**Math 307, Introduction to Abstract Mathematics, Autumn 2016**

**Catalog Description:** Offered autumn and spring. Prereq., M 172 or 182. Designed to prepare students for upper-division proof-based mathematics courses. Topics include proof techniques, logic, sets, relations, functions and axiomatic methods. Students planning to take both M 221 and 307 are encouraged to take M 221 first. 3.000 Credit hours 3.000 Lecture hours

**Goals:** The learning goals, as defined by the Dept. of Mathematical Sciences, are divided into two categories; the overarching learning goals and the specific learning goals.

Course overarching learning goals:

1. to develop a facility in using the language of mathematics, to learn the language of mathematics and to gain understanding of mathematical rigor.
2. to learn how to read, construct, and write proofs and recognize when the reasoning is correct and when it is incorrect.
3. to create and develop the ability to reason mathematically as demonstrated by the construction of proof strategies, methods and techniques and the clearness with which a proof is written.
4. to learn to work in the realm of abstract mathematics, correctly applying definitions, axioms, and theorems.
5. to create and develop students critical thinking ability and independent thought.

The course specific learning goals are:

1. to learn the basics of mathematical logic (propositional and predicate calculus).
2. to learn how to construct and write direct proofs, contrapositive proofs, proofs by contradiction, and proofs by mathematical induction.
3. to learn set-notation, and techniques, to prove set-theoretic properties.
4. to learn properties of abstractly defined functions and relations.
5. to gain understanding of injections, surjections and bijections, and their use in comparing cardinalities of sets.
6. to understand how the various numbers systems (natural numbers, integers, rational numbers, real numbers, complex numbers) can be introduced rigorously, and to learn the distinguishing properties of these numbers systems .

**Teacher:** Greg St. George

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**Office hours:** to be announced.

**Text:** G. Chartrand, A. D. Polimeni, P. Zhang, Mathematical Proofs: A Transition to Advanced Mathematics, 2nd Edition, , 2008 Pearson Education.

There is a 3d edition of this text available. As of today, 27 August 2016, the hardcover is listed on Amazon at $149.74. The softcover is $140. I bought a softcover "international edition" of the 3d from England for about $55 (shipping included), but this took three weeks to ship. Apparently the U.S. is not covered by 'international' since that edition is not available here. I compared the two editions and found little difference, though the authors say some exercises have been added.

In my opinion the pricing of the pricing of the 3d edition, while not surprising, is unconscionable, so I have decided to use the 2nd edition. I was able to buy three copies of this book this summer for less the $20 a copy, although prices in the used market do tend to spike higher around the beginning of school. I have put two of those copies on reserve in the library for your use. If you desire a physical copy of the book then I would recommend searching at `used.addall.com` to find available copies. If you are price insensitive, you are welcome to buy the 3d edition, but in-class references to problem numbers will be to the the earlier book (although, if I have time, I will try to give the newer number, if they have changed).

**Website:** I will use a Moodle site as a document repository.

**Schedule:** The main topics are logic, and proof in the context of set theory and other setting, perhaps to include analysis, number theory or linear algebra (you do not need to have any exposure to these topics beyond the calculus series). How far we get and exactly what we do will be determined by the teacher depending on class performance.

**Grading Policies:** The intention at this point, is to have three tests during the semester and a third during the final time. I may decide to do one more or one fewer test however. If three tests are given, the lowest score will be dropped if that helps your average. There may be some extra "testing" in the form of occasional announced quizzes. A very important part of the class, though, must also be student written work. The amount of this will depend on how much grading I am actually able to do. What I have enunciated here is intended to be a guiding framework, but none of this is set in stone and I reserve the right to adapt the grading structure to fit the course as the course evolves.

**Final:** At the present time this is planned to be a regular test offered at the time scheduled in the "Schedule of Classes".

**On reserve:** Two copies of the text. More material to be added later.

**Academic Honesty:** All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

**Student Conduct Code:** All students need to be familiar with the Student Conduct Code. (The Code is available for review online; one way to find it is to search for "Student Conduct Code" via the "A to Z Index" link on the UM home page.)