

New Binary

One day Chandrima decided to make a list of all numbers starting from 1 in binary format, the list would be like 1,10,11,100,... and so on. Now she get bored of this list and decide to remove any pattern having atleast two consecutive ones and prepare a new list. The new list will be like 1,10,100,101,... and so on. She then thought if a number n is given to her can she find the n^{th} member of the new list. After trying for some time she comes to you for help. Can you help her by writing a program for her that could do the specified task

Input

The first line contains T (≤ 1000) test cases. The next T lines each contain one integer N ($\leq 10^{15}$) for which you need to find the N^{th} member of the list.

Output

Output T lines each containing the required answer.

Example

Input:

3
1
2
3

Output:

1
10
100