Problem F. First Occurrence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

The famous *Thue-Morse sequence* $T = t_0 t_1 t_2 \ldots$ is an infinite binary sequence that can be defined as follows: if the number of ones in the binary representation of n is odd then $t_n = 1$, otherwise $t_n = 0$.

The sequence starts with 0110100110010110100101100110100 1 . . .

Consider a substring of this sequence $t_{l..r} = t_l t_{l+1} \ldots t_r$. Find the index of the first occurrence of $t_{l..r}$ in T. In other words, find the smallest non-negative integer i such that $t_{l..r} = t_{i..i+(r-l)}$.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \le t \le 10^5$). Description of the test cases follows.

The only line of each test case contains two integers l and r ($0 \le l \le r \le 10^{18}$).

Output

For each test case, print the index of the first occurrence of $t_{l..r}$ in T.

Example

standard input	*standard output*
3 0 10 13 13 23 27	0 1 5

Note

In the first example test case, $t_{0..10}$ obviously first occurs in T at index 0.

In the second example test case, $t_{13..13} = 1$ first occurs in T at index 1.

In the third example test case, $t_{23..27} = 00110$ first occurs in T at index 5.