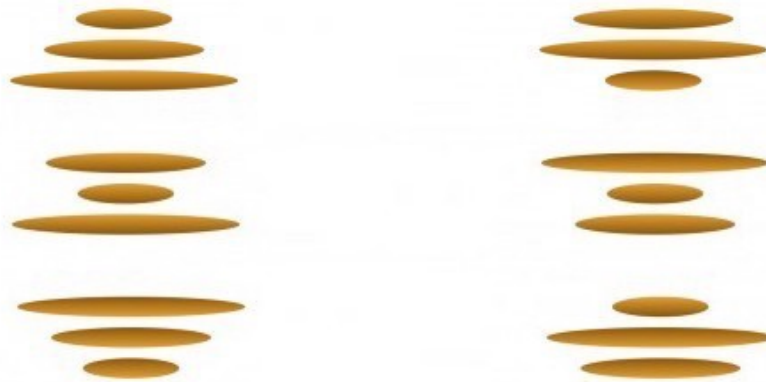


## EDITORIAL

Have you heard of the pancake problem? You have a stack of all different size pancakes that you want to order from largest on the bottom to smallest on top. You are allowed to insert a spatula at any point in the stack and use it to flip all pancakes above it.

Let's try a small case of 3 pancakes. How many flips are required to order the following stacks?



More generally, what is the maximum number of flips required for  $n$  pancakes?

This problem was first proposed by Jacob E. Goodman, under the pseudonym Harry Dweighter, in 1975 when it appeared as Elementary Problem E2569 in *American Mathematical Monthly*. Here is what we know so far. In 1979, Bill Gates and Christos Papadimitriou gave an upper bound of  $\frac{5n+5}{3}$  (yes, that Bill Gates!). In 2008, the bound was improved to  $\frac{18}{11}n$ . In 2011, this problem was proved to be NP-hard. Not so elementary after all.

It gets even more interesting in biology context. This “flipping” operation can be applied to create reversals in the gene sequence, which allows us to study genome rearrangements in evolution. For example, cabbage is only 3 flips away from turnip! Maybe one day we will find out what came first.

Kseniya Garaschuk