The quest for pi.

This article gives a brief history of the computation of the mathematical constant \( \pi = 3.14159 \ldots \) with emphasis on the most recent developments.

Various approximations were known to the ancients. In the Bible the value 3 occurs. Archimedes presented the first rigorous mathematical method for the calculation of \( \pi \). After the discovery of the calculus by Newton and Leibniz many formulas for \( \pi \) were derived from the power series for the inverse trigonometric functions.

The development of computers after the war increased the computing power. At the same time several new and unexpected formulas connected with \( \pi \) were discovered. First progress was made with Ramanujan’s fast converging series. A second improvement was the quadratically convergent algorithm of Salamin and Brent (1976) based on the arithmetic-geometric mean. With related methods Kanada calculated in 1995 over 6 billion decimal digits of \( \pi \). These methods still require high precision arithmetic.

The spigot algorithm of Rabinowicz and Wagon calculates successive digits from previous digits recursively without the need of multiply precision computation software. Recently, a new algorithm has been discovered for computing individual hexadecimal digits of \( \pi \) without the need of calculation any previous digits. By the way, the 100-billion’th hexadecimal digit of \( \pi \) is 9.

The headline of the final section is “Why?”. There are some applications: Test computer hardware, advance computational techniques and theoretical questions, such as the equidistribution of digits. But the most fundamental motivation for computing \( \pi \) is: “Because it is there”.

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References:


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