

## UNDERGRADUATE MATHEMATICS SEMINAR

As you might already know, the undergraduate mathematics seminar will be meeting regularly and often over the next couple of weeks, though at irregularly scheduled times and intervals!

**Please be sure to check the posters around Bailey Hall for the dates and times of the upcoming seminars.**

### Fledgling Math Club Seeks New Members

Suppose, for contradiction's sake, that Union College has a chapter of the national math honor society, Pi Mu Epsilon. Thus, it follows that Union has a well-established Math Club. Given that Union has a Math Club, it is implied that the following axioms hold:

- (a)  $\forall$  students in the Math Club,  $\exists$  great ideas for fun math events.
- (b) A committee  $\subseteq$  Math Club takes charge of math seminars and works towards finding interesting lecturers.
- (c)  $\exists$  students  $\in$  Math Club such that these students coordinate participation in math conferences such as the Hudson River Undergraduate Mathematics Conference.
- (d) The Math Club  $\cup$  other Union students can participate in school-wide Math based events, such as Pi Day, final exam study breaks, and birthday parties for celebrated mathematicians.

We see that none of the previous four axioms currently hold and therefore, a math club doesn't exist at Union – a contradiction to our original assumption that  $\exists$  a chapter of Pi Mu Epsilon. ■

We are beginning an initiative to start a chapter of Pi Mu Epsilon on our campus. The only qualification that we are lacking in order to apply for membership to this society is an established Math Club. As you can see above, we have many ideas for what type of role this club would take on. In addition to those mentioned above, we have also considered organizing math tutoring for younger kids (such as local middle school and high school students), game nights where we play math games such as Set and Sudoku, opportunities to work on extra problems just for fun (possibly with the assistance of professors), and much more! We welcome any additional ideas, and as much support as possible. We are working on gaining official club status through Union, but in the meantime, we would like to get the club off the ground. Our first official meeting will be **Wednesday, February 2 during Common Lunch, in the Math Common Room, Bailey 204.**

We look forward to your enthusiasm!

Contact us with any questions:

**Jessica Singer:** [singerj@garnet.union.edu](mailto:singerj@garnet.union.edu)  
**Erin Whitney:** [whitneye@garnet.union.edu](mailto:whitneye@garnet.union.edu)  
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Have Ideas for the Newsletter?

Contact Prof. Friedman  
 Bailey 107D  
[friedmap@union.edu](mailto:friedmap@union.edu)

### Mystery Link

See if you can identify the Union math major and some sights in Schenectady in

<http://www.youtube.com/watch?v=vRIQjvIIHzQ>

## Pieces from Theses, a View from Andrea Marois '11

*In the article below, senior Math major Andrea Marois describes her senior thesis topic, the Logics of Knowledge. She wrote her thesis this past fall under the guidance of Professor Hardin.*

I wrote my thesis during fall term with Professor Hardin on the “Logics of Knowledge.” I thought the topic would be interesting after I attended his seminar about it last year, so I chose it as one of my top choices when I was deciding what thesis topics I would be interested in. Since I was doing just a one-term thesis, I did some preliminary research and reading beforehand to get familiar with the terminology and notation.

Although I had a topic chosen and was familiarizing myself with the technical aspects of logic, at first I was unsure where I would be going with it all. I wanted to apply it to something in the ‘real world’ and see what types of connections I could make. Professor Hardin started talking to me about using game theory and voting theory. In addition, a visitor named Herbert Gintis did a seminar about his work in the field. Then I did some more research about the topics, even consulting some of our other math department ‘specialists’ in the field. Professor Zwicker helped me by offering me some further information on voting theory and directed me to some further in-depth research done by people that he had met at conferences about voting theory. I used Professor Taylor’s book *Mathematics and Politics*, too. All of this supported my decision to apply logics of knowledge to voting theory and game theory, and I felt like I had more of a direction in what I would ultimately write about.

The logics of knowledge are essential to game and voting theories, particularly with strategy. Basically, the logics of knowledge refer to things such as establishing common knowledge, understanding what people know and the implications. In my introduction, I discuss a situation called the “muddy children puzzle” to show how this works. Assume there are three children playing in the mud and afterwards, the kids must see their father. Each cannot see his or her own forehead (but can see all of the other kids’ foreheads), and each wishes to have a clean forehead to avoid getting in trouble. If they go to the father and the father says, “at least one of you has mud on your forehead,” then the kids will eventually be able to figure out whether their own forehead is muddy. However, without the father’s statement, it is not possible (unless, of course, the kids talked with one another). This is because of the distinction between common knowledge and the ‘everyone knows’ phenomenon. The father’s statement clears up uncertainty among the kids, because each child has a different ‘world’ because of what they can and cannot see. This basic scenario sets the stage for the further applications with respect to strategies in games (particularly the Prisoner’s Dilemma) and in voting that I later discuss in my thesis.

Thesis is a difficult yet rewarding experience, partly because it requires a lot of independent research and self-motivation. I also had to get used to the typesetting format called “LaTeX” which is commonly used in math publications and research presentations. It is hard to get used to at first, but ultimately your thesis looks like a published book, which is a lot nicer looking than any other paper you’d write for a typical class. I feel very accomplished after writing my thesis, and I hope that future thesis writers find an interesting topic and reap the same benefits that I know I have for mine!

## Problem of the Newsletter: January 28, 2011

**Here is this week’s problem:** A trickie quickie! There is one counterfeit coin among a collection of eleven coins. The counterfeit coin can be distinguished from a true coin by its weight. Using a simple two-pan balance scale, determine, using **only two weighings**, if the counterfeit coin is heavier or lighter than a true coin.

**Professor Friedman** will accept solutions to this problem until noon Thursday, February 3<sup>rd</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.