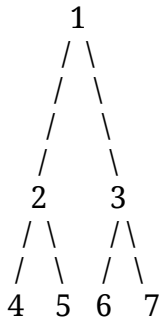


# Diameter of Binary Trees

Let's define an infinite **unweighted** binary tree where nodes are numbered with natural numbers and each node numbered  $i$  has 2 children numbered  $2*i$  and  $2*i+1$ .

So, tree looks somewhat like this:



and so on...

You are given  $N$  queries  $Q_1, Q_2 \dots Q_N$ . For each query  $Q_i$  output the diameter of binary tree consisting only of nodes numbered from 1 to  $Q_i$ .

Diameter of a binary tree is the maximum distance between any two nodes in the tree.

## Input

- First line contains  $N$ , the number of queries.
- Each of the next  $N$  lines contain integers denoting the queries.

## Output

For each query, print the required answer in a single line.

## Constraints

- $0 \leq N \leq 10^5$
- $1 \leq Q_i \leq 10^9$

### **Example**

Input:

2

3

4

Output:

2

3

### **Explanation**

For  $Q_1 = 3$ , the tree is:

```
  1
 / \
2   3
```

and the longest path is between nodes 2 and 3.

For  $Q_2 = 4$ , the tree is:

```
  1
 / \
2   3
/
4
```

and the longest path is between nodes 4 and 3.