GCD Extreme (hard)

This problem is a harder version of GCDEX.

Let

$$G(n) = \sum _{i=1}^{n} \sum _{j=i+1}^{n} \gcd(i, j).$$

For example, $G(1) = 0$, $G(2) = \gcd(1, 2) = 1$, $G(3) = \gcd(1, 2) + \gcd(1, 3) + \gcd(2, 3) = 3$.

Your task is to find $G(N)$ **modulo** 2^{64}.

Input

First line of Input contains T ($1 \le T \le 10000$), the number of test cases.

Next T lines contain a single number N. ($1 \le N \le 235711131719$)

Output

For each number N, output a single line containing $G(N)$ **modulo** 2^{64}.

Example

Input:

```
5
1
4
100
1000000
100000000000
```

Output:

```
0
7
13015
4071628673912
5482289417216306300
```

Explanation for Input

- $G(4) = \gcd(1, 2) + \gcd(1, 3) + \gcd(1, 4) + \gcd(2, 3) + \gcd(2, 4) + \gcd(3, 4) = 7$.

- $G(10^{11}) = 75710919967921216138364 \equiv 5482289417216306300 \pmod{2^{64}}$.

Information

There are 7 Input files.

- Input #0: $1 \le T \le 10000,\ 1 \le N \le 10000,\ TL = 1$s.

- Input #1: $1 \le T \le 1000,\ 1 \le N \le 10^{7},\ TL = 20$s.

- Input #2: $1 \le T \le 200,\ 1 \le N \le 10^{8},\ TL = 20$s.

- Input #3: $1 \le T \le 40,\ 1 \le N \le 10^{9},\ TL = 20$s.

- Input #4: $1 \le T \le 10,\ 1 \le N \le 10^{10},\ TL = 20$s.

- Input #5: $1 \le T \le 2,\ 1 \le N \le 10^{11},\ TL = 20$s.

- Input #6: $T = 1,\ 1 \le N \le 235711131719,\ TL = 20$s.

My solution runs in 17.05 sec. (total time)

Source Limit is 10 KB