SPRING 2015
MATH 595 SECTION AG2 (CRN: 61537)
ALGEBRAIC GEOMETRY II

Time: TR 9:30-10:50am
Location: Room 1, Illini Hall
Instructor: Jason Lo
Required Text: Algebraic Geometry, R. Hartshorne, Graduate Texts in Mathematics 52, Springer NY 1977
Prerequisites: Algebraic Geometry I

This course is a continuation of Algebraic Geometry I, where the language of schemes was introduced, and begins with Chapter III of the text.

Chapter III starts with an overview of derived functors. We will then discuss three types of derived functors:

- Cohomology functors for sheaves, which are the derived functors of the global sections functor. Sheaf cohomology is the basis of many calculations in algebraic geometry, and we will see how explicit computations of sheaf cohomology can be made with the use of Čech cohomology. As an application, we will compute the cohomology of line bundles on projective spaces.

- The Ext and \( \mathcal{E}xt \) functors, which are the derived functors of \( \text{Hom} \) and \( \mathcal{H}om \). We will need this in order to understand Serre Duality, another basic tool for a working algebraic geometer.

- Higher direct images, which are the derived functors of the pushforward functor \( f_* \) associated to a morphism \( f : X \to Y \) of schemes. This leads to the concepts of flat morphisms, smooth morphisms and the theorem of semicontinuity.

The course then moves on to the general theory of curves and surfaces (selected topics from Chapters IV and V of the text), where many of the above tools are applied to help us understand the geometry of various varieties. One highlight in this part of the course will be the Riemann-Roch theorem - we will see its manifestations on curves and surfaces. If time permits, we will also introduce Chern classes and see more general forms of the Riemann-Roch theorem, such as the Hirzebruch-Riemann-Roch.