

The Great XOR



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:

$$\begin{aligned} 1 \oplus 5 &= 4 \\ 2 \oplus 5 &= 7 \\ 3 \oplus 5 &= 6 \\ 4 \oplus 5 &= 1 \end{aligned}$$

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:

$1 \oplus 100 = 101$
 $2 \oplus 100 = 102$
 $3 \oplus 100 = 103$
 $8 \oplus 100 = 108$

$$9 \oplus 100 = 109$$

$$10 \oplus 100 = 110$$

$$11 \oplus 100 = 111$$

$$12 \oplus 100 = 104$$

$$13 \oplus 100 = 105$$

$$14 \oplus 100 = 106$$

$$15 \oplus 100 = 107$$