# Party

Mr.B wants to hold a series of parties for his employees, holding one party every night. Assuming his company has n employees, these employees have unique ids in the range 1 to $n$ and the employee with id i is friends with the employees with the ids $2i$, $2i+1$ and $\lfloor \frac{i}{2} \rfloor$ if they exist.

On the first day, Mr.B chooses a random subset of his employees chosen uniformly from all non-empty subsets and invites them to the party for that day. For each subsequent day, anyone attending the previous party will attend the next party themselves, and they will also invite all of their friends.

It can be shown that after a limited number of days, every employee will be attending the parties. When one employee finds out about the parties, they will be sad about the parties they have missed and their sadness will be equal to the number of parties they have missed i.e. it will be zero for the people invited directly to the first party, one for their non-invited friends and so on. The sadness of the whole series of parties is then defined as the sum of the sadness of all employees.

Mr.B wants to know the expected value of this sadness for his series of parties, given that he chooses the initial subset of employees to invite uniformly from all non-empty subsets. Obviously, he doesn't have time to calculate this himself and has asked you to do it for him. He also doesn't actually remember the number of his employees (!) so he needs you to calculate this expected value for each of the q guesses he has as to what the number of employees actually is.

Finally, Mr.B doesn't enjoy handling non-integers, so, knowing that each answer can be shown as an irreducible fraction $\frac{P}{Q}$ where $P$ and $Q$ are coprime integers and $Q$ is not divisible by $10^9+7$, he wants you to report the number $P * Q^{-1}$ modulo $10^9+7$ instead.

## Input

The first line contains the integer $q$.
Each of the next $q$ lines contains one integer $n$.

## Output

For each of the $q$ values for $n$, print the required expected value in a separate line.

## Constraints

- $1 \leq q \leq 2000$
- $1 \leq n \leq 10^{18}$

## Subtasks

| Subtasks | score | constraints |
|---|---|---|
| 1 | 7 | $n \leq 200$ |
| 2 | 23 | Each $n$ value is in the form $2^k - 1$ |
| 3 | 33 | $q \leq 200$ |
| 4 | 37 | No additional constraints. |

## Examples

| Standard input | Standard output |
|---|---|
| 5<br>1<br>2<br>3<br>4<br>5 | 0<br>666666672<br>571428577<br>733333341<br>548387104 |
| 5<br>438683104447824131<br>461983238699791439<br>483227912528828095<br>352592111888489755<br>432980889538354445 | 597802608<br>929243282<br>897893632<br>550955255<br>88788769 |

## Sample explanation

For the case $n = 1$ the answer is 0.

For the $n = 2$ case, the real expected value is $\frac{2}{3}$ and as $3^{-1}$ modulo $10^9 + 7$ is 333333336, the output value is 666666672. The $\frac{P}{Q}$ form answers for the first sample are as follows:

- $\frac{0}{1}$
- $\frac{2}{3}$
- $\frac{11}{7}$

*** 38/15**
*** 105/31**