Permutative Abacaba Vector

by Sven Nilsen, 2018

In this paper I represent an "abacaba vector", a new number sequence for counting permutations.

When counting with binary numbers, taking the `neq` operation with previous number yields an "abaca" pattern, which occurs in many places in mathematics. A similar pattern occurs when counting with permutations:

Binary	**`neq`**	**Abacaba**	**Permutation**	**`neq`**	**Abacaba**
0000	-	-	4321	-	-
0001	0001	a	4312	0011	a
0010	0011	b	4231	0111	b
0011	0001	a	4213	0011	a
0100	0111	c	4132	0111	b
0101	0001	a	4123	0011	a
0110	0011	b	3421	1101	c
0111	0001	a	3412	0011	a

If you are unfamiliar with counting with permutations, it happens by a kind of sorting and "factoring" when an order is achieved. For example, `4123` is followed by `3421` because you pick the largest number in the ascending order `123` that is smaller than `4`, which is `3`, then you start with descending order `421` and perform a new sort. You have to swap elements using nested sorting.

By keeping counting and looking at the `neq` pattern, you get the following for binary:

abacabadabacabaeabacabadabacaba…

This pattern can be represented by what I call an "abacaba vector":

[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, …] Binary numbers

[1, 2, 1, 1, 4, 2, 1, 6, 3, 1, 8, 4, 1, 10, 5, 1, …] Permutations (conjecture)

To construct the pattern from this vector, one constructs an L-system (with a special `aa → a` rule):

0	1	2	1	1	4	2
aa → a	b → aba	c → bbcbb	d → cdc	e → ded	f → eeeefeeee	g → ffgff

A search in OEIS (The On-Line Encyclopedia of Integer Sequence) could not find the sequence. As far as I know, this number sequence is a new discovery.

In Dyon, the source for this vector (or number sequence) is:

```
perm(n: f64) = if (n % 3) == 0 {1}
               else if (n % 3) == 1 {2*(floor(n/3)+1)}
               else if (n % 3) == 2 {floor(n/3)+1}
```