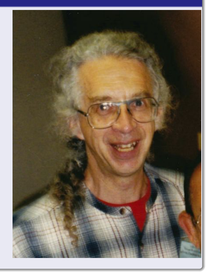
Millions, Billions, Trillions Digits of π

Jean Guilloud & Martin Bouyer

In 1973 , Jean Guilloud and Martin Bouyer were the first team to reach 1 million digits of π. They used **CDC 7600** with 23.3 hours of computing time to calculate the first $1,001,250$ digits.

Bill Gosper

In 1977, Gosper calcated 17 million terms of the continued fraction of π. Based on Ramanujan's series, Gosper was able to obtain 17 million decimal digits of π, which was the world record for several months.



Chudnovsky Brothers

In 1989, David and Gregory Chudnovsky were the first to reach 1 billion digits. They used an algorithm based on a variation of Ramanujan's series.

Figure: David Chudnovsky (L) and Gregory Chudnovsky (R)

Yasumasa Kanada

In November 2002, a team from University of Tokyo lead by Yasumasa Kanada were the first to reach 1 trillion digits of π (actually, 1.2411×10^{12} digits). Their algorithm was also based on the variation of Ramanujan's series.

BBP Formula

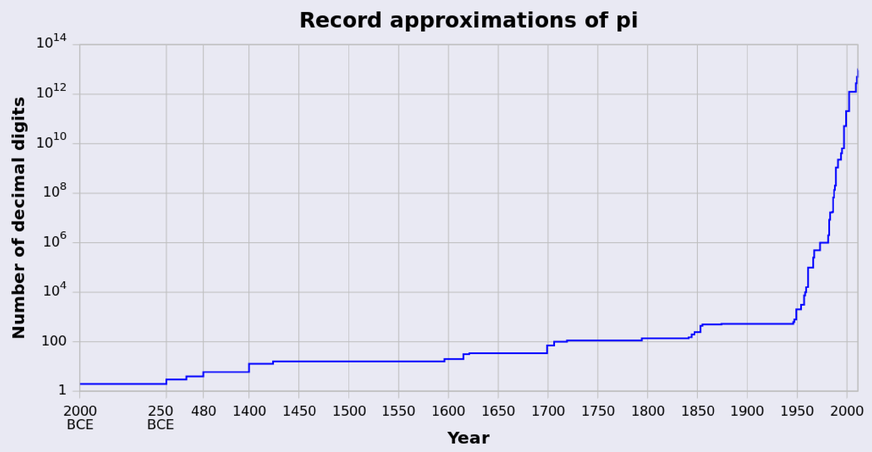
In 1997, David Bailey, Peter Borwein, and Simon Plouffe published the following surpising formula

$$\pi = \sum_{k=0}^{\infty} \left[\frac{1}{16^k} \left(\frac{4}{8k+1} - \frac{2}{8k+4} - \frac{1}{8k+5} - \frac{1}{8k+6} \right) \right].$$

For centuries it was believed that one cannot find the next digits of π without knowing all the preceding digits. With this formula, one can build an algorithm to compute the nth digit of π with a minimum knowledge of all predecessors. The BBP type formulas are considered the fastest way to find nth digits of π, and are used as the main algorithm for verification of world records for most digits of π.

Figure: David Bailey (L), Peter Borwein (C), and Simon Plouffe (R)

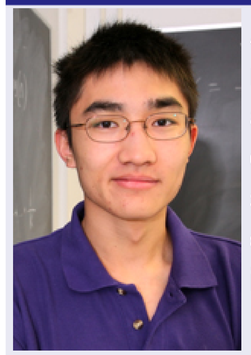
Timeline



Fabrice Bellard

In 1997, Fabrice Bellard discovered a faster formula to calculate single digits. His formula is a variant of BBP formula. In December 2009, he calculated 2.7 trillion digits of π in 90 days using a single (cheap) desktop PC.

Alexander Yee



Alex Yee is a U of Illinois alumnus (Master in CS). He developed a program called *y*-cruncher. *y*-cruncher has been used to set several world records for the most digits of π ever computed, including the current world record.

Records Using *y*-cruncher

- 13.3 trillion digits - October 2014 ("houkouonchi").
- 12.1 trillion digits - December 2013 (Shigeru Kondo).
- 10 trillion digits - October 2011 (Shigeru Kondo).
- 5 trillion digits - August 2010 (Shigeru Kondo).

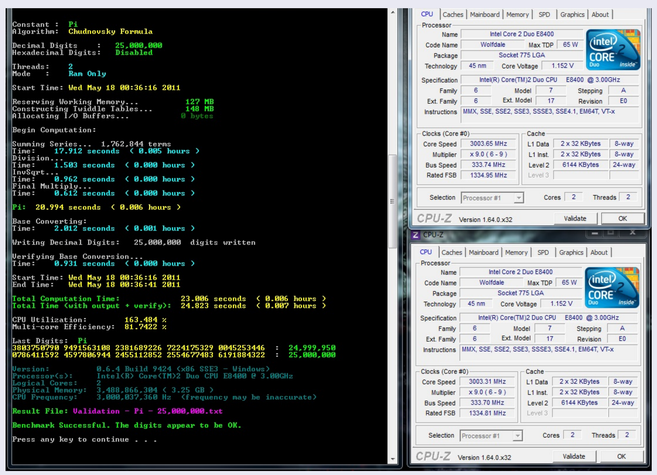


Figure: *y*-cruncher programs