MATH-UA 343.001 Thomas Leble Fall 2018
Mondays & Wednesdays, 2PM-3:15PM

Course description:Â An introduction to abstract algebra. We will study the fundamental algebraic structures: groups, rings, fields.Â

Prerequisites:Â At least one "proof-based" class. The equivalent of discrete mathematics would be helpful. We will give examples and applications, but this is certainly an abstract course.Â

Textbook(s):Â We will use theÂ open source textbook "Abstract algebra: Theory and applications." by Thomas W. Judson.Â You can read it online and download it as a PDF, for free, fromÂ the book webpage.Â

Grading:Â Homework (25%), Midterm 1 (20%), Midterm 2 (20%), Final exam (35%).Â

Class outline:
- Groups: definitions, subgroups, cyclic groups, permutation groups, Lagrange's theorem, group (iso)morphisms, group actions.
- Rings: definitions, ideals, integral domains, principal rings, factorial rings, polynomial rings, Noetherian rings.
- Fields: definitions, fields of fractions, finite fields.
- Application: elements of algebraic coding theory.
- Depending on time/interest: modules versus vector spaces. Extension fields, splitting fields, algebraic closure. Free product versus direct product.

Weekly breakdown

Sept 5: Welcome, class logistics. Discussion about structures.
Sept 10: Groups I (definitions, examples, first properties). Sections 3.1/3.2.
Sept 12: Groups II (more properties). Subgroups. Sections 3.2/3.3.
Sept 17: Cyclic groups. Section 4.1
Solutions HW2
Sept 19: Cyclic groups (end).
Sept 24: Permutations. Section 5.1
Sept 26: Permutations.
Oct 1: End of permutations. Morphisms, isomorphisms. Sections 9 and 11.1
Oct 3: Some constructions (direct product, quotient group) Sections 9.2 and 10.1
Oct 9 [Legislative day - Monday on Tuesday]: Group actions. Cayley's theorem.
Oct 10: Wrap-up about groups. Lagrange Theorem.
Oct 15: Midterm 1.
Oct 17: Rings : definitions, examples.
Oct 22: Integral domains. Ideals.
Oct 24: Principal rings. Noetherian rings.
Oct 29: The ring of integers.
Oct 31: Polynomial rings I.
Nov 5: Polynomial rings II. Factorial rings.
Nov 7: Ring of matrices.
Nov 12: Wrap-up about rings.
Nov 14: Midterm 2.
Nov 19: Fields: definitions, examples.
Nov 21: Thanksgiving.

Nov 26: Fields of fractions.
Nov 28: Splitting fields.
Dec 3: Finite fields.
Dec 5: Wrap-up about fields.
Dec 10: Algebraic coding theory I.
Dec 12: Algebraic coding theory II.
Dec 17--19: Final exam week.