Problem 264: Reciprocal Repetition

Difficulty: Medium

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Problem Background

Any time you calculate the reciprocal of a number (divide 1 by that number), you're going to get a decimal value. What's interesting about that decimal value, is that it will eventually start to repeat itself. For example, if you divide 1 by 3, you get 0.333333333.... Those 3's will never stop repeating themselves. Sometimes this repetition can include multiple numbers; dividing 1 by 7 results in 0.142857142857142857.... Here, the repeating group is 142857. Another way to write this number is $0.\overline{142857}$; the bar over those numbers indicates that they repeat indefinitely. Even if a number doesn't appear to repeat indefinitely, as with 1 / 10 = 0.1, it still has a repeating group of 0; $0.1\overline{0}$. We just typically ignore the extra zeroes.

Problem Description

Let's write a program to calculate the repeating portion of several reciprocal numbers. Given an integer value, you will need to calculate the reciprocal of that number, then identify the repeating group of that reciprocal as shown above.

WARNING: Computers are notoriously bad about storing decimal numbers in their memory. Computers store numbers in a binary format, and this can cause inaccuracies when working with decimal numbers. We strongly recommend that you do not rely on simple division to create your reciprocals. Using long division will be more likely to yield accurate numbers and avoid wrong answers.

$$
\begin{array}{r}
0.\ 2\ 5\ \overline{0} \\
4\,)\overline{1.\ \ 0\ \ \ 0\ \ \ 0} \\
-\ \ 8 \\
2\ \ \ 0 \\
-\ \ 2\ \ \ 0 \\
0 \\
-\ \ 0 \\
0
\end{array}
$$

Sample Input

The first line of your program's input, **received from the standard input channel**, will contain a positive integer representing the number of test cases. Each test case will include a line containing a positive integer between 2 and 100 inclusive.

3
3
7
10

Sample Output

For each test case, your program must print a single line containing the repeating group of the reciprocal of the given number.

3
142857
0