# Digit Fun!

HackerRank

**Problem Statement**

Recurrence relations are an important tool for the computer scientist. Many algorithms, particularly those that use divide and conquer, have time complexities best modeled by recurrence relations. A recurrence relation allows us to recursively define a sequence of values by defining the $n^{th}$ value in terms of certain of its predecessors.

Many natural functions, such as factorials and the Fibonacci sequence, can easily be expressed as recurrences. The function of interest for this problem is described below.

Let $|A_n|$ denote the number of digits in the decimal representation of $A_n$. Given any number $A_0$, we define a sequence using the following recurrence:

$A_i = |A_{i-1}|$ for $i > 0$

The goal of this problem is to determine the smallest positive $i$ such that $A_i = A_{i-1}$.

**Input Format**

Input consists of multiple lines, each terminated by an end-of-line character. Each line (except the last) contains a value for $A_0$, where each value is non-negative and no more than a million digits. The last line of input contains the word END.

**Output Format**

For each value of $A_0$ given in the input, the program should output one line containing the smallest positive $i$ such that $A_i = A_{i-1}$.

**Sample Input**

```
9999
0
1
9999999999
END
```

**Sample Output**

```
3
2
1
4
```

**Explanation**

The first input value is $A_0 = 9999$, resulting in $A_1 = |9999| = 4$. Because 4 does not equal 9999, we find $A_2 = |A_1| = |4| = 1$. Since 1 is not equal to 4, we find $A_3 = |A_2| = |1| = 1$. $A_3$ is equal to $A_2$, making 3 the smallest positive $i$ such that $A_i = A_{i-1}$.

The second input value is $A_0 = 0$, resulting in $A_1 = |0| = 1$. Because 0 does not equal 1, we find $A_2 = |A_1| = |1| = 1$. $A_2$ is equal to $A_1$, making 2 the smallest positive $i$ such that $A_i = A_{i-1}$.

The third input value is $A_0 = 1$, resulting in $A_1 = |1| = 1$. $A_1$ is equal to $A_0$, making 1 the smallest positive $i$ such that $A_i = A_{i-1}$.

The last input value is $A_0 = 9999999999$, resulting in $A_1 = |9999999999| = 10$. Because 10 does not equal 9999999999, we find $A_2 = |A_1| = |10| = 2$. Since 2 is not equal to 10, we find $A_3 = |A_2| = |2| = 1$. Since 1 is not equal to 2, we find $A_4 = |A_3| = |1| = 1$. $A_4$ is equal to $A_3$, making 4 the smallest positive $i$ such that $A_i = A_{i-1}$.