Summer 2014: Minicourses

- **Characteristic Classes** by John Wiltshire-Gordon, MWF, week of 6/9/14.
  
  *Abstract:* The main topics covered in this mini-course are cohomology, vector bundles and characteristic classes. More specifically, the construction of all sorts of characteristic classes, Bott periodicity, Brown’s reprehensibility theorem, the splitting principle, the Chern character and others will be discussed.

- **Symmetric Functions and Young Tableaux** by Gabriel Frieden, T-F, week of 7/7/14.
  
  *Abstract:* Symmetric functions are polynomials in countably many variables $x_1, x_2, \ldots$ that are invariant under permutations of the subscripts. They occur naturally in many contexts, including representation theory, algebraic geometry (Chern classes, Schubert calculus), and many areas of combinatorics. In this minicourse, we will look at several important bases of the ring of symmetric functions, the most important of which is the Schur basis. Time permitting, we will apply what we’ve learned to the representation theory of the symmetric group and the general linear group. There are no prerequisites, although an acquaintance with basic finite group representation theory (irreducible characters, the group algebra, induced representations) will be helpful for the last part of the course.

- **Translating Between Commutative Algebra and Algebraic Geometry** by Jake Levinson and Rebecca Rebuhn-Glanz, M-F, week of 7/7/14.
  
  *Abstract:* Commutative algebraists and algebraic geometers talk about many of the same objects, but use different language to describe them. In this mini-course, we will provide dictionaries between the two, starting with basics and moving on to more advanced topics like local cohomology vs. sheaf cohomology. If you are planning to attend the course, please let us know whether you have more background in commutative algebra or algebraic geometry, and if there are any topics you’d particularly like to see. We will assume knowledge of 614, 631, and at least one of 632 or 615.

- **Schubert Calculus** by Jake Levinson, M-F, week of 7/14/14.
  
  *Abstract:* The goal of this course is to help both my combinatorially- and geometrically-minded friends know enough of both kinds of toolsets to know how geometry and intersection theory work on $G(k, n)$. Ideally you will be able to do computations! The main topics covered will included coordinates and line bundles (and maybe vector bundles) on $G(k, n)$, Schubert cells/varieties and the Schubert stratification, and the concrete description of the Chow ring, and some delightful and charming methods for computing intersection products! Expect puzzles, growth diagrams, symmetric polynomials
and/or checker games.
Extra topics (time permitting): stuff on modern generalizations of Schubert calculus
(possibly: flag manifolds, K-theory, or torus-equivariant cohomology) or other sides of
the story (such as representation theory).
Prerequisite: 631. Also, on Wednesday I will use without proof some theorems from
Gabe’s mini-course on symmetric polynomials.

• **Several Complex Variables** by Purvi Gupta, MWF, week of 7/28/14.
  *Abstract:* This mini-course is meant to be a brief introduction to some fundamental
notions in SCV. The intended audience is anybody who would like a taste of math
605 or is just curious as to why multivariate complex analysis merits separate study.
Some surprising phenomena occur when you move from one to several variables and my
approach will be to highlight these differences and discuss the concepts that have been
introduced to bridge the gap. Topics that will be discussed in this talk: domains of
holomorphy, holomorphic convexity, pseudoconvexity, plurisubharmonicity, the dbar-
problem and the Cousin problem(s). Things that I may discuss, time permitting: Stein
manifolds and automorphism groups.

• **Birational Geometry of Surfaces** by Ashwath Rabindranath, M-F, week of 8/11/14.
  *Abstract:* I’ll start out by discussing the geometry of algebraic surfaces and curves on
algebraic surfaces. Next, we’ll talk about birational morphisms between surfaces and
we’ll prove Castelnuovo’s theorem on contracting curves with negative self-intersection.
Finally, I’ll prove some theorems about cones in the Neron-Severi space and their con-
nections to the Mori program.