# **HackerRank**

# Project Euler #137: Fibonacci golden nuggets

This problem is a programming version of Problem 137 from projecteuler.net

Consider the infinite polynomial series  $A_F(x)=xF_1+x^2F_2+x^3F_3+\ldots$ , where  $F_k$  is the  $k^{\rm th}$  term in the Fibonacci sequence:  $1,1,2,3,5,8,\ldots$ ; that is,  $F_k=F_{k-1}+F_{k-2}$ ,  $F_1=1$  and  $F_2=1$ .

For this problem we shall be interested in values of x for which  $A_F(x)$  is a positive integer.

Surprisingly

$$A_F(1/2) = (1/2) \cdot 1 + (1/2)^2 \cdot 1 + (1/2)^3 \cdot 2 + (1/2)^4 \cdot 3 + (1/2)^5 \cdot 5 + (1/2)^6 \cdot 8 + \cdots$$

$$= 1/2 + 1/4 + 2/8 + 3/16 + 5/32 + \ldots$$

$$= 2$$

The corresponding values of  $\boldsymbol{x}$  for the first five natural numbers are shown below.

$$egin{array}{c|cccc} x & A_F(x) \ \hline \sqrt{2}-1 & 1 \ rac{1}{2} & 2 \ rac{\sqrt{13}-2}{3} & 3 \ rac{\sqrt{89}-5}{8} & 4 \ rac{\sqrt{34}-3}{5} & 5 \ \hline \end{array}$$

We shall call  $A_F(x)$  a golden nugget if x is rational, because they become increasingly rarer; for example, the  $10^{
m th}$  golden nugget is 74049690.

Given N, find the  $N^{
m th}$  golden nugget. Since this number can be very large, output it modulo  $10^9+7$ .

## **Input Format**

The first line of input contains T, the number of test cases.

Each test case consists of a single line containing a single integer, N.

### **Constraints**

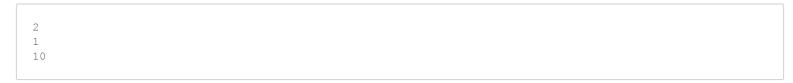
$$1 \le T \le 10^5$$

In the first test case:  $1 \le N \le 20$  In the second test case:  $1 \le N \le 10^6$  In the third test case:  $1 \le N \le 10^{18}$ 

# **Output Format**

For each test case, output a single line containing a single integer, the answer for that test case.

# Sample Input



# **Sample Output**

```
2
74049690
```