MATH 405: Abstract Algebra

TR 9:45 – 11:15
Reichardt 203
http://www.dms.uaf.edu/∼eallman/classes/405/405-2014.html

Instructor: Elizabeth S. Allman

Contact Details: Chapman 308B, e.allman@alaska.edu, and 474-2479.

Office Hours: (tentative) M 3:00, W 9:00, Th 8:30 and by appointment.

Prerequisites: Math 215 with a grade of C or better.

Textbook: *Contemporary Abstract Algebra*, 8th ed., by J. Gallian, Brooks Cole

Midterm: Tuesday, March 11

Final Exam: Thursday, May 8, 10:15 – 12:15 am

Teaching Assistant: TBA

Course Overview and Goals:

A first course in Abstract Algebra introduces the student to fundamental structures in mathematics: *groups*, *rings*, and *fields*. The first algebraic object we encounter is a *group*, that is, a non-empty set together with a single binary operation $\cdot$ so that any two group elements can be 'multiplied' to create a new group element (closure under multiplication); multiplication is associative; there exists a distinguished element 1 (the identity element) so that $\forall g \in G$, $g \cdot 1 = g$ and $1 \cdot g = g$; and each element has an inverse ($\forall g \in G$, $\exists g^{-1}$ so that $g^{-1} \cdot g = 1$). As examples, you might keep in mind the integers together with addition, $(\mathbb{Z}, +)$, or $(\mathbb{R}^+, \cdot)$, or even invertible 2×2 matrices with real entries.

This definition will seem quite abstract (hence the name...), and the goal of abstract algebra has been to formalize and axiomatize such structure properties. The term group was first used by Galois around 1830, the modern conception of the proper axioms was introduced by Weber and von Dyck in the late 1880s, and these ideas gained wide-spread acceptance only in the twentieth century. Amazingly, so many mathematical (and physical) objects can be described with such simple axioms and such deep structural theorems can be proved.

After an introduction to groups, we study *rings* and *fields*. Naturally, because these ideas are so new, we want to build a large repertoire of examples, and understand deeply the main theorems in abstract algebra.

In general, because of the abstract nature of this course, students struggle with definitions and proof-writing in the beginning. Still, perseverance is well worth the effort and one goal of this course is for you to develop an appreciation for both the simple elegance of algebra and the remarkable power of algebraic reasoning.

Course Mechanics:

Class meetings will be run as interactive lectures, to the extent possible given the enrollment. That means that while I will be presenting material at the board, and you will be taking notes, I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating — that makes the class more interesting for us all.

Class attendance is expected, although I will not formally take roll. If you miss a class, you should get notes from another student. Homework assignments will be posted on the course web page, and you should make it a habit to check for new problems after each class.

Homework will usually be assigned daily, and picked up from my mailbox Thursday afternoon. At the beginning of class, there may be a little time for simple questions on homework, but you should expect to get your homework questions answered during office hours. There is an emphasis on proof-writing in algebra, and substantial time and effort must be expended to develop clear and lucid proof-writing techniques.

I encourage you to work with others on the homework, and to share ideas for solutions, but you must *write up solutions independently*. You will learn nothing from simply copying a solution. Even though you

may find you can't do every problem, you must make a reasonable attempt on them all. The entire homework assignment will be checked to be sure you have attempted everything. Selected problems will be graded more completely.

Homework will be accepted until 5 pm on its due date, either at my office or in my mailbox in the math department office. I will not accept *any* late homework that has not been cleared ahead of time or is not due to a genuine emergency (e.g., a death in the family).

Missed examinations that are not approved in advance will result in an 'F' on that exam. No make-up exams will be given except in extreme circumstances (e.g., family death, documented illness, etc.). Notifying me by email or a note that you will miss an exam is not sufficient for advance approval; you must speak with me to be excused.

Auditing of this course will only be allowed for those who agree to attend regularly, as evidenced by completion of midterm exams and most quizzes.

Examinations:

The midterm exam will be 1.5 hours in length, requiring both an understanding of definitions and statements of theorems, and proving some relatively straight-forward statements. The final examination will consist of two parts: an in-class part that will focus on definitions, examples, and 'routine' proofs, and a take-home part that will consist of more challenging proofs which you will be able to work on for at least several days. For the take-home parts you will be able to refer to your textbook, class notes, and homework, but nothing else. If for any reason I believe that a take-home final examination is not a good option for this class, then only an in-class examination will be given.

Any form of cheating on these exams will be dealt with harshly. At a minimum, the full examination (take-home and in-class) will receive a score of zero. Depending on my concern with the extent of cheating, any incident may result in a course grade of F, and I may also request a University Disciplinary and Honor Code Committee hearing which could result in suspension or expulsion. Please note that evidence of collaboration on work in mathematics is usually obvious, so even if your personal honor is worth nothing to you, cheating is a foolish risk to take.

For missed examinations that are not approved in advance, no make-up exams will be given except in case of emergencies.

Grades:

As mentioned above, there will be a midterm exam and a cumulative final exam, and weekly homework assignments in MATH 405. Grades will be assigned using the following weights:

Homework	30 %
Midterm	30 %
Final Exam	40 %

Grade Bands: A, A- (90 - 100%); B+, B, B- (80 - 89%); C+, C, C- (70 - 79%); D+, D, D- (60 - F%); 69 (0 - 59%). On rare occasion, I may lower the thresholds. Also, in an effort to reward the student who makes significant improvement over the course of the term, a stellar grade on the final may overcome a deficiency on the midterm and improve a student's final grade.

Other Policies:

Course accommodations: If you need course adaptations or accommodations because of a disability, please inform your instructor during the first week of the semester, after consulting with the Office of Disability Services, 203 Whitaker (474-7403).

University and Department Policies: Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams, some of which are listed below. A complete listing can be found at

`http://www.dms.uaf.edu/dms/Policies.html`.

Prerequisites: The prerequisite for MATH 405 is MATH 215 with a grade of C or better. Students not meeting this prerequisite are not eligible to take this course and will be dropped.

Late Withdrawal: This semester the last day for withdrawing with a 'W' appearing on your transcript is March 14. If, in my opinion, a student is not participating adequately in the class, I may elect to drop this student.

Graded Coursework: Please keep all graded work for MATH 405 until final grades have been assigned.

Academic Honesty: Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Courtesies: As a courtesy to your instructor and fellow students, please arrive to class on time, turn your cell phones and iPods off during class, and pay attention in class.