

## Algebra 1 – MATH 5111

FALL 2009

**Instructor:** Professor Egon Schulte  
Office – 469 Lake, ext. 5511, schulte@neu.edu

**Time:** Mondays and Wednesdays 5:30–7:00 pm

**Room:** 509 Lake Hall

**Office Hours:** By appointment.

**Grading:** Based on homework sets.

**Text:** We follow Notes distributed in class.

**Complementary Reading:**

S. Lang, *Linear Algebra*, Springer-Verlag.

S. Lang, *Algebra*, Addison-Wesley.

This is a standard algebra course covering linear algebra. We begin with a review of basic topics: vector spaces, linear maps, Gauss-Jordan elimination, rank of a linear map, basis, dimension. Next we cover determinants and Cramer's rule, and use determinants as the motivation to introduce groups and study their basic properties. In particular, we focus on permutation groups and the sign and length of a permutation. Then we move to multilinear algebra: tensor products, symmetric and alternating products of vector spaces and their universality properties. We also investigate the Jordan canonical form of an endomorphism of a vector space. Throughout we stress invariant formulations of the results, i.e. statements that do not depend on the choice of a basis of the vector space. The remaining time is spent on quadratic and alternating forms. We cover the classification of quadratic forms over the complex and real numbers, Sylvester Theorem, signature, Hermitian forms, Witt theorems, spectral theorems.