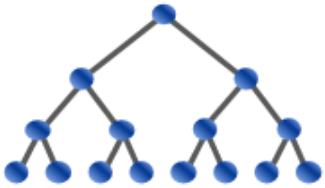

USACO 2020 December Contest, Platinum
Problem 3. Cowmistry

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Contest has ended.

Log in to allow submissions in analysis mode

English (en)

Bessie has been procrastinating on her cow-mistry homework and now needs your help! She needs to create a mixture of three different cow-michals. As all good cows know though, some cow-michals cannot be mixed with each other or else they will cause an explosion. In particular, two cow-michals with labels a and b can only be present in the same mixture if $a \oplus b \leq K$ ($1 \leq K \leq 10^9$).

NOTE: Here, $a \oplus b$ denotes the "bitwise exclusive or'' of non-negative integers a and b. This operation is equivalent to adding each corresponding pair of bits in base 2 and discarding the carry. For example,

$$0 \oplus 0 = 1 \oplus 1 = 0,$$

$$1 \oplus 0 = 0 \oplus 1 = 1,$$

$$5 \oplus 7 = 101_2 \oplus 111_2 = 010_2 = 2.$$

Bessie has N ($1 \leq N \leq 2 \cdot 10^4$) boxes of cow-michals and the i-th box contains cow-michals labeled l_i through r_i inclusive ($0 \leq l_i \leq r_i \leq 10^9$). No two boxes have any cow-michals in common. She wants to know how many unique mixtures of three different cow-michals she can create. Two mixtures are considered different if there is at least one cow-michal present in one but not the other. Since the answer may be very large, report it modulo $10^9 + 7$.

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains two integers N and K.

Each of the next N lines contains two space-separated integers l_i and r_i. It is guaranteed that the boxes of cow-michals are provided in increasing order of their contents; namely, $r_i < l_{i+1}$ for each $1 \leq i < N$.

OUTPUT FORMAT (print output to the terminal / stdout):

The number of mixtures of three different cow-michals Bessie can create, modulo $10^9 + 7$.

SAMPLE INPUT:

```
1 13
0 199
```

SAMPLE OUTPUT:

```
4280
```

We can split the chemicals into 13 groups that cannot cross-mix: $(0 \ldots 15)$, $(16 \ldots 31)$, $\ldots$ $(192 \ldots 199)$. Each of the first twelve groups contributes 352 unique mixtures and the last contributes 56 (since all $\binom{8}{3}$ combinations of three different cow-michals from $(192 \ldots 199)$ are okay), for a total of $352 \cdot 12 + 56 = 4280$.

SAMPLE INPUT:

```
6 147
1 35
48 103
125 127
154 190
195 235
240 250
```

SAMPLE OUTPUT:

```
267188
```

SCORING

- Test cases 3-4 satisfy $\max(K, r_N) \leq 10^4$.
- Test cases 5-6 satisfy $K = 2^k - 1$ for some integer $k \geq 1$.
- Test cases 7-11 satisfy $\max(K, r_N) \leq 10^6$.
- Test cases 12-16 satisfy $N \leq 20$.
- Test cases 17-21 satisfy no additional constraints.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.