Math 343
Introduction to Algebraic Structures
Spring 2014

Professor: Pete Goetz

Office: Behavioral and Social Sciences 358

Office Hours: MW, 4-5 PM, BSS 308; TR, 10-1050, BSS 358;
F, 9:30-10:30 AM, BSS 358; and by appointment

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Course Website: http://users.humboldt.edu/pgoetz/math343sp13.html

Time and Place: We meet MTRF from 2:00-2:50 PM in BSS 408.

Text: A Book of Abstract Algebra, Second Edition, by Charles C. Pinter, Dover.

Pre-requisite: Math 240 and Math 241 or consent of the instructor.

Course Overview: The subject of "abstract algebra" includes a variety of different but interconnected areas of modern mathematics. In this course we begin an introductory study of *group theory* and *ring theory*; these are concerned with the structure of *groups* and *rings*. You already know some examples. The set of integers equipped with the operation of addition is an example of a group. An example of a ring is the set of integers with the operations of addition and multiplication.

There is interplay in this course between the concrete and the abstract. Groups and rings did not appear out of the vacuum; rather they were discovered in the course of solving some very concrete problems. Hence the concrete, realized in specific examples, is necessary for the discovery of the abstract. On the other hand, studying structures in their most general form, i.e. defined axiomatically, enables us to prove theorems applying to *all* specific examples of such structures. So both theory *and* examples are important and complement each other.

Course Goals: The following four fundamental goals 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 goals.

(1) Obtain a basic understanding of the theory and techniques of abstract algebra.
(2) Gain ability in abstract reasoning, problem solving, and formulating conjectures.
(3) Obtain a stock of examples of specific groups and rings.
(4) Be able to clearly communicate and express mathematical ideas.

Class Period Format: Mondays, Tuesdays, and Thursdays will be straight lecture days. Fridays we will spend the hour discussing the homework that is due the following Monday and the reading from the book; I may ask students to present their questions or work at the board. **It is very important that you read the textbook carefully and come to class prepared**. I won't have time to write all the definitions on the board or prove all the theorems. Instead I will talk about the definitions, give examples, sketch proofs of theorems, or give motivation. I'm hoping that this will create a more dynamic and fun classroom experience and that you will learn more abstract algebra in the process. One more time for emphasis: to get the most out of the course, **you must read the book regularly and repeatedly**.

Homework: Homework will be posted on the course website so check there frequently for updated homework assignments. It will be collected in class on Mondays. 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 be a clear, concise, logical, written argument using complete English sentences with correct grammar. I will be grading your homework sets on both presentation and mathematical correctness. Some of the homework problems could be difficult. **Be sure to come see me in office hours if you need extra guidance**. I will not accept late homework. If you have to miss class, you need to make an arrangement to turn in your assignment early. I will drop your four lowest homework scores.

Exams: We will have two in-class exams during the semester in addition to a cumulative final exam. The dates for these exams are given below. Mark your calendars and plan accordingly as **no makeup exams** will be given. Each exam will consist of four parts: definitions, theorem statements, true or false, and statements to prove. I will hand out a practice exam the week before the actual exam. The practice exam will be very similar to the actual exam. Make sure you can complete it in 50 minutes without notes. You are welcome to discuss the practice exam with your fellow classmates or me.

Exam 1	Friday, March 7, 2014
Exam 2	Friday, April 18, 2014
Final Exam	Monday, May 12, 2014, 12:40-2:30 PM

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

Homework	25%
Exam 1	25%
Exam 2	25%
Final Exam	25%

Academic Integrity: Please see http://www.humboldt.edu/studentrights/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. Review http://www.humboldt.edu/emergencymgmtprogram/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.

Tentative Timeline for Math 343
Spring Semester 2014

Week	Topics	Chapters	Reading
1	Overview; Binary operations	1, 2	pp. 1-24
2	Definition of a group	3	pp. 25-35
3	Elementary properties of groups; Definition of a subgroup	4, 5	pp. 36-46
4	Generators and relations; Important subgroups; Cayley diagrams; Codes	5	pp. 46-55
5	Functions; Symmetric groups	6, 7	pp. 56-72
6	Dihedral groups; Finite symmetric groups	7, 8	pp. 72-84
7	Alternating groups; Isomorphism; Cayley's Theorem; **Exam 1**	8, 9	pp. 84-102
8	Order of an element; Cyclic groups	10, 11	pp. 103-118
9	**Spring Break**	12	pp. 119-125
10	Lagrange's Theorem; Homomorphisms	13, 14	pp. 126-138
11	Homomorphisms; Quotient groups	14, 15	pp. 139-156
12	The fundamental homomorphism theorem; Rings	16, 17	pp. 157-172
13	Rings; Ideals and homomorphisms; **Exam 2**	17, 18	pp. 173-189
14	Quotient rings; Integral domains	19, 20	pp. 190-207
15	Rings of polynomials; Factoring polynomials	24, 25	pp. 240-257
16	Substitution in polynomials	26	pp. 258-269
5/12	**Final Exam: 12:40-2:30 PM**		