

Abstract Algebra I

Fall Semester 2007

Course MATHS 411/511 Section 2

TR 5:00–6:15 pm

RB 117

Instructor Dr. Hanspeter Fischer

Contact Office: RB 426

Phone: 285-8680

E-mail: fischer@math.bsu.edu (please use MATHS 411 as subject line)

<http://www.cs.bsu.edu/~fischer/math411>

Office Hours Mon 3:00 – 3:50 pm, Tue 4:00 – 4:50 pm, Wed 11:00 – 11:50 pm,
Thu 4:00 – 4:50 pm, Fri 3:00 – 3:50 pm, and by appointment.

Prerequisites MATHS 311

Text *A First Course in Abstract Algebra*, by John B. Fraleigh (7th Edition).

Contents This course covers Parts I, II, III and VII of the textbook as well as some selected additional topics. It is the first in a two-course sequence entitled *Abstract Algebra*. Abstract Algebra I deals with group theory alone, while Abstract Algebra II is devoted to the theory of rings and field extensions, culminating in *Galois Theory*, which is the classical context in which all of these concepts were developed.

The Subject Historically, Abstract Algebra was designed to answer questions regarding geometric constructions, which were already raised by the ancient Greeks: is it possible, with straightedge (i.e. unmarked ruler) and compass alone, to (a) construct the side of a cube twice the volume of a cube whose side is given; (b) trisect an arbitrary angle; or (c) construct a square with the area of a given circle? All of these questions were answered in the negative with concrete proof, using Abstract Algebra, in the early 19th century. It was also determined exactly which regular n -gons can be constructed, and which cannot. Around the same time, the long search for general formulas that would solve polynomial equations of degree 5 and higher using radicals, came to a definite halt when it was proved that they could not exist. In fact, Galois Theory provides a beautiful explanation for why equations like $x^5 - 6x + 3 = 0$ or $2x^5 - 10x + 5 = 0$ cannot be solved with such formulas.

Over the past 150 years, many advanced aspects of Abstract Algebra have found profoundly deep applications in all fields of modern Mathematics, Computer Science, and Physics. In particular, group theory has become an important tool for studying properties of objects, real or abstract, by means of analyzing the algebraic structure of groups which act upon them. This important idea will be a re-occurring theme throughout this course.

Therefore, Abstract Algebra I is much more than “the course before Abstract Algebra II.” Group theory itself is an essential part of every modern mathematician’s training.

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Website The above website features hints to selected homework problems and additional reading. Please visit this site regularly for course announcements and up-to-date deadlines.

Homework Homework assignments will be posted online as we work through the material. Some problems will be assigned for practice only, while other designated problems will be collected and graded. As a rule, homework will be due the Thursday of the following week; the exception being the week before an exam, during which other due dates might be announced. Late homework will not be accepted. The assignments (with due dates) will be available online at above website. When submitting exercises make sure to have your name and course number on it to earn credit.

One of the goals of this course is to gain further experience in proof-writing. Your homework assignments are therefore an important part of your engagement with the material. *Never submit the first draft of your homework.* Instead, neatly rewrite your ideas into logically complete proofs, which could be easily read and understood by a classmate.

Please staple your solutions.

Examinations There will be three midterm examinations. The comprehensive final exam will be on Wednesday, December 12, 4:30–6:30 pm.

The exams will include some take-home questions.

All exams must be taken at their scheduled time (see attached time table); the only exception being a verifiable illness or family emergency, of which you must inform your instructor *before* the test.

Evaluation All three midterm exams combined make up 50% of your grade and the final exam represents 25%. Homework accounts for the remaining 25%.

The approximate grading scale (in percent) is:

A: 90 – 100, B: 80 – 90, C: 70 – 80, D: 60 – 70, F: below 60.

Time Table A tentative schedule is attached. See above website for updates.

Deadlines The last day to change a course is Friday, August 24. The withdrawal period is Saturday, August 25, through Tuesday, October 23, 4:00 pm. During this period students can elect to receive a “W” for the course by completing and submitting the proper form to the Registrar’s Office.

- General Remarks**
- (1) Students are expected to come prepared to all meetings, having read upcoming sections of the textbook. Be always up to date!
 - (2) It takes time to digest and master new abstract concepts. Expect to study for a minimum of two to three hours outside of class for each hour in class. Missing class is a major setback.
 - (3) Everybody is strongly encouraged to form study groups with classmates. However, credit should be claimed only for one’s own work.
 - (4) If you need course adaptations or accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible.
 - (5) Please turn cell phones off during class.