University of Utah
Department of Mathematics

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A f t e r m a t h

LCB Loft Coming Along

The work on the LCB attic is almost finished. Go and have a look! You can reach the attic through the staircase on the East Side of LCB, or a dedicated staircase in the center of the third floor of LCB. Some furniture is still missing but we expect it to arrive within the next few weeks. The South half of the attic will be reserved for first year graduate students. The North half will be public and we hope and expect that it will be well used for meeting and studying by our students and also our faculty, much like the study areas of our math center. There will be an official dedication ceremony (with the donors present) on Monday, February 23, at 3:00pm. Mark your calendar!

New Mersenne Prime Found

A Mersenne Prime Number is a prime number of the form $M_p = 2^p - 1$. It's easy to see that in order for M_p to be prime, p itself must be prime (think about it next time you are in the shower), but even if p is prime, M_p may not be. (Next time you are stuck in traffic, figure out the smallest Mersenne number M_p where p is prime and M_p isn't – Angie and I decided we should assign home work in this newsletter.)

Mersenne Prime numbers are rare! In fact, only 40 are known at present. The most recent one was discovered only last month. It's $2^{20,996,011} - 1$, and it's huge! Moreover, all Mersenne prime numbers up to and including $p = 6{,}972{,}593$ are known. There are just 38 of them! ($2^{13,466,917} - 1$ is also prime, but there may be unknown smaller ones with $6{,}972{,}593 < p < 13{,}466{,}917$.) It's legitimate to ask whether it matters to know a yet larger prime number – although you can earn $100,000 by being the first to identify a prime number with at least 10,000,000 digits – but setting that unfriendly query aside, the process of finding Mersenne Prime numbers is fascinating. The last six were found in the Great Internet Mersenne Prime Search, GIMPS, http://www.mersenne.org/prime.htm,which employs the spare cycles of thousands of computers worldwide.

Identifying a prime number with millions of digits has any hope of success only if one can exploit some special structure. It turns out that a Mersenne number M_p, with p prime, is prime if and only if $S_{p-2} = 0$ where S_{p-2} is defined recursively by

$S_0 = 4$, $S_{k+1} = ((S_{k-1})^2 - 2) \bmod M_p$, $k = 0,1,\ldots, p-3$.

So to determine that $2^{20,996,011} - 1$ is prime all you have to do is square a number with millions of digits 20,996,009 times and each time compute its remainder after a division by M_p (which has 6,320,430 decimal digits). This process took a few weeks on GIMPS participant Michael Shaefer's computer. The software implementing this Lehmer-Lucas testing process is based on Fast Fourier Transforms, and is very sophisticated. You can find details on the above mentioned web site.

Attention Undergraduates!

The Spring 2004 REU (Research Experience for Undergraduates) application deadline is approaching.

If you are interested in getting involved in research (and being paid for it!) make sure you submit your application by January 21. Applications are available at www.math.utah.edu/vigre/reu

Personality!

Mary Levine is the department's project coordinator for the graduate program and has been with the math department for almost six years. She has lived in Sandy for most of her life, graduating from Hillcrest High School and then attending Southern Utah State College. While she lived in Southern Utah Mary did a lot of climbing and hiking (instead of studying), and that part of the state holds some very dear memories for her.

Mary loves to sing and dance and is always looking for a good dance partner. She played the accordion for a short time in her youth and would really like to learn to play the piano. She loves to read just about anything she can get her hands on, but mysteries are her favorite. Mary enjoys crocheting around the edges of baby blankets and burp cloths that she makes for family and special friends. If you've even seen her work you know how pretty it is! Mary is also quite a gardener, and shares her extra tomatoes, squash, and whatever with department members.

Mary is the youngest of her siblings, and she has two half-brothers and two half-sisters, including Glenda Woods (in the Dean's Office). Mary has two children, both of whom live with her. Tyler, 23, works full time, and Tonia, 18, is attending massage therapy school.

Mary's biggest dream is to complete her college degree, and one day she will, although she suspects it won't be until after she's retired and can attend the free classes that the U offers to students over 65!

Mathematical Morsels

Need a job? The following puzzle used to be posed to job seekers interviewing with a major software company. See if you are eligible.

There are four people walking together at night. The people are: a girl, a young man, an old woman, and an old man. They only have one lantern. On their walk they come to a bridge that must be crossed. The bridge can only support two of them at a time. They must carry the lantern to light their way as they cross the bridge. The lantern will expire in 40 minutes. The girl can cross the bridge in 3 minutes. The young man can cross the bridge in 5 minutes. It takes the old woman 10 minutes to cross. The old man is slowest. It takes him 20 minutes. They cannot carry each other. They must all walk.

How do they do it? You have as much time to figure this out as those four can afford to spend thinking (with the light on).

Aftermath is published monthly during the academic year. Issues of the newsletter will be archived on the web at:

www.math.utah.edu/newsletter

The Aftermath is edited by Peter Alfeld and Angie Gardiner. Please contact either one of us if you have an idea or article to submit.