

## Problem C. Modulo 4

Input file: *standard input*  
 Output file: *standard output*  
 Time limit: 1 second  
 Memory limit: 256 mebibytes

Let  $A$  be the set of all arithmetic expressions consisting of the digits 0, 1, and the bitwise OR operator  $|$ , starting with 1, such that there is a 1 immediately after each  $|$ .

Let  $B_n$  be the subset of all expressions from  $A$  such that their value is equal to  $2^n - 1$  when considering the numbers in the expression in binary.

Let  $C_n$  be the subset of all expressions from  $A$  containing at least one expression from the set  $B_n$  as a suffix. For example, the following expressions are in  $C_3$ : 10011111, 111, 110|1|11, 11|11001|1010|101, and these expressions are not in  $C_3$ : 111|1011, 1, 10|11|11, 1100|10|100.

For given positive integers  $n$  and  $k$ , find the number of expressions from the set  $C_n$  that contain exactly  $k$  digits (and an arbitrary number of  $|$ ). As the answer may be very large, output it modulo 4.

### Input

The input contains  $t \leq 10$  test cases. The value  $t$  is given on the first line of input.

The only line in each test case contains two integers  $n$  and  $k$  ( $2 \leq n \leq 10^{12}$ ,  $n + 2 \leq k \leq 2 \cdot 10^{12}$ ).

### Output

For each test case, output the number of expressions from the set  $C_n$  containing exactly  $k$  digits, modulo 4.

### Example

<i>standard input</i>	<i>standard output</i>
4	2
2 4	0
5 15	1
147 10000	3
60 150	

### Note

Here are 14 expressions from the first example:

1111, 1011, 1|111, 111|1, 110|1, 11|11, 10|11, 11|10, 10|1|1, 11|1|1, 1|10|1, 1|11|1, 1|1|10, 1|1|11