MATH 7420 MWF 10:30 AM - 11:20 AM, Room: Lockett 232

Instructor: William (Riley) Casper, Lockett 108, wcasper1@lsu.edu

Office Hours: TBA.

Course Webpage: `http://www.math.lsu.edu/~wcasper1/algeom_fall18.html`

Textbook: The material from this course will be presented mostly following

- *The Rising Sea (Foundations of Algebraic Geometry)* . Ravi Vakil, Nov. 18, 2017 draft. `http://math.stanford.edu/~vakil/216blog/FOAGnov1817public.pdf`
- *Algebraic Geometry.* Robin Hartshorne, Springer 1997.
- *Basic Algebraic Geometry I: Varieties in Projective Space.* Igor Shafarevich, Springer 1994.

Lectures will roughly follow certain sections from Vakil's notes or Hartshorne's text. In addition to the class homework, Vakil's notes provides a plethora of problems that students are encouraged to try and discuss, though these will not be collected.

Prerequisites: Students should understand some basic ideas from commutative algebra, such as those generally found in a first year algebra course. Additionally, while not necessary, students will benefit from some basic understanding of category theory and topology.

Classroom Expectations: Students in this class have the following expectations:

1. attend class daily, participate and ask questions
2. preform required reading
3. complete weekly homework assignments

Final grade in the class will be based entirely on homework.

Homework: Students should expect weekly homework assignments, with each homework set due the next week. Collaboration with other students is encouraged, though each student should turn in their own (non-identical) written solutions. Use of reference to materials outside the textbook materials mentioned above is okay. However, collaborations with other students or application of external reference materials to problem sets must be explicitly acknowledged on the homework turned in. Moreover, please resist the temptation to google/stackexchange/whatever specific problems.

An additional extra credit opportunity will be available at the end of the semester in the form of an expository paper.

Class schedule		
Date	Topic	Source
08/20	Intro/Syllabus/Spectrum of a ring	Vakil 3.2.[1-3] pp 102-107
08/22	The Zariski topology	Vakil 3.4.[1-4], 3.5 pp 115-118
08/24	Topological properties of Spec	Vakil 3.6.1-3.6.11 pp 119-123
08/27	Irreducible components, Noetherianity	Vakil 3.6.12-21 pp 123-127
08/29	Hilbert Nullstellensatz	Vakil 3.7, 3.2.4, 3.2.5
08/31	Spec of Quotients and Localizations	Vakil 3.2.6-3.2.10 pp 108-112
09/03	Labor Day	
09/05	Classical perspective: affine varieties	Hart. 1.1 pp 1-7
09/07	Presheaves and Sheaves	Vakil 2.2.[1-11] pp 73-77, Hart. 2.1 pp 60-62
09/10	Direct and Inverse Image Sheaves	Vakil 2.3.[1-4], Hart. 2.1 pp 63-65
09/12	Schemes	Vakil 4.1-4.3
09/14	Examples of schemes	Vakil 4.4
09/17	The Proj construction	Vakil 4.5
09/19	Projective schemes	Vakil 4.5
09/21	First properties of schemes	Vakil 5.1,5.2
09/24	Affine local props: Noetherian schemes	Vakil 5.3
09/26	Normal and factorial schemes	Vakil 5.5
09/28	Morphisms of schemes	Vakil 6.2, 6.3.[1-3]
10/01	Morphisms to affine schemes	Vakil 6.3.4
10/03	Morphisms with projective schemes	Vakil 6.4
10/05	Fall holiday	
10/08	Types of morphisms	Vakil 7.3
10/10	Closed subschemes	Vakil 8.1

Date	Topic	Source
10/12	More projective geometry	Vakil 8.2
10/15	Fibered products and base change	Vakil 9.1
10/17	Pull back diagram	Vakil 9.3
10/19	Properties preserved by base change	Vakil 9.4
10/22	Segre embedding	Vakil 9.6
10/24	Separated morphisms	Vakil 10.1, Hart. 2.4 pp 95-100
10/26	Proper morphisms	Vakil 10.3, Hart. 2.4 pp 100-105
10/29	Quasicoherent sheaves	Vakil 13.1,13.2
10/31	Invertible sheaves	Vakil 14.1
11/02	Weil divisors	Vakil 14.2
11/05	Cartier divisors	Vakil 14.3
11/07	Ample invertible sheaves	Vakil 16.6
11/09	Cohomology intro	Vakil 18.1
11/12	Čech cohomology	Vakil 18.2
11/14	Cohomology of line bundles on $\mathbb{P}^n$	Vakil 18.3
11/16	Riemann-Roch	Vakil 18.4, Hart. 4.1 pp 294-297
11/19	Genus	Vakil 18.4, Hart. 4.1 pp 294-297
11/21	Thanksgiving holiday	
11/23	Thanksgiving holiday	
11/26	Differentials	Hart. 2.8 pp 172-187
11/28	Serre duality	Hart. 3.7 pp 239-250
11/30	Classification of vector bundles on $\mathbb{P}^1$	Vakil 18.5