Helping Ants

HackerRank

Problem Statement

Its Julia's birthday today, so Abhimanyu presented her N magical ants. Ants are numbered as $1, 2, 3, \ldots, N$. Julia placed i^{th} ant on X-axis at $(i,\ 0)$. She wants to draw $N-1$ line segments. 1^{st} segment connects $(1, 0)$ and $(2, 0)$, 2^{nd} segment connects $(2, 0)$ and $(3, 0)$ and so on. She doesn't want to draw segments by herself so she asked Abhimanyu to help her.

Abhimanyu decides that all the segments will be drawn by the ants. When any ant moves from $(i, 0)$ to either $(i-1, 0)$ or $(i+1, 0)$, a segment connecting these two points is drawn magically. He made some rules to be followed by the ants:

- i^{th} ant can move to $(i-1, 0)$ and $(i+1, 0)$. 1^{st} ant can move to $(2, 0)$ and N^{th} ant can move to $(N-1, 0)$ only.
- i^{th} ant can move, if it is at $(i, 0)$.
- Only one ant moves at a time. So there will be total $N-1$ moves in order to draw all the segments.

He encodes the sequence of moves made by ants in order to draw all the segments, as a string S. String S consists of either L or R. i^{th} letter of string will be:

- L if on the i^{th} move any ant moved to its left.
- R if on the i^{th} move any ant moved to its right.

Abhimanyu knows that there are total W_a different ways that exist for drawing all the segments, but he asked Julia to tell the total number of different ways. Two ways are considered different if the corresponding encoded strings are different.

Julia wrote the following code to find total number of different ways and according to the code there are a total of W_j ways:

```
ways(N)
  total_ways = 0

  if (N == 1)
    return 1

  for i in [1, N]
    if (i == 1 or i == N)
      total_ways = total_ways + ways(N - 1)
      total_ways = total_ways + 2
    else
      total_ways = total_ways + ways(i - 1)
      total_ways = total_ways + ways(N - i)
      total_ways = total_ways + 1

  return total_ways
```

Abhimanyu realized that $W_j > W_a$, but he wants you to compute the value of $W = W_j - W_a$.

Input Format

First line of input is an integer T, total number of test cases. Each of the next T lines contains a single integer N, total number of ants presented to Julia.

Constraints

- $1 \leq T \leq 5 \times 10^5$
- $2 \leq N \leq 10^9$

Output Format

For each test case print the value of W modulo $(10^9 + 7)$, in a separate line.

Sample Input

```
2
2
3
```

Sample Output

```
4
15
```

Explanation

$N = 2$

All the possible ways are shown below:

Starts From	Moves To	Encoded String
(1, 0)	(2, 0)	R

Starts From	Moves To	Encoded String
(2, 0)	(1, 0)	L

Encoded strings are L and R. So,

- $W_a = 2$
- $W_j = 6$.
- $W = W_j - W_a = 4$

$N = 3$

All the possible ways are shown below:

Starts From	Moves To	Encoded String
(1, 0)	(2, 0)	
(2, 0)	(3, 0)	RR

Starts From	Moves To	Encoded String
(1, 0)	(2, 0)	
(3, 0)	(2, 0)	RL

Starts From	Moves To	Encoded String
(2, 0)	(1, 0)	
(3, 0)	(2, 0)	LL

Starts From	Moves To	Encoded String
(2, 0)	(3, 0)	
(1, 0)	(2, 0)	RR

Starts From	Moves To	Encoded String
(3, 0)	(2, 0)	
(1, 0)	(2, 0)	LR

Starts From	Moves To	Encoded String
(3, 0)	(2, 0)	
(2, 0)	(1, 0)	LL

Encoded strings are RR, RL, LL, RR, LR and LL. As only four strings are different, So,

- $W_a = 4$
- $W_j = 19$.
- $W = W_j - W_a = 15$