

Z-order Curve

Input file: standard input
Output file: standard output
Time limit: 1 second
Memory limit: 1024 megabytes

Welcome to the China Collegiate Programming Contest (CCPC) Zhengzhou onsite! Bobo has noticed that the initials of “Zheng” and “Zhou” are both Z. This motivates him to study the well-known Z-order curve.

To introduce the Z-order curve, we first introduce the Moser–de Bruijn sequence $(B_t)_{t \geq 0}$, the ordered sequence of numbers whose binary representation has nonzero digits only in the even positions. The first few terms of the Moser-de Bruijn sequence are 0, 1, 4, 5, 16, 17, 20, 21.

Each non-negative integer z can be uniquely decomposed into the sum of B_x and $2B_y$. Therefore, we can write down all natural numbers in an infinitely large table. The Z-order curve is then obtained by connecting all the numbers in numerical order.

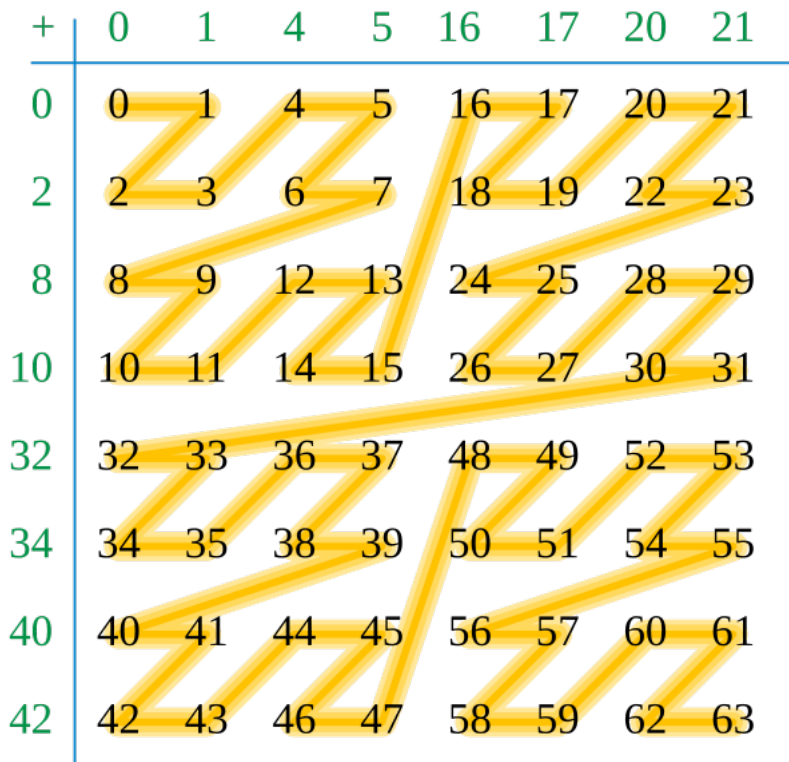


Illustration of Z-curve

Bobo now challenges you with the following problem: For a given fragment extracted from the Z-curve from L to R , find the smallest integer l such that the Z-curve from l to $l + R - L$ is identical to the given fragment (i.e., the curve from l to $l + R - L$ can be obtained by translating the curve from L to R).

Please note that in this problem, the curve is directed. Specifically, the curve from 1 to 2 is NOT identical to the curve from 3 to 4.

Input

The first line of the input contains a single integer T ($1 \leq T \leq 100$), denoting the number of test cases.

The first and only line of each test case contains two integers L and R ($0 \leq L < R \leq 10^{18}$).

Output

For each test case, output the answer in one line.

Example

| standard input | standard output |
|---------------------------------------|-----------------|
| 4 | 1 |
| 17 20 | 0 |
| 0 63 | 6 |
| 38 40 | 2145186925057 |
| 998244353998244353 998244853998244853 | |

Note

The following figure illustrates the Z-curve for the first and third test cases in the sample.

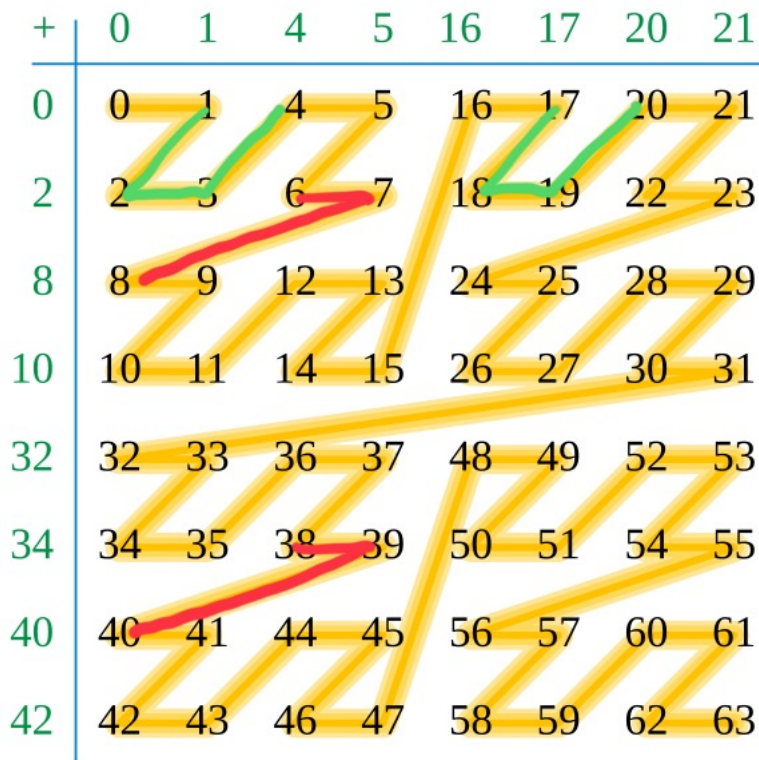


Illustration of test cases in the sample

(red: test case 1, green: test case 3)