An Introduction to the Theory of Groups
a.k.a. Senior Seminar in Algebra
MATH 437.01 – Fall 2015

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Office Hours 2:30PM–4:30PM MWF or by appointment.

Course Webpage http://people.hamilton.edu/jwiscons/teaching/math437_f15.html

Course Overview The course will be structured to build both intuition and theory with the generation and exploration of student-generated conjectures being the glue. The main theoretical objective is to develop enough machinery to prove Sylow's theorems from finite group theory; however, this objective will be reached early enough for you to conclude the course with a research project of your own choosing. Possible topics for the project include: the countable random graph and its automorphism group, symplectic spaces and symplectic groups, groups associated to games such as Spinpossible™(https://spinpossible.com), reflection groups and Coxeter groups, free groups, or the classification of the finite multiply transitive groups.

Typical Day A typical class meeting will consist of students presenting solutions to problems from the class notes. The goals of the presentations are (1) for the speaker to effectively and clearly communicate their (perhaps partial) solution to the class and (2) for the class to meaningfully engage the speaker with comments and questions meant to clarify, challenge, and extend the argument being presented.

Course Components

Homework. Homework will typically be assigned each class meeting, due at the next meeting. This will consist of solving problems and proving theorems from the class notes. You are *allowed and encouraged* to work together on homework, but you are expected to **write up your solutions on your own**. Before each class, you will self-assess your work on the following $2 - 0$ scale.

2	This is a clearly written correct and fully-justified solution.
1	This is a clearly written account of significant progress.
0	Insignificant progress was made.

Important: I do not want you using outside resources for this component of the course; I do want you to create mathematics on your own and in collaboration with your classmates.

Presentations. Presentations are graded on the following $2 - 0$ scale. The way in which you function as an audience member will also influence your grade for this component.

2	This is a clear, concise, and thoughtful presentation of a correct solution or significant progress with minimal assistance from the audience.
1	This is a presentation of a correct solution or significant progress, but there was noticeable room for improvement with respect to it being clear, concise, and thoughtful.
0	Insignificant progress was made.

Group Portfolio. Each week you will be responsible for revising and typing up, in LaTeX, some problems from the previous week. (I will support you as much as needed with LaTeX, and for those of you unfamiliar with LaTeX, ShareLaTeX is a good place to start.) These will be compiled by the weekly editor into a common portfolio of solutions. The class will receive a common grade for the portfolio, but each student's grade will also be influenced by their editorial role.

Project. Near the end of the course, you will be responsible for researching a group-theoretical topic of your own choosing. You do not need to prove something original, but you will be required to write up an introduction to your topic, including motivation, definitions, statements of theorems, and proofs (in your own words!) of nontrivial results. You will also give a 20-25 minute in-class presentation on your topic. The goal of this component is simply to keep the following words of Paul Halmos in mind.

> *Don't just read it; fight it! Ask your own questions, look for your own examples, discover your own proofs. Is the hypothesis necessary? Is the converse true? What happens in the classical special case? What about the degenerate cases? Where does the proof use the hypothesis?*

Grade Composition

Homework	10%
Presentations	30%
Group Portfolio	30%
Project	30%

Getting Help Mathematics is hard. Try hard. But don't be surprised if that is not always enough. Talk with your classmates, but please try to avoid asking "how do I start." Instead, try to rewrite the problem in a way that is more meaningful to you and then ask, "does my interpretation of the question seem correct." Very often, the act of "simply" reformulating a problem will lead to insight about its answer.

Disabilities Any student with a documented disability needing academic adjustments or accommodations should speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should contact Allen Harrison in the Dean of Students Office (Elihu Root House; ext. 4021).