MATH 434, Abstract Algebra
Spring 2007

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1 Introduction

Although there are few prerequisites, Abstract Algebra 434 is a senior level course. Faculty in mathematics consider this course a capstone for those of you pursuing either a career in secondary education or graduate studies in mathematics.

In this course, you will continue to acquire a deeper knowledge of linear algebra, investigate a bit more of group theory and learn the basics of a the algebraic structures called rings, modules and fields.

As you did last semester, please think of our text, not as the course bible, but rather as your primary resource for filling in details of the material covered in class. I also recommend that you take the time to find and use additional references. In particular, there are an abundance of useful books in the library and mathematics reading room.

For an official description of this course, see MATH 434 Syllabus[4].

By the time we finish this course, you should also have refined the skills outlined in the information sheet for first semester abstract algebra as well as

- Research, understand, summarize, and verbally present an application of the concepts you have learned in this course.

2 Course Information

2.1 Textbook

The textbook is *Contemporary Abstract Algebra*, 5th Ed, Joseph A. Gallian, ©2002, Houghton Mifflin Company.

Since most of you are majoring in either mathematics or science, you should consider buying *Scientific Notebook* or some other technical word processor. Almost all such products have student editions that are significantly less expensive than the standard editions.

2.2 Basic Information

You can find information pertinent to all of my classes at the link below and, once there, information specific to this class by clicking on the Math 434 link.

`http://math.ups.edu/~bryans/` [1]

2.2.1 Logistics

Because of the construction on Thompson Hall, the rooms for my office and our class might change during the semester. Currently those rooms are as listed below.

Professor Bryan Smith	(Temp) Temp. Bldg E, Room 2	879-3562	bryans[at]ups.edu
Office Hours		Monday	2:00 - 2:50 P.M
		Tuesday	9:30 - 10:30 A.M.
		Wednesday	2:30 - 3:20 P.M.
		Friday	10:00 - 10:50 A.M.
Classroom / time	Jones 206	M,T,W,F	11:00 - 11:50 A.M.

I am also available for appointments at other times.

2.3 Day to Day Structure

The class weeks will be structured in essentially the same way as last semester. One difference is that an appropriate number of days at the end of the semester will be reserved for you to present your application topics to the rest of the class.

2.4 Examinations

Since the homework problems will be used to facilitate deep understanding, tests will be used more as a basic check of your knowledge. Hence, there will be one, "straightforward", semester examination.

Examination One Tuesday March 27

2.5 Final Examination: Wednesday May 9 at 8:00 A.M.

The final will also be "straightforward" and comprehensive. The final cannot be rescheduled so do not plan plane flights (or anything else) that will conflict with it.

2.6 Writing Projects

Homework will be assigned and collected as it was last semester except that each of you will get to develop two or three problems associated with your presentation (see below). I expect a total of 25 problems to be accepted by the end of the semester. However, this semester you do not need to designate any of them as writing problems. Instead, write all problems for an audience consisting of the rest of the class. If I have questions about the quality of your writing I will check your level of exposition by having a classmate read your proof, asking pertinent questions of that reader, and using their feedback to assess the clarity of your writing. Feel free to use (or not) any technology that you like (e.g., calculators, *Mathematica*, MATLAB, etc.). You may also work with others in solving these problems but there is to be no collaboration on the written exposition of the solutions. In addition, you are to include a reference page citing each resource you use: technological tools, reference texts employed, names of participants in discussions, and anything else other than your own thoughts. Failure to include references is plagiarism! It is intellectual theft and, as such, is extremely unacceptable. Please see the "Academic Honesty" section of the *Logger* to see how seriously we take this issue.

Since most of you are either science or mathematics majors, you should attempt to use a word processor to write your papers. One possibility is *Scientific Notebook* since it is not only an easy to use technical word processor but also contains a symbolic algebra package that can be useful for analyzing problems. Another, cheaper, approach would be to learn the basics of LaTeX (or TeX) and install the software package MikTeX, see `http://miktex.org` [5], and a front end program such as TeXnicCenter, see `http://miktex.org/Links.aspx`, [6]. This last approach gives you far more control over your mathematical writing but has a steeper learning curve. On the other hand, knowledge of LaTeX is almost a requirement for graduate school in mathematics and science.

2.7 Talk/Paper

The last 2 weeks of class will be devoted to talks given by the class members. You may investigate any topic that involves higher algebra. Those of you with interests in physics or chemistry will have no trouble finding many possibilities. There are also a number of choices mentioned in part 5 of our text. For example, you could go into more depth on the Sylow theorems, discuss the classification of finite simple groups, indicate how generators and relations are used to investigate groups (this is a fundamental tool in knot theory), get hard core with symmetry (other than discrete planar symmetries),

show how to use more sophisticated counting arguments like Burnside's Theorem, look at how algebra is used in the study of graphs (one example is the Cayley Digraphs), expound on algebraic coding theory, or introduce the class to Galois theory (the interaction between groups and fields). Or if none of those seem like fun, how about: looking at why it is impossible to trisect all angles using only a straightedge and a compass or other construction questions like why it is impossible to square the circle, investigating boolean algebras (for those of you with a leaning toward computer science), or talking about lattice theory (we dealt a bit with lattices in our classification of planar symmetries but wouldn't it be fun to research the Leach lattice in 24 dimensional space and how it applies to the best way to pack spheres into a box – not to mention the way it links to the theory of codes and finite simple groups.) And, of course, there is always the way that algebra is used in the study of topological spaces. You will see a bit of this soon but there is much more that is accessible for a presentation to the class.

The main thrust of this assignment is the oral presentation of your investigations but you are also to present the material in a paper that you submit to me electronically (I prefer PDF format but will accept it in Microsoft Word format as well). With your permission, I will publish your paper in the *Journal of Undergraduate Mathematics at Puget Sound* that I maintain on my web page. This might prove useful to mention when you are interviewing for a job.

In any event, you should talk with me no later than midterm or slightly thereafter about your choice of topic.

2.8 Reading

Developing an ability to read and understand a (relatively) technical piece of writing is a primary goal of this course. This skill is fundamental not only for those who wish a career in science but also for anyone who wishes to be a well-rounded member of society. Hence, careful reading of the texts is an integral part of this course — especially since lectures will not be word-for-word reiterations of the material in the textbook. I recommend multiple readings of the material as we cover it since technical material is difficult to grasp quickly. (See "How to Study"[7] on the course webpage for more details.)

2.9 Course Information Updates

If you wish, I will post (and update) a grade report on your current standing in the class on my university web page. You should keep track of your grades on the various assignments and check them against these reports. If there are any discrepancies they should be dealt with immediately.

To have your information posted you need to print your name, the class (MATH 433), and a code on a sheet of paper. Then sign the paper and physically hand it to me. The code is to be a sequence of up to 23 symbols I can type on a keyboard.

2.10 Total Points

Homework	60%
Oral/Paper Presentation	20%
Midterm	10%
Final Examination	10%

2.11 First Graded Homework Assignment

(Due Friday September 1 at 5:00 P.M.)

1. Look over both my university web page `http://math.ups.edu/~bryans/` [1] and the course webpage for MATH 434 you'll find there.

2. Send an e-mail message to me at bryans [at] ups.edu that contains the information below. Make sure the course number, 433, and your name are in the "Subject" line.

   (a) Tell me your mathematical plans after graduation.

   (b) Write a paragraph or two detailing your personal learning style. Include any classroom techniques you have found that enhance or block your learning.

References

[1] Bryan Smith's Homepage
`http://math.ups.edu/~bryans/`

[2] Math 433A Course Webpage
`http://math.ups.edu/~bryans/Current/Fall_2006/433Index_Fall2006.html`

[3] Department Calculator Policy
`http://www.math.ups.edu/info/calcpolicy.pdf`

[4] Department Syllabus for MATH 433
`http://www.math.ups.edu/~matthews/Syllabi/MA433Syllabus.pdf`

[5] Location of MikTeX package for using LaTeX `miktex.org`

[6] Development tools for composing LaTeX documents `miktex.org/Links.aspx`

[7] William Rapaport's "How to Study"
`http://www.cse.buffalo.edu/~rapaport/howtostudy.html`

[8] TI-86 Manual
`http://education.ti.com/us/product/tech/86/guide/86guideus.html`