Math 490A Introduction to Abstract Algebra for Future Teachers—Fall 2019

Course description: Abstract algebra forms a key part of the ideas behind high school mathematics and is the basis for several parts of the Massachusetts Test for Educator Licensure for secondary school math teachers. This course will cover the parts of abstract algebra most important for building a deep understanding of the ideas of high school mathematics and their interconnections. It will focus on the properties of rings (especially the integers and polynomial rings over fields), and fields. During the course, we will be making connections between these topics and high school mathematics. The course will assume that you’ve had Math 300.

As you probably know, we offer a two-semester sequence (Math 411-412) in abstract algebra. So why do we need a special course for future teachers? The 411-412 sequence starts with the simplest kinds of algebraic structures, with Math 411 focusing on groups, which have a single associative operation and capture key ideas of algebraic structure and symmetry. Math 412 then builds on the ideas of Math 411 and studies rings (structures with two operations like the addition and multiplication of the integers) and fields (special kinds of rings, such as the rational numbers and real numbers). This ordering of the topics builds logically from the simpler to the more complex, but the topics most important for high school mathematics are covered in Math 412, and most students in the teaching concentration aren’t able to fit 412 into their programs. This means that most future teachers don’t see the parts of abstract algebra that would deepen their understanding of the material that they’ll be teaching. So this course will try to develop some of the material that would normally be in 412, at least the parts most relevant to high school mathematics, without basing it on the study of groups. We won’t be able to do everything that would be in 412, and our emphasis will be a bit different than in Math 412, but much of what we’ll be covering would normally be part of 412, not 411.

Math 490A is (officially!) an experimental course. That means that we’re trying something new and I certainly expect to make adjustments to the topics and class organization as we go. Doing that effectively will be easier if I get lots of feedback from you during the semester. So in addition to asking questions in class and coming to office hours if you don’t understand some of the material, I very much encourage you to give me comments about how the course is going and how you think it could be improved. In addition to informal comments, I will probably do some kind of anonymous midterm course evaluation.

Texts and References: The main textbook will be Ronald S. Irving’s Integers, Polynomials, and Rings. You can read this online through the UMass library, or buy ebook, softcover, or hardcover editions for fairly low prices from the publisher. The library will also let you download small parts of the book, but the rules are complicated so I recommend you don’t do any downloading.
until we discuss this in class. I expect to occasionally supplement the text with additional material.

**Grading and Course Policies:** There will be occasional quizzes, mostly on definitions, and weekly homework. There will be two in-class exams and a cumulative final exam. There will also be frequent group work in class; participation in group work and class is an important part of your work in this course and attendance is required.

You are encouraged to talk to me about the assigned problems, to look for references in the library and online, and to work with your fellow students. But if you use outside sources or work with others on the homework, you should make sure that you can explain the solution by yourself. Here are the rules for collaborating on homework problems:

- You **must** list the names of all the people with whom you discussed a specific problem. If you used other sources (such as books) in working on a problem, besides class notes and the textbook, you must list those sources as well.

- You **must** write up your own solutions independently.

The quizzes and homework will count 30% of the course grade, each of the in-class exams will count 20%, the final will count 25%, and participation in discussions and group work will count 5%.

**Accommodation:** The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

**Academic Honesty:** Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this
policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent. See http://www.umass.edu/dean_students/codeofconduct/acadhonesty/.