

Problem D

Evaluation of Symmetric Functions

Input File: *testdata.in*

Time Limit: 1 second

Problem Description

A *Symmetric Function* of n variables is one whose value at any n -tuple of arguments is the same as its value at any permutation of that n -tuple. Let $X = (x_1, x_2, x_3, \dots, x_n)$ and $A = (a_1, a_2, a_3, \dots, a_n)$ be any n -tuples in $\{0, 1\}^n$. Define

$$F_k(X) = \bigoplus_{1 \leq i_1 < i_2 < i_3 < \dots < i_k \leq n} \bigwedge_{j=1}^k x_{i_j}$$

$$G_A(X) = \bigoplus_{k=1}^n (a_k \wedge F_k(X)) = \bigoplus_{k=1}^n a_k F_k(X)$$

where \oplus is the eXclusive-OR (XOR) operator and \wedge is the AND operator (AND operators between variables can be omitted). By a careful observation, it is easy to verify that for any $1 \leq k \leq n$ and any n -tuple A in $\{0, 1\}^n$, $F_k(X)$ and $G_A(X)$ are symmetric functions from $\{0, 1\}^n$ to $\{0, 1\}$.

For instance, if $n = 4$ and $A = (1, 0, 1, 1)$, then

$$F_1(X) = x_1 \oplus x_2 \oplus x_3 \oplus x_4$$

$$F_2(X) = x_1x_2 \oplus x_1x_3 \oplus x_1x_4 \oplus x_2x_3 \oplus x_2x_4 \oplus x_3x_4$$

$$F_3(X) = x_1x_2x_3 \oplus x_1x_2x_4 \oplus x_1x_3x_4 \oplus x_2x_3x_4$$

$$F_4(X) = x_1x_2x_3x_4$$

$$G_A(X) = a_1F_1(X) \oplus a_2F_2(X) \oplus a_3F_3(X) \oplus a_4F_4(X) = F_1(X) \oplus F_3(X) \oplus F_4(X)$$

$$= x_1 \oplus x_2 \oplus x_3 \oplus x_4 \oplus x_1x_2x_3 \oplus x_1x_2x_4 \oplus x_1x_3x_4 \oplus x_2x_3x_4 \oplus x_1x_2x_3x_4$$

and if $X = (1, 1, 1, 0)$,

$$G_A(X) = G_A(1, 1, 1, 0) = 0$$

Given n , A , and the input n -tuple X , can you efficiently determine the output of $G_A(X)$?

Technical Specifications

1. The number of test cases would be smaller than or equal to 20.
2. The number of variables, n , would satisfy $4 \leq n \leq 200$.
3. $X = (x_1, x_2, x_3, \dots, x_n)$ and $A = (a_1, a_2, a_3, \dots, a_n)$ are n -tuples in $\{0, 1\}^n$.

Input Format

The first line of the input file contains an integer indicating the number of test cases to follow. For each test case, the values of n , A , and X are given in one line. There is a space between n and A or A and X , but there are no spaces within the n -tuples A and X .

Output Format

For each test case, output the value of $G_A(X)$ in one line.

Sample Input

```
2
4 1011 1110
5 10001 10110
```

Sample Output

```
0
1
```