

## UNDERGRADUATE MATHEMATICS SEMINAR

The next meeting of the seminar will be this coming **Monday, January 21**, with refreshments beginning at **4:00** in the Math Common Room, **Bailey 204**, and the lecture following at **4:15** in **Bailey 207**.

In this seminar, **Professor Daniel J. Velleman** of Amherst College will be presenting the following talk:

### TITLE: Taylor Series by Nonstandard Analysis

**ABSTRACT:** In 1715, Brook Taylor discovered what is known today as the Taylor series of a function. How did he do it? His method was not the one that is found in modern calculus textbooks, but rather involved algebra with "infinite" and "infinitesimal" numbers. Such reasoning was common in the early history of calculus, but was eventually rejected as not rigorous and replaced by reasoning with limits. In the 1960s, Abraham Robinson showed how reasoning with infinite and infinitesimal numbers could be made rigorous, and used such numbers to develop an approach to calculus called nonstandard analysis. In this talk I will give a brief introduction to nonstandard analysis, and then show how the methods of nonstandard analysis can be used to justify Taylor's original reasoning.

### Pieces from Theses: A View from **Valencia Starr** ('08)

My name is Valencia Starr and I am a senior mathematics major at Union College. I have just finished my thesis last term on "The Mathematics of the Mayan Empire," under the supervision of Professor Friedman.

At first I was going to do a thesis on a topic Professor Friedman had picked, but then I decided to write a thesis on Mayan mathematics since I have an interest in Latin American culture. Initially, I was going to pick a particular Hispanic mathematician to do research on and to describe the mathematics that he did. But then I had difficulty finding a particular Hispanic mathematician whom I could find enough information about, so then I started thinking, "How about doing research on the Mayas, Incans, or Aztecan?" I therefore started doing research in the New York City library over the summer on the mathematics that they used.

In my initial research, I found information on their astronomical discoveries, their calendar

system, their number system, and how to do arithmetic using their number system. I spoke with my professor about my new proposal and he said that it sounded like a good start. When I returned to Union College in the fall, I found even more information on the Mayas and Incans through the Schaffer Library. From the information that I had found, I was able to, with the help of Professor Friedman of course, develop a few conjectures on the mathematics of their complicated base-20 calendar system and prove them. I also did research on their history and social background so as to put my thesis in a proper context.

Professor Friedman and I met twice a week. At every meeting, I gave Professor Friedman a lecture on the research that I had found and the mathematics that I had learned.

Once I had finished all the research and learned the mathematics and developed the proofs, I had to focus my attention on writing my paper. I

decided that I was going to discuss everything that I had learned about the Mayas and their math, except for the astronomical discoveries of the Mayas since I felt it did not relate to everything else I had found.

The writing part of the thesis was the hardest because I had to edit over and over again what soon felt like a mini-book so as to make it understandable to the reader. I realized that the hardest part of writing a thesis is to be able to communicate, in the clearest possible way, the research and information one finds, and the mathematics and the proofs.

In addition to my written paper, I made a Mayan Calculator using the Java programming language. The calculator performed Mayan arithmetic, using the symbols the Maya used. One part of the calculator took input of numbers in decimal forms and then converted these numbers from Hindu-Arabic decimal to Mayan form. For me it was very hard work - actually the second most rigorous thing I have done in my life, if not the first. However, it is important to know that it is worth the work because you learn a lot from it, and it is something you can feel proud of.

## WOW – It's Cold Outside! Start Thinking about your Summer Plans!!

The National Science Foundation (NSF) sponsors many Research Experience for Undergraduates (REUs) in mathematics at colleges and universities throughout the country. These are summer programs that last 6-8 weeks where undergraduates are given the opportunity to perform some mathematical research – and get paid for it!

Almost every summer, some Union students participate in an REU. If you are interested, you should start planning soon as most application deadlines are in February-March.

For a current list of programs, go to <http://www.ams.org/employment/reu.html>. As the math department receives bulletins and emails announcing the REUS, we will post the information on the bulletin boards around Bailey Hall, and advertise some of them in the newsletter.

## Problem of the Newsletter: January 18, 2008

Congratulations to **Ronghua Dai**, and **Michael Gillin** for submitting correct formulas to answer last week's problem. You can view last week's question with a winning solution on the first floor bulletin board in Bailey Hall.

**Here is this week's problem:** How many odd numbers are there in the 1000<sup>th</sup> row of Pascal's Triangle?

Professor Friedman will accept solutions to this problem until 12:00 noon Thursday, January 24<sup>th</sup>. Email your solution to him ([friedmap@union.edu](mailto:friedmap@union.edu)) or put it in his mailbox in the Math Department's office on the second floor of Bailey Hall.

<b>0th</b>					1												
<b>1st</b>				1		1											
<b>2nd</b>			1		2		1										
<b>3rd</b>			1		3		3		1								
<b>4th</b>			1		4		6		4		1						
<b>5th</b>			1		5		10		10		5		1				
<b>6th</b>			1		6		15		20		15		6		1		
<b>7th</b>			1		7		21		35		35		21		7		1