The Great XOR

HackerRank

Given a long integer x, count the number of values of a satisfying the following conditions:

- $a \oplus x > x$
- $0 < a < x$

where a and x are long integers and $\oplus$ is the bitwise XOR operator.

You are given q queries, and each query is in the form of a long integer denoting x. For each query, print the total number of values of a satisfying the conditions above on a new line.

For example, you are given the value $x = 5$. Condition 2 requires that $a < x$. The following tests are run:

$1 \oplus 5 = 4$
$2 \oplus 5 = 7$
$3 \oplus 5 = 6$
$4 \oplus 5 = 1$

We find that there are 2 values meeting the first condition: 2 and 3.

Function Description

Complete the *theGreatXor* function in the editor below. It should return an integer that represents the number of values satisfying the constraints.

theGreatXor has the following parameter(s):

- *x*: an integer

Input Format

The first line contains an integer q, the number of queries.
Each of the next q lines contains a long integer describing the value of x for a query.

Constraints

- $1 \leq q \leq 10^5$
- $1 \leq x \leq 10^{10}$

Subtasks

For 50% of the maximum score:

- $1 \leq q \leq 10^3$
- $1 \leq x \leq 10^4$

Output Format

For each query, print the number of values of a satisfying the given conditions on a new line.

Sample Input 0

```
2
2
10
```

Sample Output 0

```
1
5
```

Explanation 0

We perform the following $q = 2$ queries:

1. For $x = 2$ the only value of a satisfying $0 < a < x$ is 1. This also satisfies our other condition, as $1 \oplus 2 = 3$ and $3 > x$. Because we have one valid a and there are no more values to check, we print 1 on a new line.

2. For $x = 10$, the following values of a satisfy our conditions:

   $1 \oplus 10 = 11$
   $4 \oplus 10 = 14$
   $5 \oplus 10 = 15$
   $6 \oplus 10 = 12$
   $7 \oplus 10 = 13$

   There are five valid values of a.

Sample Input 1

```
2
5
100
```

Sample Output 1

```
2
27
```

Explanation 1

In the first case:
$2 \oplus 5 = 7$
$3 \oplus 5 = 6$
In the second case, the first 10 values are:
$1 \oplus 100 = 101$
$2 \oplus 100 = 102$
$3 \oplus 100 = 103$
$8 \oplus 100 = 108$

$9 \oplus 100 = 109$
$10 \oplus 100 = 110$
$11 \oplus 100 = 111$
$12 \oplus 100 = 104$
$13 \oplus 100 = 105$
$14 \oplus 100 = 106$
$15 \oplus 100 = 107$