UNDERGRADUATE MATHEMATICS SEMINAR

The next meeting of the seminar will be this coming **Monday, October 9**, in Bailey 312 beginning at 7:00. Before the seminar, people might want to discuss their approaches and solutions (!) to the Putnam Exam Practice Problems distributed last week. As usual, fresh cider and donuts will be provided.

In this week's seminar, Professor Bill Zwicker will present the following talk:

TITLE: **Grades, ★s, and ,s**

ABSTRACT: You are a professor, and you are planning to teach a course. There will be 3 tests, each graded on a scale from 1 to 5, with 5 as the highest possible grade and no fractional grades allowed. You want each test to be equally important in deciding a student's final course grade, for which there are only two possibilities: ***Pass*** and ***Fail***. Finally, you don't want the system to be "perverse" – if you realize you made an error, and as a result you *raise* one of Sara's test grades, her final course grade should never switch from Pass to Fail as a result. Here are a few possible grading systems:

- Everyone passes, regardless of his or her test grades [(1)].
- Everyone fails, regardless of his or her grades.
- You pass if and only if your average test score is 3 or higher.
- You pass if and only if your median test score is 3 or higher.

How many other possibilities can you think of?

The table below gives the number of possible Pass-Fail grading systems when there are n tests, each graded on a scale from 1 to j. (We were using n = 3, j = 5, above.)

What interesting patterns can you find in the table?

We'll extend a standard method in finite combinatorics to confirm what may be the most surprising of these patterns. If time permits, we'll explain the connections between these grading systems and the theory of voting with abstention.

[(1)] This Professor is probably ***not*** in the Mathematics Department.

j\n	*2*	*3*	*4*	*5*	*6*	*7*
2	4	5	6	7	8	9
3	8	16	32	64	128	256
4	16	66	352	2431	21760	252586
5	32	**352**	9304	683464	161960220	
6	64	2431	683464			
7	128	21760	161960220			
8	256	252586				

Record Large Prime Discovered

On September 4, 2006, Curtis Cooper and Steven Boone discovered the largest known prime number: $2^{32,582,657}-1$. Curtis and Boone made this discovery as part of GIMPS, The Great Internet Mersenne Prime Search.

A Mersenne number, named for the French monk Marin Mersenne (1588-1648), is one of the form $M_k = 2^k - 1$ for some integer k. Mersenne numbers that are prime are called *Mersenne primes*. It is not hard to show that if k is composite then M_k is also composite. Thus, in the search for Mersenne primes, it is enough to consider only those M_k with k prime. Mersenne primes are then denoted M_p where p is prime.

It is believed that Mersenne primes were first studied due to their link to *perfect numbers*, that is, numbers that are equal to the sum of their proper divisors. Theorems of Euclid and Euler show that even perfect numbers are in one-to-one correspondence with Mersenne primes (with $M_p(M_p+1)/2$ being perfect).

In 1996, George Woltman and Scott Kurowski distributed free software via http://www.mersenne.org, the home of GIMPS, allowing networked personal computers to work together in the search for Mersenne primes. Mersenne primes found using GIMPS software are therefore also attributed to Woltman and Kurowski. Currently, there are about 250,000 computers using their program. (**You** can download it and participate in the search!)

This most recent prime discovered by Cooper, Boone, Woltman, and Kurowski is the 44th known Mersenne prime. However, it falls short of receiving the $100,000 prize being offered by the Electronic Frontier Foundation for the discovery of the first 10,000,000-digit prime. How many digits does it have?

Where Are They Now? Karen Scott '06

Karen Scott '06, a math major with a minor in economics, is now in Boston working as an actuarial student at Liberty Mutual. She got this job after attending an actuarial career fair at the University of Connecticut. During the summer between her junior and senior year, she worked in an actuarial internship program at another firm. She secured this internship through an actuarial information session at Union.

Karen is currently working in the Commercial Markets side of Liberty Mutual, which covers auto, property, and worker's compensation insurance for companies. The actuary with whom she is working was also a math major at Union!

In addition to working, having passed the first two actuarial exams while an undergraduate, Karen is now studying for her third exam.

She reports that she is enjoying the work she is doing, the material on the exam and life in Boston, although it is a huge change from life in her native Vermont and Schenectady. She sees a number of other Union graduates from time-to-time. In fact, she recently had dinner with another recent Union College math major, Stephanie Conklin.

Do you have any ideas for future newsletters?

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Resources for Students

- Putnam Deadline Approaching! The deadline to register for this year's Putnam Exam is **Tuesday, October 10**. Contact Professor Johnson to sign-up.
- Get a job! On Wednesday, October 11, from 3-6pm at College Park Hall, the Becker Career Center (BCC) will be hosting "U Connect: Bringing Students and Employers Together – Engineering Science and Technology Careers", co-sponsored by GE Energy and Plug Power, Inc. The BCC asks students to sign-up in advance on eRecruiting to receive a list of participating employers.

Here is a list of the BCC's other October activities.

Thinking of Teaching? The Groton School, a grades 8-12 coed boarding school in Massachusetts, offers a Teacher-Intern Program for recent college graduates. Groton solicits applicants from top colleges, including Union College. More information about these positions is posted on the first floor bulletin board in Bailey Hall. The application deadline is January 1, 2007.

We're on the Web!

See us at:
http://www.math.union.edu

under "Department Activities"

Problem of the Newsletter: October 6, 2006

Congratulations to **Shawn Bartok** and **Schuyler Smith**, co-winners of last week's Problem of the Newsletter contest. You can view their winning solutions on the first floor bulletin board in Bailey Hall.

Here is(are) this week's problem(s): The newly discovered 44th known Mersenne prime is $2^{32,582,657}-1$. How many digits does this number have? Explain. What are the last two digits? What is the binary representation of this number? What is the base-8 representation of this number?

Solutions to this problem will be accepted by Professor Friedman until 12:00 noon Thursday, October 12. Please put your solution in his mailbox in the Math Department's office on the second floor of Bailey Hall. Be sure to include your email address with your submission. The student who solves (correctly!) the most PONs will receive a one-year student membership into the Mathematical Association of America, courtesy of the Math Department!