Abstract Algebra II
Spring Semester 2008

Course MATHS 412/512 Section 1 TR 5:00–6:15 pm RB 418

Instructor Dr. Hanspeter Fischer

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Office Hours Mon 2:00 – 2:50 pm, Tue 4:00 – 4:50 pm, Thu 4:00 – 4:50 pm,
Fri 2:00 - 2:50 pm, and by appointment.

Prerequisites MATHS 411/511


Contents This course explores ring and field theory, as covered by Parts IV, V,
VI, IX and X of the textbook, and some selected additional topics.
Once the basic notions of ring theory are in place (§18–24, 26, 27),
we turn to fields (§29–33) and go straight for the main topic: Galois
Theory and its applications (§48–56). At the end, we will return to the
study of more subtle variations in ring structures (§45–47).

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.

The 2nd Semester In this course, students will learn how Galois Theory transforms their knowledge of group theory into answers to the classical questions above. Equally important, students will acquire a more advanced understanding of additional algebraic structures which belong in the standard tool bag of every modern mathematician.
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. Late homework will not be accepted. The assignments (with due dates) will be available online at above website.

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 easily be read and understood by a classmate.

Please staple your solutions.

Reading A few proofs will be omitted in class and explicitly assigned as reading (either from the textbook or from provided supplementary materials).

Examinations There will be three midterm exams and a final exam. Each of these four examinations will consist of a take-home assignment, followed by a brief oral exam.

Evaluation Each of the four exams counts equally and, combined, all four exams make up 75% of your grade. 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. The anticipated exam due dates are marked.

Deadlines The last day to change a course is Friday, January 11. The withdrawal period is Saturday, January 12, through Monday, March 17, 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 engage in study sessions with classmates. However, claim credit only for your 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. Thank you.