedge} (x_2 \parallel x_9)^{\wedge} (x_2 \parallel x_{10})^{\wedge} (x_3 \parallel x_4)^{\wedge} (x_3 \parallel x_5)^{\wedge} (x_3 \parallel x_6)^{\wedge} (x_3 \parallel x_7)^{\wedge} (x_3 \parallel x_8)^{\wedge} (x_3 \parallel x_9)^{\wedge} (x_3 \parallel x_{10})^{\wedge} (x_4 \parallel x_5)^{\wedge} (x_4 \parallel x_6)^{\wedge} (x_4 \parallel x_7)^{\wedge} (x_4 \parallel x_8)^{\wedge} (x_4 \parallel x_9)^{\wedge} (x_4 \parallel x_{10})^{\wedge} (x_5 \parallel x_6)^{\wedge} (x_5 \parallel x_7)^{\wedge} (x_5 \parallel x_8)^{\wedge} (x_5 \parallel x_9)^{\wedge} (x_5 \parallel x_{10})^{\wedge} (x_6 \parallel x_7)^{\wedge} (x_6 \parallel x_8)^{\wedge} (x_6 \parallel x_9)^{\wedge} (x_6 \parallel x_{10})^{\wedge} (x_7 \parallel x_8)^{\wedge} (x_7 \parallel x_9)^{\wedge} (x_7 \parallel x_{10})^{\wedge} (x_8 \parallel x_9)^{\wedge} (x_8 \parallel x_{10})^{\wedge} (x_9 \parallel x_{10})^{\wedge} (x_1 \parallel x_2 \parallel x_3)^{\wedge} (x_1 \parallel x_2 \parallel x_4)^{\wedge} (x_1 \parallel x_2 \parallel x_5)^{\wedge} (x_1 \parallel x_2 \parallel x_6)^{\wedge} (x_1 \parallel x_2 \parallel x_7)^{\wedge} (x_1 \parallel x_2 \parallel x_8)^{\wedge} (x_1 \parallel x_2 \parallel x_9)^{\wedge} (x_1 \parallel x_2 \parallel x_{10})^{\wedge} (x_1 \parallel x_3 \parallel x_4)^{\wedge} (x_1 \parallel x_3 \parallel x_5)^{\wedge} (x_1 \parallel x_3 \parallel x_6)^{\wedge} (x_1 \parallel x_3 \parallel x_7)^{\wedge} (x_1 \parallel x_3 \parallel x_8)^{\wedge} (x_1 \parallel x_3 \parallel x_9)^{\wedge} (x_1 \parallel x_3 \parallel x_{10})^{\wedge} (x_1 \parallel x_4 \parallel x_5)^{\wedge} (x_1 \parallel x_4 \parallel x_6)^{\wedge} (x_1 \parallel x_4 \parallel x_7)^{\wedge} (x_1 \parallel x_4 \parallel x_8)^{\wedge} (x_1 \parallel x_4 \parallel x_9)^{\wedge} (x_1 \parallel x_4 \parallel x_{10})^{\wedge} (x_1 \parallel x_5 \parallel x_6)^{\wedge} (x_1 \parallel x_5 \parallel x_7)^{\wedge} (x_1 \parallel x_5 \parallel x_8)^{\wedge} (x_1 \parallel x_5 \parallel x_9)^{\wedge} (x_1 \parallel x_5 \parallel x_{10})^{\wedge} (x_1 \parallel x_6 \parallel x_7)^{\wedge} (x_1 \parallel x_6 \parallel x_8)^{\wedge} (x_1 \parallel x_6 \parallel x_9)^{\wedge} (x_1 \parallel x_6 \parallel x_{10})^{\wedge} (x_1 \parallel x_7 \parallel x_8)^{\wedge} (x_1 \parallel x_7 \parallel x_9)^{\wedge} (x_1 \parallel x_7 \parallel x_{10})^{\wedge} (x_1 \parallel x_8 \parallel x_9)^{\wedge} (x_1 \parallel x_8 \parallel x_{10})^{\wedge} (x_1 \parallel x_9 \parallel x_{10})^{\wedge} (x_2 \parallel x_3 \parallel x_4)^{\wedge} (x_2 \parallel x_3 \parallel x_5)^{\wedge} (x_2 \parallel x_3 \parallel x_6)^{\wedge} (x_2 \parallel x_3 \parallel x_7)^{\wedge} (x_2 \parallel x_3 \parallel x_8)^{\wedge} (x_2 \parallel x_3 \parallel x_9)^{\wedge} (x_2 \parallel x_3 \parallel x_{10})^{\wedge} (x_2 \parallel x_4 \parallel x_5)^{\wedge} (x_2 \parallel x_4 \parallel x_6)^{\wedge} (x_2 \parallel x_4 \parallel x_7)^{\wedge} (x_2 \parallel x_4 \parallel x_8)^{\wedge} (x_2 \parallel x_4 \parallel x_9)^{\wedge} (x_2 \parallel x_4 \parallel x_{10})^{\wedge} (x_2 \parallel x_5 \parallel x_6)^{\wedge} (x_2 \parallel x_5 \parallel x_7)^{\wedge} (x_2 \parallel x_5 \parallel x_8)^{\wedge} (x_2 \parallel x_5 \parallel x_9)^{\wedge} (x_2 \parallel x_5 \parallel x_{10})^{\wedge} (x_2 \parallel x_6 \parallel x_7)^{\wedge} (x_2 \parallel x_6 \parallel x_8)^{\wedge} (x_2 \parallel x_6 \parallel x_9)^{\wedge} (x_2 \parallel x_6 \parallel x_{10})^{\wedge} (x_2 \parallel x_7 \parallel x_8)^{\wedge} (x_2 \parallel x_7 \parallel x_9)^{\wedge} (x_2 \parallel x_7 \parallel x_{10})^{\wedge} (x_2 \parallel x_8 \parallel x_9)^{\wedge} (x_2 \parallel x_8 \parallel x_{10})^{\wedge} (x_2 \parallel x_9 \parallel x_{10})^{\wedge} (x_3 \parallel x_4 \parallel x_5)^{\wedge} (x_3 \parallel x_4 \parallel x_6)^{\wedge} (x_3 \parallel x_4 \parallel x_7)^{\wedge} (x_3 \parallel x_4 \parallel x_8)^{\wedge} (x_3 \parallel x_4 \parallel x_9)^{\wedge} (x_3 \parallel x_4 \parallel x_{10})^{\wedge} (x_3 \parallel x_5 \parallel x_6)^{\wedge} (x_3 \parallel x_5 \parallel x_7)^{\wedge} (x_3 \parallel x_5 \parallel x_8)^{\wedge} (x_3 \parallel x_5 \parallel x_9)^{\wedge} (x_3 \parallel x_5 \parallel x_{10})^{\wedge} (x_3 \parallel x_6 \parallel x_7)^{\wedge} (x_3 \parallel x_6 \parallel x_8)^{\wedge} (x_3 \parallel x_6 \parallel x_9)^{\wedge} (x_3 \parallel x_6 \parallel x_{10})^{\wedge} (x_3 \parallel x_7 \parallel x_8)^{\wedge} (x_3 \parallel x_7 \parallel x_9)^{\wedge} (x_3 \parallel x_7 \parallel x_{10})^{\wedge} (x_3 \parallel x_8 \parallel x_9)^{\wedge} (x_3 \parallel x_8 \parallel x_{10})^{\wedge} (x_3 \parallel x_9 \parallel x_{10})^{\wedge} (x_4 \parallel x_5 \parallel x_6)^{\wedge} (x_4 \parallel x_5 \parallel x_7)^{\wedge} (x_4 \parallel x_5 \parallel x_8)^{\wedge} (x_4 \parallel x_5 \parallel x_9)^{\wedge} (x_4 \parallel x_5 \parallel x_{10})^{\wedge} (x_4 \parallel x_6 \parallel x_7)^{\wedge} (x_4 \parallel x_6 \parallel x_8)^{\wedge} (x_4 \parallel x_6 \parallel x_9)^{\wedge} (x_4 \parallel x_6 \parallel x_{10})^{\wedge} (x_4 \parallel x_7 \parallel x_8)^{\wedge} (x_4 \parallel x_7 \parallel x_9)^{\wedge} (x_4 \parallel x_7 \parallel x_{10})^{\wedge} (x_4 \parallel x_8 \parallel x_9)^{\wedge} (x_4 \parallel x_8 \parallel x_{10})^{\wedge} (x_4 \parallel x_9 \parallel x_{10})^{\wedge} (x_5 \parallel x_6 \parallel x_7)^{\wedge} (x_5 \parallel x_6 \parallel x_8)^{\wedge} (x_5 \parallel x_6 \parallel x_9)^{\wedge} (x_5 \parallel x_6 \parallel x_{10})^{\wedge} (x_5 \parallel x_7 \parallel x_8)^{\wedge} (x_5 \parallel x_7 \parallel x_9)^{\wedge} (x_5 \parallel x_7 \parallel x_{10})^{\wedge} (x_5 \parallel x_8 \parallel x_9)^{\wedge} (x_5 \parallel x_8 \parallel x_{10})^{\wedge} (x_5 \parallel x_9 \parallel x_{10})^{\wedge} (x_6 \parallel x_7 \parallel x_8)^{\wedge} (x_6 \parallel x_7 \parallel x_9)^{\wedge} (x_6 \parallel x_7 \parallel x_{10})^{\wedge} (x_6 \parallel x_8 \parallel x_9)^{\wedge} (x_6 \parallel x_8 \parallel x_{10})^{\wedge} (x_6 \parallel x_9 \parallel x_{10})^{\wedge} (x_7 \parallel x_8 \parallel x_9)^{\wedge} (x_7 \parallel x_8 \parallel x_{10})^{\wedge} (x_7 \parallel x_9 \parallel x_{10})^{\wedge} (x_8 \parallel x_9 \parallel x_{10})^{\wedge} \end{aligned}$$

In this formula  $\parallel$  stands for logical or, and  $\wedge$  stands for exclusive or (xor). Remember that in C++ and Java these two binary operators are denoted as " $\parallel$ " and " $\wedge$ ".

Given the values of  $x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}$ , calculate the value of  $f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10})$ .

## Input

The first line of the input file contains  $T$ , the number of test cases. The next  $T$  lines contain 10 numbers each,  $x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9$ , and  $x_{10}$ . Each of these numbers is either 0 or 1.

## Output

For each test case output a single line with the value  $f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10})$ .

## Example

**Input:**

```
1
1 0 0 1 0 0 1 0 0 1
```

**Output:**

```
0
```