

< Back

Python3 Fibonacci-ish four lines (beating 99.84%)



ye15

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November 7, 2019 8:26 AM 98 VIEWS

4 The key to solve this problem is to derive the below recursive formula

$$f(n) = (f(n-1) + f(n-2)) * (k-1),$$

where  $f(n)$  is the number of ways to paint  $n$  poles following given rules, and initial condition

$$f(1) = k \text{ and } f(2) = k * 2.$$

Assume when painting the  $n$  th pole you already know  $f(n-1)$ ,  $f(n-2)$ , etc. To get  $f(n)$ , there are two means:

1. add  $n$  th pole whose color is different from that of  $(n-1)$  th;
2. add  $n$  th pole whose color is the same as that of  $(n-1)$  th.

The contribution from 1) is  $f(n-1) * (k-1)$  as there are already  $f(n-1)$  ways to paint the first  $n-1$  poles and the new pole's color ought to be different from the  $(n-1)$  th (i.e.  $k-1$  choices).

The contribution from 2) is  $f(n-2) * (k-1)$  as this is effectively to add two poles of the same colors to first  $n-2$  poles. The two new poles need to have color different from that of  $(n-2)$  th pole which again has  $k-1$  choices.

$f(1) = k$  is obvious since one could use any of  $k$  colors on one pole and  $f(2) = k * 2$  is also obvious since it is allowed for two consecutive poles to have the same color.

The above argument is where below implemented is based upon.

```
class Solution:
    def numWays(self, n: int, k: int) -> int:
        if n == 0: return 0
        a, b = k, k*k
        for i in range(n-1): a, b = b, (a+b)*(k-1)
        return a
```

The below implementation is slightly more efficient (beating 100%).

```
class Solution:
    def numWays(self, n: int, k: int) -> int:
        if n == 0: return 0
        elif n == 1: return k
        a, b = k, k*k
        for i in range(n-2): a, b = b, (a+b)*(k-1)
        return b
```

python 3

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