Department of Mathematics February 1, 2008

UNDERGRADUATE MATHEMATICS SEMINAR

The next meeting of the seminar will be this coming **Monday, February 4th,** 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 Emelie Kenney** from Siena College in Loudonville, NY (just about 12 miles east of Union) will be presenting the talk below.

SPECIAL OPPORTUNITY: Following the seminar, some members of the math faculty will be dining with Professor Kenney at a local restaurant. There will certainly be room around the dinner table for some students to join in. If you are interested, contact Professor Zwicker in Bailey 200B, or electronically at zwickerw@union.edu. (Don't worry: the math department will pick up the tab.)

TITLE: Cyndi Lauper's Paradise: Some Open Questions in Graph Coloring Theory

ABSTRACT: Graph coloring theory is a subfield of combinatorics, or combinatorial analysis, which sounds exotic, but is simply about counting. Although graph-coloring theory can be applied to scheduling and other problems, the beauty and elegance of its ideas make it worthwhile in its own right. In this talk, which assumes no familiarity with graph coloring theory and, indeed, very little mathematical knowledge in general, we present some open questions in the field that are deceptively easy to state, but devilishly difficult to solve.

Pieces from Theses: A View from **Michael Doctor** ('08)

Although there were many thesis topics to choose from, I completed a one-term mathematics thesis on a subject I knew nothing about or even that it existed. Advised by Prof. William Zwicker, I studied possible new voting systems for the United Nations Security Council (UNSC) and voting games to describe them. We started by looking at systems of voting in which a voter can either vote "yea" or "nay" and with a chosen number of "yea" votes, a resolution passes. This system cannot properly be used as a model for the UNSC, however, because the permanent members are allowed to abstain. So, we looked at expanded systems in which there were three levels of voting which can be thought of as abstaining, voting yes, and voting no. I found it easiest and most natural to assign a number value, called a weight, to each type of vote for each voter, so we mostly concentrated on that. This led to the first accurate representation of the UNSC, which we studied. We went further though, and ended up creating a new type of voting system in which all members of the UNSC could be represented by one voting game. In this game, which we called a hybrid game, weights were equal for each voting level for equivalent voters, making it an anonymous and weighted voting game.

The original purpose of this thesis was to create a voting game, which would still be able to represent an expanded UNSC, so we also embarked on this task. From the hybrid game we created, an algebraic argument led to an equation which can be used to represent any variation of a hybrid game, not just specifically to the one based on the current UNSC. Interestingly, we found this could be translated into the equation of a plane, which, when cut through a 3-D graph of all possible voting outcomes, came out such that winning outcomes lay above the plane and losing

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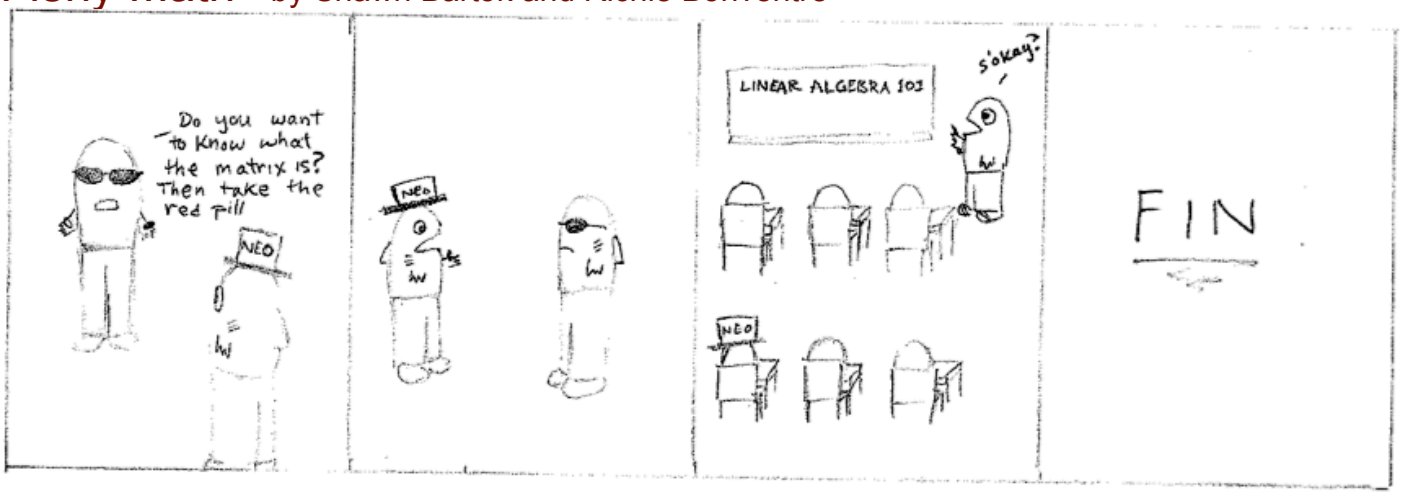
outcomes lay below the plane.

As well as the math content, I looked into the political science behind restructuring the UNSC with help from Prof. Darius Watson. Completely unknown to me, most sources stated that in general, most people agreed some kind of restructuring was needed to more accurately reflect power in the real world. Several plans for a new UNSC had been discussed by politicians; so we based our own ideas of possible restructurings off of them.

By the time fall term was over, I had a completed thesis paper demonstrating everything I had learned and created. Voting games are a section of mathematics I knew absolutely nothing about, and studying it was like learning to work with a completely new number system where the normal rules don't apply. I think the most unusual part of this thesis experience was the way I had to learn about voting games though. Instead of a colorful textbook meant to teach students, the majority of the sources I used were published articles, which I've never seen, read, or used before in mathematics; most were written for an audience expected to be extremely familiar in the field. For any future math thesis students, I'd tell you to pick a topic you'll enjoy learning about, whether it's history, biology, or political science. There's a topic you'll be able to enjoy and a way to tie mathematics into it.

Fishy Math – by Shawn Bartok and Richie Bonventre



Problem of the Newsletter: February 1, 2008

Congratulations to **Ben Miles and Schuyler Smith**, for submitting correct solutions to 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: As promised, here is a generalization of last week's problem.

(a) Let n be an even positive integer. Find all lines that are simultaneously tangent to the graph of $y = x^n + n - 1$ and to the graph of $y = -x^n - n + 1$. (Last week's problem handled the case $n = 2$.)

(b) Let n be an odd positive integer. Are there any lines that are simultaneously tangent to the graph of $y = x^n + n - 1$ and to the graph of $y = -x^n - n + 1$? Explain.

Professor Friedman will accept solutions to this problem until 12:00 noon Thursday, February 7th. Email your solution to him (friedmap@union.edu) or put it in his mailbox in the Math Department's office on the second floor of Bailey Hall.