GIMPS project discovers largest known prime number

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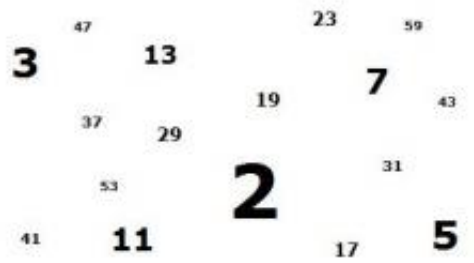

Prime Numbers

The Great Internet Mersenne Prime Search (GIMPS) has discovered the largest known prime number, $2^{77,232,917}$-1, having 23,249,425 digits. A computer volunteered by Jonathan Pace made the find on December 26, 2017.

Jonathan is one of thousands of volunteers using free GIMPS software.

The new prime number, also known as M77232917, is calculated by multiplying together 77,232,917 twos, and then subtracting one. It is nearly one million digits larger than the previous record prime number, in a special class of extremely rare prime numbers known as Mersenne primes. It is only the 50th known Mersenne prime ever discovered, each increasingly difficult to find. Mersenne primes were named for the

French monk Marin Mersenne, who studied these numbers more than 350 years ago. GIMPS, founded in 1996, has discovered the last 16 Mersenne primes. Volunteers download a free program to search for these primes, with a cash award offered to anyone lucky enough to find a new prime. Prof. Chris Caldwell maintains an authoritative web site on the largest known primes, and has an excellent history of Mersenne primes.

The primality proof took six days of non-stop computing on a PC with an Intel i5-6600 CPU. To prove there were no errors in the prime discovery process, the new prime was independently verified using four different programs on four different hardware configurations.

- Aaron Blosser verified it using Prime95 on an Intel Xeon server in 37 hours.
- David Stanfill verified it using gpuOwL on an AMD RX Vega 64 GPU in 34 hours.
- Andreas Höglund verified the prime using CUDALucas running on NVidia Titan Black GPU in 73 hours.
- Ernst Mayer also verified it using his own program Mlucas on 32-core Xeon server in 82 hours. Andreas Höglund also confirmed using Mlucas running on an Amazon AWS instance in 65 hours.

Jonathan Pace is a 51-year old Electrical Engineer living in Germantown, Tennessee. Perseverance has finally paid off for Jon—he has been hunting for big primes with GIMPS for over 14 years. The discovery is eligible for a $3,000 GIMPS research discovery award.

GIMPS Prime95 client software was developed by founder George Woltman. Scott Kurowski wrote the PrimeNet system software that coordinates GIMPS' computers. Aaron Blosser is now the system administrator, upgrading and maintaining PrimeNet as needed.

Volunteers have a chance to earn research discovery awards of $3,000 or $50,000 if their computer discovers a new Mersenne prime. GIMPS' next major goal is to win the $150,000 award administered by the Electronic Frontier Foundation offered for finding a 100 million digit prime number.

Credit for this prime goes not only to Jonathan Pace for running the Prime95 software, Woltman for writing the software, Kurowski and Blosser for their work on the Primenet server, but also the thousands of GIMPS volunteers that sifted through millions of non-prime candidates. In recognition of all the above people, official credit for this discovery goes to "J. Pace, G. Woltman, S. Kurowski, A. Blosser, et al."

More information: mersenne.org/

Provided by Great Internet Mersenne Prime Search (GIMPS)

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