

# TEACHING STATEMENT

Andrew Berget, October 11, 2011

As a postdoc at UC Davis, I have taught in many different contexts; I have taught large and small entry level courses, higher level undergraduate classes on linear algebra and combinatorics, a graduate course on matroids, as well as advising undergraduate students in summer research. Each situation has its unique rewards and challenges, and these continually re-inform and reinforce how I approach my role as a teacher.

Below, I briefly describe my previous experience and future goals in the above contexts. Each section can be read independently of the others. Click on the above links to jump to a particular section.

**Upper division courses:** I have taught several gateway courses to higher level mathematics, namely, abstract linear algebra, combinatorics and (as a teaching assistant) an advanced calculus class. Each course had a distinct set of goals, but the pedagogy was determined by me. An over-arching idea in my teaching is to emphasize mathematical exposition, and to use computation as a means to suggest proof.

For example, in the linear algebra class I devised a series of writing assignments. I provided solutions to the problems in class, but not in a polished form. Instead, students were instructed to formalize and type their solutions. A long term goal of mine is to develop and cull a series of writing assignments for such transitional classes. Learning to write mathematics is difficult for the novice, and becomes doubly hard when coupled with problem solving. Being able to focus several assignments on writing allows students to gain valuable feedback on their ability to communicate clearly. It also allows students to see the essential aspects of a clear solution, something that can become garbled in the problem-solving process.

In a more general upper division course, I try to emphasize computation as a means to suggest proof. This often means computing easy instances of an abstract idea by hand or with a computer, and then generalizing these steps into a formal proof. I believe computation is an integral part of even abstract and advanced undergraduate courses. Courses on abstract algebra and combinatorics are particularly well-suited for this. In the future, I am interested in teaching and developing courses that use freely available computer algebra systems such as SAGE, GAP, Macaulay2 and Polymake to do algebra, combinatorics, and geometry.

A longer term goal of mine is to develop a series of lecture notes for an advanced undergraduate course on combinatorics and linear algebra. Much of the motivation for the theory of matroids comes from linear algebra, and the basics of this theory can rapidly be presented in a down to earth way. Recent advances in the

literature make topics such as the Tutte polynomial well-motivated and accessible.

**Advising and undergraduate research:** For me, one of the great joys of being a mathematician is interacting with undergraduates. The enthusiasm of a young student can provide a welcome relief from the daily grind of my own research. Informally, I find many students come to me for advice about taking and preparing for future courses, to talk about their undergraduate research projects, or just to talk about math in general. In the future, I hope to formally function as a departmental undergraduate advisor. Personally, my undergraduate advisor played an invaluable role in helping me achieve my goals, and I plan to do the same for others.

One of my research goals is the successful solicitation of government grants. As part of my proposal, I plan to include the funding of several undergraduate students in summer research. In the Summer of 2010 I mentored four undergraduates in research at UC Davis. The students worked on problems in algebra and combinatorics, and the strategy I had for them was to write computer programs to compute instances of a problem and try to generalize their findings to formal conjectures and proofs. See my research statement for potential undergraduate research projects.

I continued to mentor one of the above students in the 2010–2011 academic year in UC LEADS, a program designed to encourage participation of under-represented groups in the sciences. The culmination of our work together was her presentation of a poster at a UC-wide undergraduate conference, and she will be attending graduate school this fall. I will continue my effort to encourage students of all backgrounds in their post-secondary study of mathematics.

**Lower division courses:** I have taught calculus and precalculus both as the lead instructor at UC Davis and previously as a graduate teaching assistant at the University of Minnesota. This includes organizing homework, exams, weekly quizzes, correspondence with 25–200 students, coordination between different sections, and managing teaching assistants. I view the teaching of such courses as being an integral part of my job for many reasons; here are three.

First, when I arrived at the university as an undergraduate I had to take these classes. It is partly because I had diligent and thoughtful instruction at this level that I decided to pursue a career in math. In these lower level there are students with mathematical potential waiting to be tapped, and I want them to discover this potential within themselves.

Second, classes like calculus are where most students end their mathematical careers. I view myself as an ambassador both for mathematics, and for mathematicians. To this end, I want these students to end their study believing that math is interesting, and something useful in their future field of expertise. I also want students to believe that mathematicians are fair, helpful, and nice people; people that can be counted on to answer real life questions when they arise in other areas.

Third, I think that lower level teaching is *important*. Certainly a calculus class is not the most important course an English major will take, but it can inform a world view where certain problems can be studied methodically and with rigor. Learning math can provide students with the ability to make better informed decisions, by giving them a glimpse of the mathematics that is regularly put to work in their lives. I view myself as a person who can help students realize this.

The importance of teaching these classes being understood, it can be difficult to strike the right tone in one's teaching. It seems tautological, but the idea that a student cannot succeed without trying is a difficult one to impress. To do so, I endeavor to help and encourage students when they get stuck. Sometimes helping means having an outgoing student articulate their difficulty at the blackboard. Sometimes it means sending a student away from office hours with a list of particularly illustrative instances of a problem. Helping always means setting reasonable and attainable goals. It also always means striving to be an excellent teacher by investing both time and resources to enable students to excel.

**Graduate level teaching:** In the 2010–2011 academic year, I organized a research focus group (RFG) at UC Davis titled *Matroids and their applications*. This was part of the UC Davis math department's VIGRE program (a vertically integrated research grant from the NSF). As part of the RFG I organized a one quarter graduate level topics course of matroids. I also regularly met with a group of 5 graduate students for a reading course on various current research topics. This culminated in a one-day mini-conference of student presentations on their readings. I also organized a quarter long group reading course on polytopes, splines and matroids. These activities had consistently high attendance throughout the year and several graduate students are now pursuing related topics in their research.

The integration of teaching and research that the VIGRE program furnished is something that I plan to continue doing with my most advanced students. The one-on-one meetings, student presentations and reading courses are things that truly bring an area to life, and allow students and myself to flourish mathematically. A post-tenure goal of mine is to be able to regularly contribute to such an environment.

One way I plan to do this is by teaching parts of the basic graduate curriculum, and being involved in graduate student admissions and administration. I would also teach and attend specialized topics courses of interest to my colleagues and my students.

**Conclusion:** I am enthusiastic to continue teaching at all levels. I look forward to joining a mathematics department that shares my commitment to teaching, and learning from my new colleagues how things work at their institution. Teamwork and good communication outside the classroom are integral, be it casual talk about what works in a course before a colloquium, or by serving on committees about undergraduate curricula. I am happy to play my role in making my new department an excellent place to learn mathematics.