

Math 443
Advanced Algebraic Structures
Fall 2014

Professor: Pete Goetz

CRN: 45389

Office: BSS 358

Office Hours:

Monday: 4-5 PM, BSS 308; Tuesday: 4-5 PM, BSS 308;

Wednesday: 2-3 PM, BSS 358; Thursday: 10-11 AM, BSS 358;

Friday: 3-4 PM, BSS 358

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Time and Place: We meet MWF from 8:00-8:50 AM in SH 002.

Texts:

- 1) A Book of Abstract Algebra, Second Edition, by Charles C. Pinter, Dover.
- 2) Representation Theory of Finite Groups: An Introductory Approach, by Benjamin Steinberg, Springer.

Pre-requisite: Math 343 or consent of the instructor.

Course Overview:

In the first half of the course, we will cover Chapters 27-33 in Pinter. We will study polynomials and field extensions in the context of Galois Theory. This part of the course will culminate in the fundamental theorem of Galois Theory which provides a complete answer to the question of when a polynomial equation can be solved using radicals. Along the way we will see how to settle three famous straightedge and compass problems from antiquity: doubling a cube, trisecting an angle and squaring a circle.

The second half of the course will be an introduction to the representation theory of finite groups. We will cover Chapters 1-5 in Steinberg. Representation theory is a powerful way to study groups by using linear algebra techniques. The course will conclude with an application to Fourier Analysis, part of the mathematics underlying data compression.

Course Goals and Student Learning Outcomes: The following outcomes are what I will keep in mind as I teach the course, design assignments, and assess your work. Your final grade will depend on how well you achieve each of these outcomes.

- 1) Describe the basic theorems and examples of field extensions.
- 2) Prove the impossibility of certain straightedge and compass constructions.
- 3) Use the Fundamental Theorem of Galois Theory to: compute the Galois group of a field extension; compute the fixed field of a group of field automorphisms.
- 4) Determine the solvability in radicals of a polynomial equation over the rationals.
- 5) Describe the basic theorems in the character theory and representation theory of finite groups.

Program Level and HSU Learning Outcomes:

Program Level:

- 1) The ability to read, write and create mathematical proofs.
- 2) Fluency in mathematical language through communication of mathematical work following normal conventions for logic and syntax.

HSU Learning Outcomes:

- 1) Effective communication through written and oral modes.
- 2) Critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues.
- 3) Competence in a major field of study.

Homework: Homework sets require both problem solving and presentation skills. It is of no use to solve a problem if you can't clearly communicate your solution to someone else. A solution to a problem or the proof of a theorem should consist of a clear, concise, logical, written argument. I will be grading your homework sets on both presentation and mathematical correctness. Some of the homework problems could be difficult. I highly suggest starting the weekly assignment as soon as possible. Be sure to come see me in office hours if you need extra guidance. **Homework is due by 5 PM** on Monday (and the Tuesday after Labor Day). I will only accept late homework in case of an emergency. Your two lowest homework scores will be dropped, and **not turning in five or more homework assignments is an automatic no pass.**

Exams: We will have two exams, a midterm and the final. Dates for these exams are given below. Mark your calendars and plan accordingly as **no makeup exams** will be given.

Midterm Exam: Monday, October 20, 2014

Final Exam: Wednesday, December 17, 2014, 8:00-9:50 AM

Grading Components: Your course grade will be based on the following components:

Homework Sets	40%
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Midterm Exam	30%
Final Exam	30%

Academic Integrity: Please see http://studentaffairs.humboldt.edu/judicial/academic_honesty.php for HSU's policy on academic honesty.

Emergency Evacuation Procedures: The evacuation plan for the classroom is posted on the orange signs. Also review http://studentaffairs.humboldt.edu/emergencyops/campus_emergency_preparedness.php for information on campus Emergency Procedures. During an emergency, information can be found on campus conditions at: 826-INFO or www.humboldt.edu/emergency.