

# The sum of digits of prime numbers is evenly distributed

May 12 2010

---

(PhysOrg.com) -- On average, there are as many prime numbers for which the sum of decimal digits is even as prime numbers for which it is odd. This hypothesis, first made in 1968, has recently been proven by French researchers from the Institut de Mathématiques de Luminy.

A prime number is an integer greater than or equal to 2 that has exactly two distinct natural number divisors, 1 and itself. For example, 2, 3, 5, 7, 11,..., 1789, etc. are prime numbers, whereas 9, divisible by 3, is not a prime number.

Numerous arithmetical problems concern prime numbers and most of them still remain unresolved, sometimes even after several centuries. For example, it has been known since Euclid that the sequence of prime numbers is infinite, but it is still not known if an infinity of prime numbers  $p$  exists such that  $p+2$  is also a prime number (problem of twin prime numbers). In the same way, it is not known if there exists an [infinity](#) of prime numbers, the decimal representation of which does not use the digit 7.

Two researchers from the Institut de [Mathématiques](#) de Luminy have recently made an important breakthrough regarding a conjecture formulated in 1968 by the Russian mathematician Alexandre Gelfond concerning the sum of digits of prime numbers. In particular, they have demonstrated that, on average, there are as many prime numbers for which the sum of decimal digits is even as prime numbers for which it is odd.

The methods employed to arrive at this result, derived from combinatorial mathematics, the analytical theory of numbers and harmonic analysis, are highly groundbreaking and should pave the way to the resolution of other difficult questions concerning the representation of certain sequences of integers.

Quite apart from their theoretical interest, these questions are directly linked to the construction of sequences of pseudo-random numbers and have important applications in digital simulation and cryptography.

**More information:** Sur un problème de Gelfond : la somme des chiffres des nombres premiers, (On a Gelfond problem: the sum of digits of prime numbers) C. Mauduit, J. Rivat, Annals of Mathematics, Vol. 171 (2010), No. 3, 1591-1646, May 2010, [annals.princeton.edu/annals/2010/171-3/p04.xhtml](https://annals.princeton.edu/annals/2010/171-3/p04.xhtml)

Provided by CNRS

Citation: The sum of digits of prime numbers is evenly distributed (2010, May 12) retrieved 9 April 2024 from <https://phys.org/news/2010-05-sum-digits-prime-evenly.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
---