Advanced Topics in Abstract Algebra
Loyola University Chicago – Math 314.001 – Spring 2016
Course Syllabus & Ground Rules

Course Details
CLASS MEETINGS: Mundelein Hall, Room 304; TuTh 10:00–11:15 p.m.
ALGEBRA LAB: Rm TBA, Mo. 12:35–1:25 p.m. & Th. 11:30 a.m.–12:20 p.m.
OFFICE HOURS: BVM Hall, Rm 507, Mo. 1:45–3:45 p.m.; Changes will be posted on my webpage.

FINAL EXAM:
• when: Tuesday, May 3, 1:00–3:00 p.m.
• format: cumulative, closed-book, closed-notes, no calculators allowed.
• rescheduling requests: granted for extenuating circumstances, must be made through Dean’s office.

(supplemental, not required)
• J. Scherk, *Algebra: a Computational Introduction*, 2nd ed. (2009), CC license (/licenses/by-sa/4.0/).

Instructor Coordinates
Aaron Lauve
BVM Hall (IES tower), Room 507 Lauve@math.luc.edu
773.508.3727 www.math.luc.edu/~lauve

Contact
Communication via Piazza is strongly encouraged. Emails to me should include 314 in the subject line. I will make every effort to reply within 48 hours.

Course Web Page(s)
There are several. Section-specific material and announcements will be posted to one of:
• piazza.com (a discussion forum; will be used extensively)
• cloud.sagemath.com (a site for computation and composition)
• sakai.luc.edu/portal/site/MATH_314.001_5636_1162 (mainly for grades and accessing Piazza)

Course Summary

PREREQUISITE. Math 313 (abstract algebra).

Why algebra? From Wikipedia: Algebra is the branch of mathematics concerning the study of structure, relation, and quantity. As “structure” is everywhere, it is safe to say that every mathematician must be familiar with the basics of algebra (in this course, we focus on rings and fields). Branches as disparate as functional analysis, algebraic geometry, algebraic topology, coding theory, combinatorics, and mathematical physics all use algebraic methods to formulate and prove results.

Applications? This course will feature two crowning jewels from the subject’s early history: impossibility theorems that dash (most) dreams of factoring the quintic polynomial or squaring the circle.
Modern applications of algebra include error-correcting codes, Pólya counting, chocolate, and using Lie groups in differential equations, cognitive science and quantum mechanics. If you want to see more, it will have to wait for a special topics course. (Ask for it!!)
Important Dates

In-term exam dates are tentative. Scheduled dates will be announced at least a week in advance.

<table>
<thead>
<tr>
<th>Exam #1</th>
<th>Feb. 16</th>
<th>Exam #2</th>
<th>Mar. 22</th>
<th>Final Exam</th>
<th>May 3</th>
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<tbody>
<tr>
<td>Spring Break</td>
<td>Mar. 8, 10</td>
<td>Drop-Date (&quot;W&quot;)</td>
<td>Mar. 28</td>
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Course Components

- **Written Homework.** (25%) Students will submit homework exercises for each chapter covered in Pinter’s text. These will be due at the start of class, two class periods after a chapter is finished. The lowest score will be dropped when computing final grades. Assignments will be graded on two criteria:

  - *Accuracy (75%).* I hope this is self evident.
  - *Neatness & Clarity (25%).* *(N):* Write as legibly as you can; write on only one side of each page; staple your work together; submit tidy paper (i.e., no spiral-bound jaggedness). *(C):* Use complete sentences (often) and proper mathematical grammar (always). It takes time to master how much to say. Use these solutions as a guide: 2.A.3 & 2.B.7, pp. 22, 23, & 355.

Students may work in groups on their written homework, but each must submit his or her own copy. Rules for group work: (i) names of other group members must be listed below your name; (ii) with little forewarning, I may ask students to defend their answers during my office hours.

- **Online Homework.** (30%) I am setting the ambitious goal of giving us a whole lot of example problems to study during exam time... roughly 20 problems per chapter. Here’s how it will work.

  - *(co)Author (80%).* Each student is responsible for providing solutions to two homework problems per chapter, assigned on a first-come, first-served basis. Each problem may be claimed at most twice. In addition to providing the first solution, authors are also responsible for correcting the solution, if necessary, based on feedback. Authors will receive a grade between 0 and 4 on each problem. (With 0, 1, or 2 points administered at first deadline, and an additional 1 or 2 points released after edits are made.)

  - *(co)Editor (20%).* Each student is also responsible for providing feedback on two homework problems per chapter, assigned on a first-come, first-served basis. Each problem may be claimed at most twice. Edits may address accuracy, clarity, proof structure, whatever you wish. And, of course, respect and civility are stressed above all else! Editors will receive a grade between 0 and 1 on each problem.

All work above shall be done in Piazza. For logistics, see “Piazza Homework” below. Here is the expected timeline: (i) author work is due at the start of each class that written assignments are due; (ii) editor work is due the following class; (iii) finalized solutions are due one class after that.

- **Exams.** (45%) There will be two in-term exams and a cumulative final exam. Among these, the highest score will count as 20% toward your final grade, the lowest as 10%, and the other as 15%.

Course Grade

While some adjustments may be necessary, it is expected that final grades will be assigned as follows:

\[
\begin{align*}
\text{A} & : 92 & \text{A-} & : 90 & \text{B+} & : 88 & \text{B} & : 82 & \text{B-} & : 80 & \text{C+} & : 78 & \text{C} & : 72 & \text{C-} & : 70 & \text{D+} & : 68 & \text{D} & : 60
\end{align*}
\]
Getting Help
This is an intense course. Be ready to work hard and learn a lot (and have fun). Some advice for success: (i) learn the definitions and statements of theorems; (ii) develop and carry with you a host of examples and counterexamples to the concepts we’re grappling with; (iii) next come theorems, which help us organize and make sense of the zoo of examples; (iv) finally come the proofs... which can be skipped on first reading, but should eventually be analyzed carefully looking for general structure of the argument as well as specific ideas/tricks that could be useful to have in your own toolbag.
Please, SEEK HELP if you are falling behind. Form study groups, come to Algebra Lab, arrange regular appointments with me; try exercises from MIT, etc.

Escape Routes
At any time, even after the last date for W-dropping the course, students who are experiencing medical or personal difficulties should not hesitate to consult their advisors or the Student Development Office or their dean. Don’t allow yourself to be overwhelmed by such problems; Loyola has resource persons who may be able to help you (www.luc.edu/wellness  www.luc.edu/bct)

Technology
Computer Algebra. I am likely to use Mathematica or Sage during class. I will be happy to help you learn more about either tool. Get the former for **free** through Loyola TechConnect. Use the latter in the cloud.

Piazza. This is a forum to post notes and questions (and answers) for me and your cohort. These contributions can be anonymous to all, to your classmates, or to nobody. Each note, question, and answer originally posted by a student can be edited by students. There is also a slide-bar at top of each post, so you can see the history of a question. Please use it liberally. If there is anything you find to share, share it here. If there is any question for me that others may also have, ask it here. And more!...

Piazza Homework.
• Each problem should be posted as a question by an author. E.g., there should be a Piazza “Question” titled 17.J.2, with the text of the problem transcribed there for everybody to follow.
• You need not acknowledge authorship anywhere within Piazza. *(When turning in your written homework, you will inform me which problems you (co)authored.)*
• Solutions should be posted as “Student Answers.” Again, you need not acknowledge authorship.
• Editorial feedback should be given via edits to the original Question. To help us remain mindful of civility, etc., you are strongly discouraged from posting feedback anonymously.
• More than likely, after feedback is taken into account, the solution will be near-perfect and will earn a “Good Answer” checkmark from me. But regardless...
• The grad students and I will post perfect solutions in SageCloud before the upcoming exam.

Academic Integrity
The Academic Standards and Regulations web page

www.luc.edu/academics/catalog/undergrad/reg.shtml

outlines the definition and ramifications of cheating at Loyola University (the “Academic Integrity” link) as well as the recourses available to you should you be accused of cheating (the “Academic Grievance Procedure” link). By attending this course, you agree to uphold the high standards of Loyola. If you are found cheating on an exam, you will receive a zero (0) for the exam and the incident will be reported to your academic dean and recorded in your permanent file.
Disability Services
The Americans with Disabilities Act (ADA) is a federal statute that provides comprehensive civil rights protection for persons with disabilities. It requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please contact the SSWD office: in the Sullivan Center, suite 117, phone 773.508.3700, fax 773.508.3810, or online at www.luc.edu/sswd/.

Course Etiquette
• We all need mental breaks from time to time. Texting or surfing the web are permissible during lecture, so long as it’s brief and infrequent. However it is unacceptable to engage in these activities, or even do homework, during groupwork. Your time does not belong to you, it belongs to your group partners. Please engage them or me so that we make the best use of this most-important time.
• Respect for others is stressed above all else; please allow me the first chance to answer your fellow students’ questions. I expect everybody to participate in class discussions, but that begins by fostering an environment where we do not hesitate to ask our questions. Here is a joke:

Mathematicians like this joke because we recognize that we over-use the word trivial. Like all puzzles, a math problem is absolutely impossible(!), until you see your way through to a solution, at which point you’re overcome with joy and are even likely to call it easy. I don’t claim to be immune…ponder for a moment how much greater the resultant joy after spending years on a problem instead of hours! Anyhow, even after everything has clicked, one can still make mistakes or miss a basic fact…including your instructor! How can I say this another way…All questions are welcome!

Make-Up Homework/Exams
Online homework and feedback will not be accepted late. Edits will be accepted late (no deadline) with a 5% penalty. Written homework will be accepted one class-period late with a 5% penalty. Make-up exams will be given, on my discretion, if: (i) a real emergency or University-sponsored event arises which prevents you from appearing at a scheduled exam time; (ii) you notify me prior to the next regularly scheduled class; (iii) you provide sufficient documentation of your extenuating circumstance by the mutually arranged make-up date. Students failing to adhere to (i)–(iii) will receive a grade of zero on the exam.

More Math. The department maintains a BLOG (blogs.luc.edu/mathstats) and a FACEBOOK page (www.facebook.com/lucmathstats) that will contain interesting math/stats related tidbits throughout the semester. Feel free to join the conversation. (Indeed, if there is a topic that you’d like to see discussed, send an email to webadmin@math.luc.edu and we’ll try to get a post up about it.)

Loyola Math Club Tutoring
The Loyola Math Club offers free tutoring to students in any math class required for the completion of a math major. The Spring 2016 schedule has not been posted yet. Here was the schedule for Fall 2015:

Mondays and Tuesdays 7:00 p.m. – 8:30 p.m. Flanner Hall, Room 007

For more information about the program, or to request tutoring for any other mathematics or statistics class, direct a question to the tutoring coordinator Daniel Montgomery (dmontgomery2@luc.edu).