Instructor: Dr. Anthony Várilly-Alvarado
Office: 412 Herman Brown
Email: varilly@rice.edu
Phone: x4597

Time: MWF 11:00-11:50AM
Classroom: Herman Brown 423
Office Hours: W 1-2PM, Th 1:30-3:30PM

Class Webpage: Look for `Math 464 001 Sp10` on Owlspace.

Teaching Assistant: The teaching assistant for this course is Fei Xu.

Texts: *Algebra*, Serge Lang (required); *Commutative Algebra with a view toward Algebraic Geometry*, David Eisenbud (strongly recommended).

Homework: Due once a week, on **Wednesdays**. This is a very important component of the course. This class has a heavy workload, and you should expect to spend a lot of time doing homework. Math 464 is in many ways similar to a language course: you must get lots of hands-on practice to internalize the definitions.

The homework is not pledged and you can collaborate with other students in the class. In fact, you are very much encouraged to do so. You should write up your solutions individually.

Exams: There will be a take-home midterm exam, due the week of **February 22nd**.

Final Paper: In lieu of a final exam, you will have to write an expository paper, typeset in LaTeX and **no more than 10 pages in length**. The paper will be on a (pre-approved) topic of your choosing. I will make a list of potential paper topics as the course goes along. This assignment will be due the day the registrar schedules an in-class final for the course.

Grades: Homework will count for 60% of your final grade. The midterm will count for 20% of your grade and the final paper will count for 20% of your grade.

Expectations: In my experience as a student, most people do not follow all the details of a Math lecture in real time. During lecture, you should expect to witness the big picture of what's going on. You should pay attention to the lecturer's advice on what is important and what isn't. A lecturer spends a long time thinking on how to deliver a presentation of an immense amount of material; they do not expect you to follow every step, but they do expect you to go home and fill in the gaps in your understanding. Not attending lecture really hurts your chances at a deep understanding of the material.

Disability Support: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities will need to also contact Disability Support Services in the Allen Center.

Topics to be covered

1. **Rudiments of Category theory:** Definitions, examples. Equivalences of categories. Adjoint functors. Representable functors and the Yoneda Lemma. Products, coproducts, fibered products. Universal properties. Limits.

2. **Commutative Algebra:** Some ideal theory beyond Math 463. Tensor and exterior algebra. Flat, free and projective modules. Localization. Primary decomposition. Gröbner Bases. Integrality. Chain conditions. Noetherian and Artinian rings. Dedekind domains.

3. **Further Galois Theory:** Inverse limits; infinite Galois theory. Characteristic p phenomena.

4. **Rudimentary Algebraic Geometry:** The category of affine schemes. Hilbert Nullstellensatz.

5. **Homological Algebra:** Complexes; homology. Injective modules and derived functors. Ext and Tor. The Koszul complex.

6. **Galois Cohomology:** (Time permitting) Group cohomology. Brauer groups.

Rather than compartmentalize the topics as above, I will blend some of the material together, mostly for pedagogical reasons.