MA383: Introduction to Modern Algebra

Baker University — Fall 2022

MWF, 9:30 to 10:20 AM; Collins Library 312

Contents

1 Instructor Information

Dr. Dylan C. Beck, Visiting Assistant Professor of Mathematics

- Discord: https://discord.gg/QeyzQenYKc (Enrollment here is optional.)
- email: Dylan.Beck@BakerU.edu (Capitalization is used for clarity.)
- office: Boyd Science Center 328
- office hours: MWF, 3:30 to 4:20 PM; Tu, 12:30 PM to 3:20 PM; or by appointment
- pronouns: he / him / his
- textbook: *Abstract Algebra: Theory and Applications* by Thomas W. Judson (PDF)
- virtual office: Click to access my virtual office via Zoom. (passcode: 044163)
- web page: https://dylan-c-beck.github.io

2 Course Information

2.1 Course Description

Per the course catalog, MA383 is a three credit-hour "advanced algebra course that includes algebraic structures with groups, fields, and rings and their applications."

2.2 Course Objectives

Because of its ubiquity in both applied fields such as computer science and cryptography and pure fields like combinatorics and number theory, modern algebra is a fundamental tool in contemporary mathematics. By the end of the course, successful students will be able to

- provide the definition of a group, a field, and a ring;
- provide examples of (non-)abelian groups and (non-)commutative (unital) rings;
- provide the definition of and use the Isomorphism Theorems for groups and rings;
- understand the relationship and distinguish between Euclidean domains, PIDs and UFDs;
- compute the Galois group of a Galois extension of fields; and
- provide examples of applications of modern algebra to (at least) the fields of computer science, cryptography, combinatorics, and number theory.

2.3 Course Prerequisites

Enrolled students must have passed both MA281 (Introduction to Linear Algebra) and MA291 (Introduction to Higher Mathematics) with a grade of C or higher. Explicitly, students should be familiar with reading and writing mathematical proofs using the language of set theory and the calculus of logic. Over the course of the semester, we will work to further hone these skills.

2.4 Course Policies

Class meetings will typically consist of an instructor-led lecture component and a short quiz. Lectures will feature materials from the course notes; these will be made available for students on the instructor's web page, and they will be maintained throughout the semester. Other than on the first day of the semester, short quizzes will be administered at the end of each class period. Each quiz will contain a few questions pertaining to materials from the preceding class; students must be able to provide definitions, answer true-false questions, and compute examples.

Occasionally, student-led activities will be incorporated into course meetings per the instructor's discretion; students will be informed in advance and subsequently provided adequate time to plan if they are expected to prepare materials in order to lead a discussion.

Regular and punctual attendance is vital to understanding the information presented in this course; however, in the event of a mandatory absence, it is the responsibility of the student to inform the instructor by filling out the Excused Absence Request Form and to make arrangements with the instructor to make up any materials or assignments missed during class.

Unless otherwise specified, the instructor requires that students wear masks in the classroom. We will adhere to Baker University guidance on other matters pertaining to COVID-19.

2.5 Coursework, Exams, and Quizzes

Each week, homework will be assigned at the instructor's discretion. Unless otherwise specified, these will be due on Moodle at 11:59 PM the Friday after they are given. Late work may not be accepted unless proper documentation is provided; however, if a student anticipates an absence and communicates it to the instructor prior to the due date of an assignment, the student may be allowed to submit their work even after the due date with no deduction in points.

Each class period other than the first of the semester, a brief quiz will be administered in the last ten minutes of the session. Unless otherwise specified, quizzes will contain one or two definitions, one or two true-false questions, and one or two computational questions related to the material that was covered in class during the *preceding* course meeting.

Exams will be administered three times throughout the semester. Like with the daily quizzes, students will answer true-false questions, compute examples, and provide definitions; however, students must *also* write some proofs on exams. Credit for definitions and true-false questions is administered to the student on an all-or-nothing basis. On the other hand, credit for computations and proofs is earned by the student primarily through citing theorems, demonstrating a command of appropriate proof techniques, and showing work: when the relevant work is shown and a problem is answered correctly, full credit will be awarded. Partial credit may be awarded when it is obvious that a problem was attempted and some pertinent details were supplied.

Before quizzes and exams, students must demonstrate that their work spaces are compliant with the regulations and guidelines set out by the instructor. Explicitly, a student is only allowed a writing utensil and a scientific calculator on their desk; other papers and electronic devices must be stored in the student's backpack and placed under or next to their desk. Once all students have cleared their work spaces, the assessment will begin, at which time each student will have 10 minutes to complete the quiz (50 minutes for exams). Once a student has finished the quiz (or time has expired), the check-out procedure is initiated by the student bringing their work to the instructor; if they so choose, the student may subsequently leave class for the day.

2.6 Student Expectations

Communication between students and the instructor will occur primarily in the classroom and during the instructor's (virtual) office hours; however, each student should check their email and the instructor's web page regularly for course updates and supplementary materials.

Collaboration with classmates on homework is encouraged; however, each student is expected to submit their own work on all assignments, and each student will be graded on their own work as it appears. Consequently, for students working together, it is critical that no party completes any work on behalf of another party and moreover that each party determines their own solutions. Explicitly, students should write original proofs rather than copy from one another; however, students may discuss different techniques or strategies leading to a possible proof. Ultimately, students must clearly indicate their collaborators for each assignment (see Section 3 below).

Outside of class, students should expect to spend (at least) two hours preparing materials and studying for every hour spent in class (see Section 5 below). Unlike in high school, students that do not understand the material covered should not assume that their instructor will repeat material until it is understood and mastered; rather, each student is expected and encouraged to ask questions as they occur in class. Certainly, all students should devote time to studying course materials outside of class, but if that does not work, students should consider visiting the instructor during his office hours. Do not hesitate to ask questions, as this course is cumulative.

2.7 Grade Distribution

Below is a table with the distribution of grades for this course.

type	*quantity*	*weight*	*total*
homework	6	2%	12%
quizzes	38	1%	38%
exams	2	15%	30%
final exam	1	20%	20%

We will use the traditional grading scale (e.g., an A is $\geq 90\%$; a B is $\geq 80\%$ and $< 90\%$; etc.)

2.8 Final Exam

Our final exam will be administered on **Friday, December 9** from **1:00 to 4:00 PM**. Questions from group theory and ring theory will constitute approximately 40% of the exam material; questions from field theory will account for the remaining portion of the exam.

3 Academic Misconduct Policy

Per the official Baker University guidelines, "students [are expected] to have solely completed or prepared the work or research that bears their name and to acknowledge the materials and sources of others; [...] to do their own work and research; to prepare their own reports and papers; and to take examinations without the assistance of others or aids not allowed in the testing procedure." Even more, Baker University holds that "academic misconduct includes but is not confined to plagiarizing; cheating on tests or examinations; turning in counterfeit reports, tests, and papers; stealing of tests and other academic material; knowingly falsifying academic

records or documents; and turning in the same work to more than one class without informing the instructors involved." Each of the aforementioned terms are in turn defined as follows.

- "Cheating includes possession, use, or receipt of unauthorized aids or assistance. Notes, charts, books, and mechanical devices used in a quiz, test, or examination, but not specifically allowed by the examiner, constitutes cheating. Visually or verbally receiving or giving information during a quiz, test, or examination that is not specifically allowed by the examiner is also cheating." Cheating can may benefit one's self or one's neighbor.
- "Counterfeit work includes work submitted as one's own that was created, researched, or produced by someone else. Submission of the work of another person, joint work as if that work was solely one's own, or production of work to be submitted in the name of another person are all forms of counterfeit work." Be sure to clearly indicate the names of any and all collaborators on any assignment that is not completed solely on one's own.
- "Plagiarism includes presenting as one's own efforts the work of someone else without proper acknowledgment of that source. It is not enough to copy the work of someone else and provide a citation. Exact copying must be enclosed in quotation marks or properly blocked with an appropriate citation of its origin. Failure to cite paraphrasing in which the basic sentence structure, phraseology, and unique language remain the same constitutes plagiarism as well as failure to acknowledge unique, unusual, or new ideas or facts not the product of one's own investigation or creativity. It is the student's responsibility to understand what constitutes plagiarism and how to properly paraphrase and cite sources. When in doubt, it is the student's responsibility to seek guidance from the instructor."

If a student engages in academic misconduct, it will be documented by the instructor and the student's grade will be reduced or an XF will be appended to the student's academic transcript, in accordance with and as permitted by Baker University. Consequently, the instructor urges that students become familiar with the academic misconduct policy from the student handbook.

4 Accommodations Policy

Per the official Baker University guidelines, "Baker University is committed to providing 'reasonable accommodations' in keeping with Section 504 of the Rehabilitation Act and the Americans with Disability Act of 1992. Students must provide appropriate documentation of the disability, which should include appropriate diagnostic testing and a recommendation form prepared by qualified personnel outside of Baker University. 'Reasonable accommodations' will be determined by university staff in consultation with the student, faculty, and / or staff member. Accommodations are not retroactive." Further information is provided here and here.

5 Credit Hour Definition

Baker University adheres to the federal definition of a credit hour as "an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than (1.) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester [...] hour of credit [...]; or (2.)

at least an equivalent amount of work as required in [the first] definition for other academic activities as established by the institution, including laboratory work, internships, practica, studio work, distance learning, and other academic work leading to the award of credit hours." Courses at Baker University are typically 50 minutes in duration. Further information is provided here.