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### H. Wonderful XOR Problem

time limit per test: 2 seconds memory limit per test: 256 megabytes

You are the proud... never mind, just solve this problem.

There are n intervals  $[l_1,r_1],[l_2,r_2],\ldots[l_n,r_n]$ . For each x from 0 to  $2^m-1$ , find the number, modulo  $998\ 244\ 353$ , of sequences  $a_1,a_2,\ldots a_n$  such that:

- $l_i \leq a_i \leq r_i$  for all i from 1 to n;
- $a_1 \oplus a_2 \oplus \ldots \oplus a_n = x$ , where  $\oplus$  denotes the bitwise XOR operator.

#### Input

Each test contains multiple test cases. The first line contains the number of test cases t (  $1 \le t \le 10^4$ ). The description of the test cases follows.

The first line contains two integers n and m ( $1 \le n \le 2 \cdot 10^5$ ,  $1 \le m \le 18$ ).

The i-th of the next n lines contains two integers  $l_i$  and  $r_i$  ( $0 \le l_i \le r_i < 2^m$ ).

It is guaranteed that the sum of n over all test cases does not exceed  $2 \cdot 10^5$ , and the sum of  $2^m$  over all test cases does not exceed  $2^{18}$ .

### Output

For each x from 0 to  $2^m - 1$ , let:

- $f_x$  be the number of valid sequences, modulo  $998\ 244\ 353$ ;
- $g_x = f_x \cdot 2^x \mod 998244353$ .

Here,  $f_x$  and  $g_x$  are both integers in the interval  $[0,998\,244\,352]$ .

Let  $h=g_0\oplus g_1\oplus\ldots\oplus g_{2^m-1}$  .

Output a single integer — the value of h itself. Do not perform a modulo operation.

### Example

input	Сору
4	
2 2	
0 2	
1 3	
5 3	
3 7	
1 3	
0 2	
1 5 3 6	
10 14	
314 1592	
653 5897	
932 3846	
264 3383	
279 5028	
841 9716	
939 9375	
105 8209	
749 4459	
230 7816	
1 5	
0 29	
output	Сору
22	
9812	
75032210	
1073741823	

### Note

# Neowise Labs Contest 1 (Codeforces Round 1018, Div. 1 + Div. 2)

### Finished

Practice



### → Virtual participation

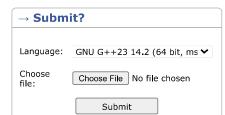
Virtual contest is a way to take part in past contest, as close as possible to participation on time. It is supported only ICPC mode for virtual contests. If you've seen these problems, a virtual contest is not for you solve these problems in the archive. If you just want to solve some problem from a contest, a virtual contest is not for you solve this problem in the archive. Never use someone else's code, read the tutorials or communicate with other person during a virtual contest.

Start virtual contest

## → Clone Contest to Mashup

You can clone this contest to a mashup.

Clone Contest



→ Last submissions		
Submission	Time	Verdict
317148815	Apr/25/2025 11:42	Accepted
317146604	Apr/25/2025 11:18	Time limit exceeded on test 4
<u>317146136</u>	Apr/25/2025 11:13	Time limit exceeded on test 4
317145942	Apr/25/2025 11:11	Time limit exceeded on test 4
317145707	Apr/25/2025 11:09	Time limit exceeded on test 4
317144973	Apr/25/2025 11:01	Time limit exceeded on test 4
316793803	Apr/23/2025 13:14	Time limit exceeded on test 4
316793385	Apr/23/2025 13:10	Time limit exceeded on test 4
316792981	Apr/23/2025 13:07	Time limit exceeded on test 4

For the first test case, the values of  $f_x$  are as follows:

- $f_0=2$ , because there are 2 valid sequences: [1,1] and [2,2];
- $f_1=2$ , because there are 2 valid sequences: [0,1] and [2,3];  $f_2=2$ , because there are 2 valid sequences: [0,2] and [1,3];
- $f_3=3$ , because there are 3 valid sequences:  $\left[0,3\right]$ ,  $\left[1,2\right]$ , and  $\left[2,1\right]$ .

The values of  $g_{x}$  are as follows:

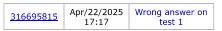
- $g_0 = f_0 \cdot 2^0 = 2 \cdot 2^0 = 2$ ;
- $g_0 = f_0 \cdot 2 = 2 \cdot 2 = 2;$   $g_1 = f_1 \cdot 2^1 = 2 \cdot 2^1 = 4;$   $g_2 = f_2 \cdot 2^2 = 2 \cdot 2^2 = 8;$   $g_3 = f_3 \cdot 2^3 = 3 \cdot 2^3 = 24.$

Thus, the value to output is  $2 \oplus 4 \oplus 8 \oplus 24 = 22$ .

For the second test case, the values of  $f_{x}$  are as follows:

- $f_0 = 120$ ;
- $f_1 = 120$ ;
- $f_2 = 119$ ;
- $f_3 = 118$ ;
- $f_4 = 105$ ;

- $f_5 = 105;$   $f_6 = 106;$   $f_7 = 107.$





# → Contest materials • Announcement (en) Tutorial (en)

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