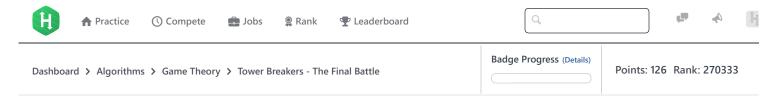
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# Tower Breakers - The Final Battle





Our unsung tower-breaking heroes (players  $P_1$  and  $P_2$ ) only have one tower left, and they've decided to break it for a special game commemorating the end of  $\mathbf{5}$  days of Game Theory! The rules are as follows:

- ullet  $P_1$  always moves first, and both players always move optimally.
- Initially there is **1** tower of height **N**.
- The players move in alternating turns. The moves performed by each player are different:
  - 1. At each turn,  $P_1$  divides the current tower into some number of smaller towers. If the turn starts with a tower of height H and  $P_1$  breaks it into  $x \ge 2$  smaller towers, the following condition must apply:  $H = h_1 + h_2 + \ldots + h_x$ , where  $h_i$  denotes the height of the  $i^{th}$  new tower.
  - 2. At each turn,  $P_2$  chooses some tower k of the x new towers made by  $P_1$  (where  $1 \le k \le x$ ). Then  $P_1$  must pay  $k^2$  coins to  $P_2$ . After that,  $P_1$  gets another turn with tower  $h_k$  and the game continues.
- The game is over when no valid move can be made by  $P_1$ , meaning that H=1.
- $P_1$ 's goal is to pay as few coins as possible, and  $P_2$ 's goal is to earn as many coins as possible.

Can you predict the number of coins that  $P_2$  will earn?

### **Input Format**

The first line contains a single integer, T, denoting the number of test cases. Each of the T subsequent lines contains a single integer, N, defining the initial tower height for a test case.

#### Constraints

- $1 \le T \le 100$
- $2 \le N \le 10^{18}$

#### **Output Format**

For each test case, print a single integer denoting the number of coins earned by  $P_{\mathbf{2}}$  on a new line.

#### Sample Input

- 4
- 2
- \_

#### **Sample Output**

- 6
- 4
- 8

## **Explanation**

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Test Case 0:

Our players make the following moves:

- 1. H = N = 4
  - 1.  $P_1$  splits the initial tower into  ${f 2}$  smaller towers of sizes  ${f 3}$  and  ${f 1}$ .
  - 2.  $P_2$  chooses the first tower and earns  $\mathbf{1^2} = \mathbf{1}$  coin.
- 2. H = 3
  - 1.  $P_1$  splits the tower into 2 smaller towers of sizes 2 and 1.
  - 2.  $P_2$  chooses the first tower and earns  $\mathbf{1^2} = \mathbf{1}$  coin.
- 3. H = 2
  - 1.  $P_1$  splits the tower into  $\mathbf{2}$  smaller towers of size  $\mathbf{1}$ .
  - 2.  $P_2$  chooses the second tower and earns  $2^2 = 4$  coins.

The total number of coins earned by  $P_2$  is 1 + 1 + 4 = 6, so we print 6 on a new line.

f in Submissions:<u>195</u> Max Score:50 Difficulty: Medium Rate This Challenge: ☆☆☆☆☆



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