

Math 607
Winter 2005

Seminar in
Commutative Algebra

Syllabus
Prof. M. Vitulli

Text: Cohen-Macaulay Rings (Revised Edition) by Winfried Bruns and Jürgen Herzog, Cambridge University Press, 1998.

Additional References:

- Atiyah, M.F. and Macdonald, I.G., Introduction to Commutative Algebra, Addison-Wesley, 1969
- Bruns, W. and Herzog, J., Cohen-Macaulay Rings, Cambridge University Press, 1993
- Eisenbud, D., Commutative Algebra with a View Toward Algebraic Geometry, Springer-Verlag 1995
- Geramita, A. and Small C., Introduction to Homological Methods in Commutative Algebra, Queen's Papers in Pure & Applied Mathematics, No. 43, Queen's University, 1976
- Kaplansky, I., Commutative Rings, Revised Edition, The University of Chicago Press, 1974
- Kunz, E., Introduction to Commutative Algebra and Algebraic Geometry, Birkhäuser, 1985
- Matsumura, H., Commutative Ring Theory (Translated by Miles Reid), Cambridge University Press, 1989.
- Matsumura, H., Commutative Algebra, Second Edition, Benjamin/Cummings 1980
Sharp, R.Y., Steps in Commutative Algebra, Cambridge University Press, 2000
- Zariski, O. and Samuel, P. Commutative Algebra I, Corrected 2nd Printing, Graduate Texts in Mathematics, Vol. 28, Springer-Verlag, 1975
- Zariski, O. and Samuel, P. Commutative Algebra II, Corrected 2nd Printing, Graduate Texts in Mathematics, Vol. 29, Springer-Verlag, 1975

Commutative Algebra Software:

Macaulay Web Site: <http://www.math.uiuc.edu/Macaulay2/>

CoCoA Web Site: <http://cocoa.dima.unige.it/>

Singular Web Site: <http://www.singular.uni-kl.de/>

Tentative Syllabus:

Matsumura, Chapter 5. Krull Dimension Theory: graded rings and modules, homogeneous ideals, the Hilbert function and the Hilbert-Samuel function (also see Appendix of Bruns-Herzog and/or Chapter 11 of Atiyah-MacDonald).

Bruns-Herzog, Chapter 1. Regular Sequences and Depth: regular sequences, grade and depth, depth and projective dimension, results from linear algebra, and the Koszul complex.

Bruns-Herzog, Chapter 2. Cohen-Macaulay Rings: Cohen-Macaulay rings and modules, regular rings and normal rings, and complete intersections.

Bruns-Herzog, Chapter 3. The Canonical Module and Gorenstein Rings: Finite modules of finite injective dimension, injective hulls and Matlis duality, the canonical module, Gorenstein ideals of grade 3, Poincaré duality, local cohomology, the local duality theorem, and the canonical module of a graded ring.

Bruns-Herzog, Chapter 4. Hilbert functions and multiplicities: Macaulay's theorem on Hilbert functions, Gotzman's regularity and persistence theorem, filtered rings, reduction of ideals, and the multiplicity symbol.

Bruns-Herzog, Chapter 6. Semigroup Rings and Invariant Theory: affine semigroup rings, normal semigroup rings