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# Recursive Digit Sum



by wanbo

Problem

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We define super digit of an integer  $x$  using the following rules:

- If  $x$  has only 1 digit, then its super digit is  $x$ .
- Otherwise, the super digit of  $x$  is equal to the super digit of the digit-sum of  $x$ . Here, digit-sum of a number is defined as the sum of its digits.

For example, super digit of **9875** will be calculated as:

```
super_digit(9875) = super_digit(9+8+7+5)
                  = super_digit(29)
                  = super_digit(2+9)
                  = super_digit(11)
                  = super_digit(1+1)
                  = super_digit(2)
                  = 2.
```

You are given two numbers  $n$  and  $k$ . You have to calculate the super digit of  $P$ .

$P$  is created when number  $n$  is concatenated  $k$  times. That is, if  $n = 123$  and  $k = 3$ , then  $P = 123123123$ .

## Input Format

The first line contains two space separated integers,  $n$  and  $k$ .

## Constraints

- $1 \leq n < 10^{100000}$
- $1 \leq k \leq 10^5$

## Output Format

Output the super digit of  $P$ , where  $P$  is created as described above.

## Sample Input 0

```
148 3
```

## Sample Output 0

```
3
```

## Explanation 0

Here  $n = 148$  and  $k = 3$ , so  $P = 148148148$ .

```
super_digit(P) = super_digit(148148148)
               = super_digit(1+4+8+1+4+8+1+4+8)
               = super_digit(39)
               = super_digit(3+9)
               = super_digit(12)
               = super_digit(1+2)
               = super_digit(3)
               = 3.
```

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Max Score: 30



Difficulty: Medium

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C++  

```
1 #include <cmath>
2 #include <cstdio>
3 #include <vector>
4 #include <iostream>
5 #include <algorithm>
6 using namespace std;
7
8 unsigned int super_digit(unsigned int x) {
9     if (x < 10) {
10         return x;
11     }
12
13     int sum = 0;
14
15     while (x) {
16         sum += x % 10;
17         x /= 10;
18     }
19
20     return super_digit(sum);
21 }
22
23 unsigned int super_digit(std::string x) {
24     if (x.length() == 1) {
25         return x[0] - '0';
26     }
27
28     unsigned int sum = 0;
29     unsigned int i;
30
31     for (i = 0; i < x.length(); i++) {
32         sum += x[i] - '0';
33         if (sum > 1000000000) sum = super_digit(sum);
34     }
35
36     sum = super_digit(sum);
37
38     return super_digit(std::to_string(sum) + x.substr(i));
39 }
40
41 int main() {
42     string n;
43     int k;
44     cin >> n;
45     cin >> k;
46
47     cout << super_digit(k * super_digit(n)) << endl;
48
49     return 0;
50 }
```

Line: 1 Col: 1

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