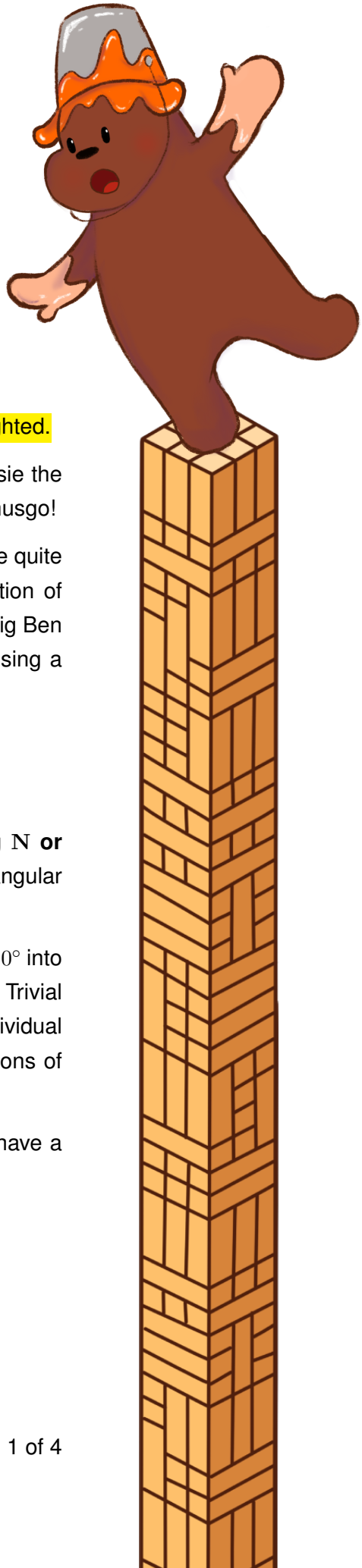
Problem 1: Big Ben's Benga Bricks
12+1=13 Points



Problem ID: `benga`
Rank: `4+4`

Introduction

This is a harder version of `jenga`! Key changes in `benga` are highlighted.

Big Ben loves Jenga! He is the undefeated champion, beating Bessie the Cow, P/NPenguin, and Ana, the Jenga National Champion from Mañusgo!

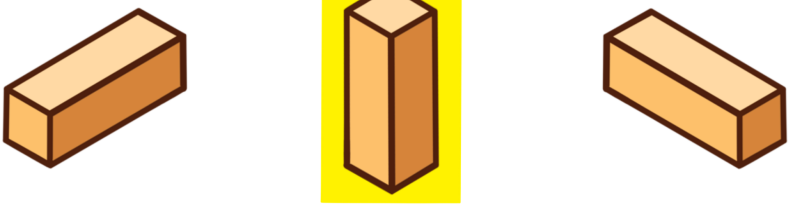
After beating all the computer science mascots, Big Ben has become quite bored of the game. One day, he decides to create his own variation of classic Jenga: Ben's Jenga (or as he likes to call it, Benga!). Now, Big Ben wants to know how many unique Benga towers he can engineer using a certain amount of bricks before getting bored again!

Problem Statement

Count the number of unique Benga towers that can be built using $\mathbf{N}$ **or fewer** bricks of size $1 \times 1 \times 3$. A Benga tower is a fully packed rectangular prism with a 3×3 base and a height of at least 1.

Bricks are indistinguishable from one another. Bricks can be rotated 90° into horizontal orientations and also vertical orientations as shown below. Trivial rotations (for example, rotating a brick along its major axis) of individual Jenga bricks should not be considered unique. However, 90° rotations of the entire tower along the vertical axis should be considered unique.

To celebrate CALICO's 2-year-old birthday and the fact that bricks have a length of 3, give your answer modulo $2^{3^2}3^{2^3} = 3359232$.



Input Format

The first line of the input contains a single integer $\mathbf{T}$ denoting the number of test cases that follow.

Each test case is described in a single line containing an integer $\mathbf{N}$ denoting the number of bricks.

Output Format

For each test case, output a single line containing an integer denoting the number of unique Benga towers modulo $2^{3^2}3^{2^3} = 3359232$.

Constraints

$1 \leq \mathbf{T} \leq 10$

Main Test Set

$1 \leq \mathbf{N} \leq 10^{18}$

Bonus Test Set

$1 \leq \mathbf{N} \leq 10^{10^5} = 10^{100000}$

Yep, you read that correctly. This is not just Nacho's computer exploding. Thanks to CALICO, Big Ben has an (almost) infinite supply of Benga Bricks.

The size of each input file will not exceed $2\,\mathrm{MB}$.

Sample Test Cases

Main Sample Input Download

```
7
2
3
6
11
16
705
333333333333333333
```

Main Sample Output Download

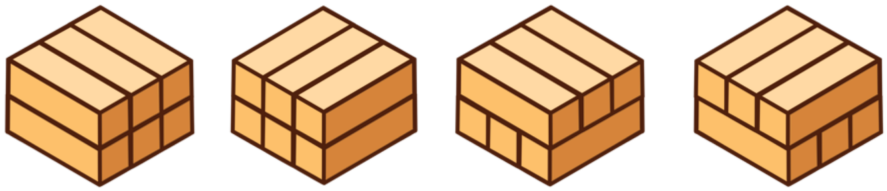
```
0
2
6
27
439
2941382
1635075
```

Main Sample Explanations

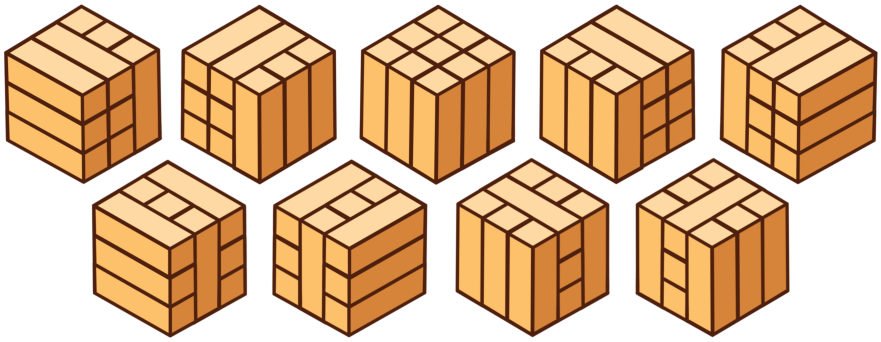
For test case #1, 2 bricks isn't enough to fill any layers, so our answer is 0.

For test case #2, 3 bricks lets us build only towers of height 1. The only 2 ways of building towers of height 1 are shown below.

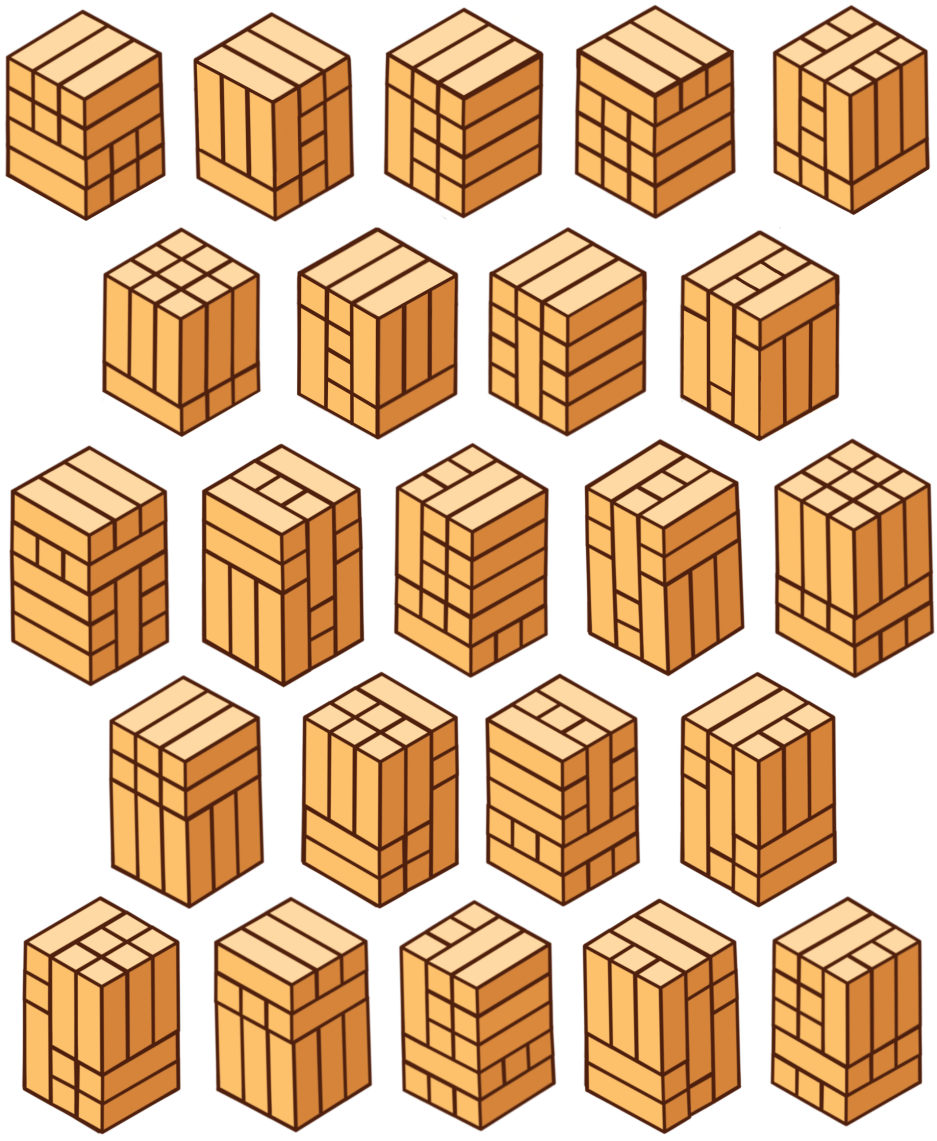
For test case #3, we can build towers of height 1 or 2. The 2 ways for height 1 are above and the 4 ways for height 2 are below, making a total of 6.



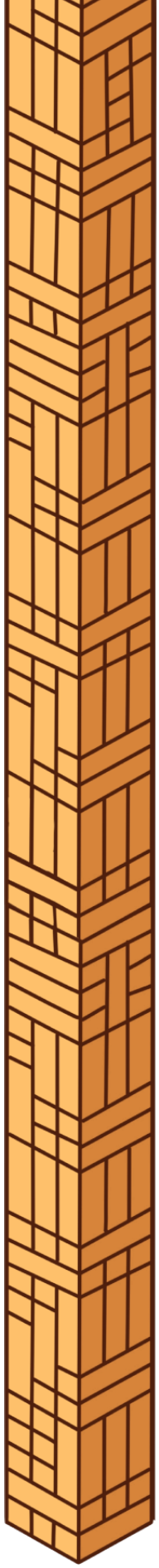
For test case #4, we can build towers of height up to 3. Some (but not all) towers with vertical pieces are shown below. This makes 27 in total.



For test case #5, there are 439 ways to build towers with height up to 5. Some (but not all) of these ways are shown below.



For test case #6, one of the towers that can be built using 705 bricks is shown to the right of this document.



Bonus Sample Input Download

```
1
314159265358979323846264338327950288419716939937510582
```

Bonus Sample Output Download

```
599783
```