USA Computing Olympiad

USACO 2024 December Contest, Bronze
Problem 1. Roundabout Rounding

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Contest has ended.

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English (en)

Bessie the cow is back in school! She has started doing her math homework in which she is tasked to round positive integers to powers of 10.

To round a positive integer a to the nearest 10^b, where b is a positive integer, Bessie first locates the b'th digit from the right. Let x denote this digit.

If $x \geq 5$, Bessie adds 10^b to a.

Then, Bessie sets all the digits including and to the right of the b'th digit from the right to be 0.

For instance, if Bessie wanted to round 456 to the nearest 10^2 (hundred), Bessie would first locate the 2nd digit from the right which is 5. This means $x = 5$. Then since $x \geq 5$, Bessie adds 100 to a. Finally, Bessie sets all the digits in a to the right of and including the 2nd digit from the right to be 0, resulting in 500.

However, if Bessie were to round 446 to the nearest 10^2, she would end up with 400.

After looking at Bessie's homework, Elsie thinks she has invented a new type of rounding: chain rounding. To chain round to the nearest 10^b, Elsie will first round to the nearest 10^1, then the nearest 10^2, and so on until the nearest 10^b.

Bessie thinks Elsie is wrong, but is too busy with math homework to confirm her suspicions. She tasks you to count how many integers x at least 2 and at most N ($1 \leq N \leq 10^9$) exist such that rounding x to the nearest 10^P is different than chain rounding to the nearest 10^P, where P is the smallest integer such that $10^P \geq x$.

INPUT FORMAT (input arrives from the terminal / stdin):

You have to answer multiple test cases.

The first line of input contains a single integer T ($1 \leq T \leq 10^5$) denoting the number of test cases. T test cases follow.

The first and only line of input in every test case contains a single integer N. All N within the same input file are guaranteed to be distinct.

OUTPUT FORMAT (print output to the terminal / stdout):

Output T lines, the i'th line containing the answer to the i'th test case. Each line should be an integer denoting how many integers at least 2 and at most N exist that are different when using the two rounding methods.

SAMPLE INPUT:

```
4
1
100
4567
3366
```

SAMPLE OUTPUT:

```
0
5
183
60
```

Consider the second test case in the sample. 48 should be counted because 48 chain rounded to the nearest 10^2 is 100 ($48 \to 50 \to 100$), but 48 rounded to the nearest 10^2 is 0.

In the third test case, two integers counted are 48 and 480. 48 chain rounds to 100 instead of to 0 and 480 chain rounds to 1000 instead of 0. However, 67 is not counted since it chain rounds to 100 which is 67 rounded to the nearest 10^2.

SCORING:

- Inputs 2-4: $N < 10^3$

- Inputs 5-7: $N \leq 10^6$
- Inputs 8-13: No additional constraints.

Problem credits: Weiming Zhou

Contest has ended. No further submissions allowed.