MATH 5530, spring 2023, Version 3
Last Revised: February 13, 2023

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Office Hours:

- **Monday: 2:30 pm to 4:00 pm**
- **Tuesday: 11 am to 12:00 pm**
- **Wednesday: 2 pm to 3:00 pm**
- **By appointment.**

General Course Information:

- This course is intended to be the second of a two semester graduate level introduction to abstract algebra. This semester will be concerned with the basics of Ring Theory, Module Theory (with applications to Linear Algebra), and Field Theory. It will be theoretical and entirely proof based.
- **You must have successfully completed Math 5520. I will assume that you have a *B-level* mastery of first year graduate group theory.**
- If you did not earn a B in 5520, you should talk to me individually about whether or not it's a good idea to be in the class.
- **If you are not a graduate student in mathematics, then this course is definitely not for you.**
- My classroom notes will be the default resource (see below).
- During our classroom meetings, I will focus on examples, some finer points of definitions, carefully worked solutions to some problems.
- The lecture notes are already posted. You must carefully read them yourselves.
- Remember: **notes should be taken as the authoritative resource** with respect to citing results, definitions, notation, and so on. And you will be doing **a lot** of careful citation in your homework write-ups.
- In short **the notes are what you will cite and use for the purposes of all homework, and all examinations.**

- A key feature of the class will be your development of the ability to **produce precise, detailed, and well organized mathematical proofs in abstract algebra.**
- **You will be expected to fill in all of the appropriate details and pay careful attention to organizational instructions in terms of your homework write-ups.**

Required Software/Apps:

- You will need the Canvas app on your portable devices.
- You will also need to be able to use Canvas on your desktop/laptop.
- Make sure you turn on notifications–you know how I send announcements via Canvas.
- You will need ZOOM on your computer **and on your phone**.
- You will also need a good scanning app for uploading homework assignments to CANVAS.

Required Reference Textbook and Classroom Notes.:

(A) **My Class Notes:**

- My classroom lecture notes will be your primary working resource for this class.
- All of the notes are already posted on the CANVAS page
- You should review the appropriate sections before we meet, and should read them carefully on your own time.
- My classroom notes will be your only reference source for **all definitions, results, notation, and the like** .
- **For the purpose of preparing your homework, you may only use the definitions and results that are included in the class notes .**
- In particular, you will be citing the classroom notes for homework, and they will be what you will need for your exams and final.
- Be advised that my definitions and notation will, in some cases, be different from the book. Ultimately, equivalence of the ideas will be demonstrated.
- **NEVER cite any other reference materials**.

(B) **The Textbook**

- The *required* reference textbook for Math 5530 is *Algebra*, by Thomas Hungerford. Be sure to order the most recent version.

- I chose Hungerford's book for a required "reference textbook" because it is a fairly complete reference text in the area of abstract algebra–and because it tends to be less expensive than some of the other standard texts.
- I will regularly assign supplementary reading from the book and many "suggested" exercises will be assigned out of the book.
- In addition, sketches of proofs from our notes will sometimes appear in the book. In short, you will need a copy of Hungerford.

Additional Reference Materials and Tools:

(A) Some references in general abstract algebra include:

- *Abstract Algebra* (3rd edition), by Dummit and Foote
- *Topics in Algebra*, by I.N. Herstein
- *A First Course in Abstract Algebra*, by John Fraleigh
- *Basic Algebra I*, by N. Jacobson

(B) Specific references:

- For Rings and Modules: *Rings, Modules and Linear Algebra*, by B. Hartley and T.O. Hawkes.
- For Field Theory: *A Course in Galois Theory* by D. J. H. Garling (this book was so good that someone stole my copy!).
- For general linear algebra: Linear Algebra, by K. Hoffman and R. Kunze. We probably won't do a lot of linear algebra, but as a reference, this book is very good.

(C) Computational resources:

- *GAP4:* GAP is a computational algebra computer package that is exceptionally powerful and useful. It is easy to download and install:

  http://www.gap-system.org/Download/

  There are a number of subtle issues that should be discussed before you use GAP4. I may give a lecture or two in the Algebra Seminar on an introduction to GAP4. I will keep you posted about this.
- *Sage:* Sage is another computational package. There are a few graduate students who use it, but I do not. Sage has the ability to call GAP functions, but I have personally found that GAP is more than sufficient for my needs.

Grading Policy:

The grading policy for this class is as follows.

Note that the exam dates are tentative.

Homework 40%

Exam 1 (Monday, 6 March) 25%

Exam 2 (Monday, 24 April) 25%

Final Exam Assignment (due Wednesday, 10 May) 10%

I will not announce a grading scale at the beginning of the class. However, I will give you substantial input throughout the course regarding your level of mastery of the material and the extent to which it meets expectation.

- I expect to collect 4 or 5 assignments over the course of the semester.
- While these assignments will generally have relatively few problems, **my expectations for clarity and precise detail are enormous, and the grading will be merciless.**
- The homework assignments will be distributed and collected through Canvas.
- There will be two online 80 minute in-class examinations.
- There will be a take home final exam (more like another homework assignment).

The In-class exams:

I expect to give two exams during class time over the course of the semester.

Some (tentative) specifics for the two exams are as follows:

(A) Exam 1:

- Exam 1 is tentatively scheduled for **Monday, 27 February, 2023**;
- The tentative topic list for Exam 1 (in terms of my classroom notes):

  Chapter I, sections 1-5 (focus on Ring Theory)

(B) Exam 2:

- Exam 2 is tentatively scheduled for **Wednesday, 19 April, 2023**;
- The tentative topic list for Exam 2 (in terms of my classroom notes):

  Chapter II, sections 1-7 (focus on Module Theory and Linear Algebra)

The Final "Exam":

- Your Final "Exam" will essentially be the same as a homework assignment.
- It will be due on **Wednesday, 10 May, at 12:30 pm.**
- I will provide precise deadlines and instructions later in the semester.
- It will be distributed and collected through Canvas.
- More on this later.

Homework Policies:

- **My expectations for the organization and general quality of your homework are very high, exacting and, in some cases, merciless.**
- **I expect you to follow the instructions to the letter.**
- **You should not** expect to sit down and write up a problem in one draft. It routinely takes me 3 or 4 drafts to write out solutions for your homework assignments. Be prepared for this to take time to do it well.
- I have posted solutions to a 5520 homework assignment to indicate how your work must be spread out and organized. If you do not do so, you will loss **substantial amounts of credit.**
- So follow the directions **to the letter.**
- In all likelihood, I will post a video with some additional comments about homework preparation. I'll keep you informed about this though CANVAS.

Homework Preparation Instructions:

- The homework will be distributed as Canvas assignments. I will include a .pdf as well as the LaTeX source code. This can help you if you're just learning to use LaTeX.
- Homework deadlines are HARD DEADLINES. I will not accept or grade late homework.
- If you wait until the last minute and your upload goes wrong, you're out of luck. Don't wait.
- You may prepare your homework in LaTeX. However. you will need to double space (and quadruple space), spread your work out, properly indent, and follow other directions related to homework preparation (see below).
- You may write it up using a note-taking application with a stylus on your tablet/surface.
- You may write it up by hand, scan it and upload it as well.
- For handwritten assignments, if you use pen, IT MUST BE ERASABLE. Your work that you turn it must not have things scratched out with pen (or pencil) because you can not, or did not erase. The work you turn in needs to neat and carefully presented.
- In your solutions, you must include the statement of the problem that you are proving.
- Your proof must begin with the word **proof** indicating precisely where your argument begins.
- It must end with **QED** (or the equivalent) precisely where your argument ends.
- You may freely reference results or exercises **ONLY FROM OUR CLASSROOM NOTES**, subject to obvious constraints–for example, you can't use results that trivialize the problem. Here, it's always best to ask. I may just be asking a trivial question!
- **You MAY NOT use the definitions or results from the book for your homework solutions.** I cannot put it in simpler terms.
- **When you refer to results from the notes, you must indicate the specific result by both number and page. That is: *"By Prop. V.1.2 p 267"*. I will take off if you do not do so. You may NOT use statements such has *by a result from class*.**
- I will include and update a list of results from the notes which you can use **without citation**. These are called the *no-cite list.* Everything else must be cited as above.
- Again, the default definitions for all of the notions are those written in my classroom notes. That is what you should be working off of in terms of quoting definitions and results.

- You must show all of your work. You must fill in all the details.
- **You must clearly indicate where you are using the various hypotheses, each time you them**
- **LaTeX proofs must be double-spaced and the font must be at least 12pt.** You will need to skip even more space between paragraphs and so on. If you don't know how to change font size and handle spacing, you shouldn't be using LaTeX.
- **Do, at most, one problem per page. This also applies to LaTeX prepared documents.** You can, of course, spread a solution over several pages, if necessary. You can also spread multi-part problems over many pages.
- Do not crowd your work.
- DO NOT CROWD YOUR WORK.
- Leave room between lines (double space) and add additional vertical space between major breaks in the argument.
- **Make frequent use of line breaks and indentation in your arguments:** densely packed arguments are difficult to read and hard to grade.
- **You MUST AVOID long lines with a sequence of implications.** This is bad form, and precludes proper supporting argument (what you are using, and where you are using it.
- **You must skip at least one line with each new implication:** This allows you to clearly support each claim with the appropriate citation.

UNT Office of Disability Access

In compliance with the *Americans with Disabilities Act*, I include the following:

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at

`https://studentaffairs.unt.edu/office-disability-access`

You may also contact them by phone at 940.565.4323.