Math 431 – Computational Algebraic Geometry

Course Description (Bulletin): Systems of polynomial equations and ideals in polynomial rings; solution sets of systems of equations and algebraic varieties in affine n-space; effective manipulation of ideals and varieties, algorithms for basic algebraic computations; Groebner bases; applications. Credit may not be granted for both MATH 431 and MATH 530. (3-0-3) (C)

Enrollment:

Ideals in the polynomial ring.	3
Polynomials in one variable, and Introduction to algorithms/pseudocode.	3
Monomial orderings and division algorithm in many variables. Dickson's Lemma. The Hilbert basis theorem. The ascending chain condition.	8
Groebner bases and their properties. S-pairs. Buchberger's algorithm and first application of Groebner bases.	6
Elimination and extension theorems. Geometry of elimination. Implicitization problem and algorithms for polynomial and rational implicitization. Resultants.	6
Hilbert's NullStellenSatz. Radical ideals, ideal-variety correspondence, radical membership.	3

Note: Some of the last three topics may be covered in less depth depending on time constraints. In some semesters, emphasis may be placed on one of the three final topics more so than the other two, in order to cover it in more depth.

Assessment:
Homework 15-30%
Quizzes/discussion/participation 10%
Mid-term exam 20-25%
Final Exam 20-30%
Project 15-25%

Syllabus prepared by: Sonja Petrović, 2/24/2015 (updated 07/08/2015)