

Problem M

Median of Xor Sequence — Easy Version

If you had taken part in *The 2022 ICPC Vietnam National Contest*, you would still remember its last problem *Median of Xor Sequence*. This time, we give you a pretty-much almost the same version of that problem. And to make things even easier, the constraint of numbers on test data is significantly reduced. So we wish to see many Accepted submissions!

Given four non-negative integers a, b, c and d ; let S be the set containing all values $z = x \oplus y$ of all pairs of integers (x, y) such that $a \leq x \leq b$ and $c \leq y \leq d$. Your task is to find the median value of S .

Please note that S is a set. In other words, if there are several pairs (x, y) with the same value of $x \oplus y$, this value is counted exactly once in S .

For example, consider $a = 3, b = 5, c = 6$ and $d = 9$. We have:

- $3 \oplus 6 = 5, 3 \oplus 7 = 4, 3 \oplus 8 = 11, 3 \oplus 9 = 10$
- $4 \oplus 6 = 2, 4 \oplus 7 = 3, 4 \oplus 8 = 12, 4 \oplus 9 = 13$
- $5 \oplus 6 = 3, 5 \oplus 7 = 2, 5 \oplus 8 = 13, 5 \oplus 9 = 12$

Hence, 8 distinct elements of S , in increasing order, are 2, 3, 4, 5, 10, 11, 12, 13; meaning that the median of S , the forth element, is 5.

A bitwise XOR (denoted as \oplus) is a binary operation that takes two bit patterns of equal length and performs the logical exclusive OR operation on each pair of corresponding bits. The result in each position is 1 if and only if two bits are different, and is 0 if two bits are equal. For example:

- $3 \oplus 6 = 011_2 \oplus 110_2 = 101_2 = 5$
- $4 \oplus 7 = 100_2 \oplus 111_2 = 011_2 = 3$
- $5 \oplus 8 = 0101_2 \oplus 1000_2 = 1101_2 = 13$

The median value of a sequence of numbers in increasing order $v_1 < v_2 < \dots < v_n$ is $v_{\frac{n}{2}}$ if n is even and $v_{\frac{n+1}{2}}$ if n is odd.

Input

The first line of the input contain an integer t ($1 \leq t \leq 16\,384$) — the number of test cases.

In the last t lines, each contains four integers a, b, c, d ($0 \leq a, b, c, d \leq 9 \cdot 10^{18}, a \leq b, c \leq d$) representing a test case. All numbers are in decimal form.

Output

For each test case, write a single integer on a single line denoting the median value of S . All numbers should be in decimal form.



The 2022 ICPC Asia Ho Chi Minh Regional Contest



HCMUTE - 9 December 2022

Sample Input 1

2	5
3 5 6 9	19
6 9 12 22	

Sample Output 1