Announcing a new honors course for Fall 2006...

MTH 493H: Computational Commutative Algebra

Polynomial equations show up in many places in science and engineering. Polynomials are used to describe the surface of a car in a computer aided design system as well as to describe the motion of a robotic arm. Even the shape of the type you are now reading is described using polynomials called Bézier curves.

The term *variety* refers to the set of common solutions to a collection of polynomial equations. For instance, the set of solutions to the equation $z^2-x^2-y^2=0$ in 3-space gives a double-sided cone. Rather than consider the geometry of the solutions, we can consider a collection of polynomials as a generating set for an ideal in the polynomial ring. In the example above, we would consider $(z^2-x^2-y^2)$ in the polynomial ring $F[x,y,z]$, where F is a field. Many interesting ideas arise from the interplay between these two ways of thinking about polynomials.

In this course we will develop both the algebra and the geometry of polynomials from a particularly concrete and computational point of view. Hilbert set the stage for computational explorations of polynomial ideals at the end of the 19th century though it was not until the later half of the 20th century that fast computers and new algorithms made it feasible. We will discuss the basic algorithms for computing a nice generating set known as a *Groebner basis* and then use its implementation in a computer algebra system to explore the world of polynomial equations and their applications.

Instructor: L. Gold
Time: TBA
Prerequisites: MTH 358 and permission of the Math Dept. Honors Program Liaison Officer