

UNDERGRADUATE MATHEMATICS SEMINAR

The next meeting of the seminar will be this coming Monday **February 2**, with refreshments beginning at 4:45 in the Math Commons Room, Bailey 204, and the lecture following at 5:00 in Bailey 201.

In this week's seminar, **Professor Tønnesen-Friedman** will present the following talk:

TITLE: Nice Metrics on Kähler Manifolds, or Why I Still Love Calculus

ABSTRACT: In (higher dimensional) spaces that are only locally like \mathbb{R}^n (so-called manifolds) we cannot do Euclidean geometry. However for smooth manifolds there is always some kind of geometry present ... in fact many different ones! To remedy this ambiguity, one puts additional requirements on the geometry - usually related to curvature and inspired by physics. In the best of cases this allows us to define a canonical geometry on the manifold.

Given a manifold and given the requirements, it is, however, often a daunting task (if not impossible) to find the geometry that fits, or at least to find out if it exists and if it is unique.

This talk will cover some examples of manifolds where the additional requirements (namely Weakly Bochner Flatness or, more generally, Extremality) happen to be manageable and yield "just really annoying calculus exercises".

The talk will be accessible to anyone with a basic calculus background.

Pieces from Theses: A View from **Jessica DiMarco** ('07)

There are a number of areas that math majors get to experience through the sequence of classes that we are required to take in our four years at Union. However, the fact that we have to cover so much information in such a short period of time often prevents us from studying some of the particulars in depth. I found that to be very true about the subject of **partitions**, so when I saw that this was a thesis topic, I decided to make it one of my top choices. This past fall, I investigated partitions for my thesis.

At first glance the whole idea of partitions can seem very elementary: a partition of a number is a way of writing it as a sum of natural numbers. For example, the natural number 4 can be partitioned in the following ways: $\{4\}$, $\{3+1\}$, $\{2+2\}$, $\{2+1+1\}$, and $\{1+1+1+1\}$. The

number of ways that a natural number n can be partitioned referred to as $p(n)$. The fact that 4 can be partitioned in 5 ways, tells us that the value of the function $p(4)=5$. Though it is apparent that the number of partitions will increase as n increases, no simple formula for $p(n)$ exists! The whole idea of partitions seems so simple, or at least that is what I thought before I began my research.

Though there are a number of influential number theorists who have studied partitions, my thesis advisor (Professor Johnson) and I found the work of one mathematician to be particularly interesting. Srinivasa Ramanujan was born in India in the late 1800's and had an intense love for mathematics at an early age. He was able to observe certain patterns in

numbers through pages of calculations and conjecture important theories that are still used today. Ramanujan went unrecognized for a number of years, due to the fact that he did not know the importance of proving his findings. Eventually he was taken under the wing of a well-known mathematician, G. H. Hardy, where his genius was cultivated to reveal a number of truly brilliant ideas.

I spent a lot of time working to understand three of Ramanujan's most well known Congruence Theorems. The theorems deal with patterns in the number of ways that natural numbers of a certain form can be partitioned: (1) $p(5q+4) = 5t$, (2) $p(7q+5) = 7t$, and (3) $p(11q+6) = 11t$. The first result means that any number that can be rewritten as 5 times some natural number plus 4, such as 9, 14, 19, 24, etc., can be partitioned in a number of ways that is divisible by 5. The other two formulas have similar interpretations. The proofs to these theorems involve a lot of very creative equation manipulation that was really different from most of the proofs that I had seen in my classes and they really opened my eyes to a new class of results that can be determined.

The simple addition problems that I had been playing with at the beginning of the term led to a lot of interesting results that I would not have had the opportunity of finding had I not researched partitions. I think that the important thing to realize when you are writing a thesis is that you really have to pick a topic that you are interested in. Then the rest of the process will become much easier and you will be able to stay on top of your work.

Resources for Students

- [Scholarships available](#). Eric J. Hornick ('86), FCAS, MAAA, FCA of Mercer Oliver Wyman Actuarial Consulting, Inc. and President Elect of The Casualty Actuaries of Greater NY wrote to announce that the CAGNY Scholarship application for the 2007/2008 Academic Year is now available at www.casact.org/affiliates/cagny/ and to say "I would love to be able to award one of our scholarships for the coming year to a deserving Union student." The deadline for applications to be received is April 15, 2007. For general information about the actuarial profession, visit www.BeAnActuary.org.
- [Take off at an REU](#). Kansas State University is offering an NSF sponsored program "Brainstorming and Barnstorming" will run over the summer June 4 - July 27, 2007 and will include a problem solving component, an applied math component on the mathematics of flight, and a pure math component. Some flight instruction will be included! More information about this program and an application form are at: <http://www.math.ksu.edu/main/events/KSU-REU>
- [What's that racket?](#) On the second floor of Bailey Hall, new display cases are being installed to house the Olivier models. Go upstairs and check them out!

Problem of the Newsletter: February 2, 2007

Congratulations to **Susan Beckhardt** and **Schuyler Smith**, co-winners of last week's Problem of the Newsletter contest, with an honorable mention to alumnus **Eric J. Hornick ('86)** for submitting a correct answer! You can view a winning solution on the first floor bulletin board in Bailey Hall.

Here is this week's problem: Consider the following game: Start with any number. Player A chooses one of the proper divisors (including 1) of the number and subtracts it from the number. For the new number that remains, Player B chooses one of its proper divisors and subtracts it. The game continues until it reaches the only number that has no proper divisors: 1. The winner is the last person able to make a move. **Find** a winning strategy for the game. (Thanks to Susan Beckhardt for suggesting this problem!)

Professor Friedman will accept solutions to this problem until 12:00 noon Thursday, February 8.