

Instructor: Christopher Eur (ceur@math.harvard.edu)

CA: Duc Vo (ducvo@math.harvard.edu)

Time and place: Tuesdays/Thursdays 9am~10:15am at Science Center 310

Office hours: Instructor: Thursdays 3pm~4pm in SC 239, CA: Mondays 4pm~5pm in SC Math Common Room (4th floor)

Textbook: We will closely follow *Algebraic Geometry* by Robin Hartshorne, online access available through [HOLLIS](#).

Prerequisites: Math 232a or equivalent.

Grades: Weekly homework (80%) and a project (20%). Weekly homework is due every Monday 11:59pm on Canvas. Students are encouraged to collaborate and come to office hours, but the write-up process must be done separately alone. The project can be: (i) a presentation on a topic not directly covered in class, or (ii) a demonstration of a Macaulay2 code written by the student.

Topics: We will roughly cover Hartshorne in the following order: II.5~II.8, III.1~III.7, IV.1~IV.6, III.8~12, (V if time allows).

Course outline:

| DATE | TOPIC | TEXT |
|--------------|--|--------------------|
| Jan 24 | Introduction, "Review" of quasi-coherent sheaves | II.5 |
| Jan 26 | Coherent sheaves, Dimensions | II.5 |
| Jan 31 | Line bundles, Cartier divisors | II.6 |
| Feb 2 | Weil Divisors, Maps to P^n | II.6, II.7 |
| Feb 7 | Ample line bundles, Linear systems | II.7 |
| Feb 9 | Blow-ups | II.7 |
| Feb 14 | Module of differentials, Nonsingular-ness | II.8 |
| Feb 16 | Sheaf of differentials | II.8 |
| Feb 21 | Applications of differentials | II.8 |
| Feb 23 | Derived Functors | III.1,2 |
| Feb 28 | Cohomology of affine schemes | III.3 |
| Mar 2 | ÄČech cohomology | III.4 |
| Mar 7 | Cohomology of projective spaces | III.5 |
| Mar 9 | Hilbert polynomials and degrees | I.7, III.5 |
| Spring Break | Project proposals due | |
| Mar 21 | (Video) Divisors on curves | II.6 |
| Mar 23 | (Video) Riemann-Roch theorem | IV.1 |
| Mar 28 | (Video) Hurwitz's theorem | IV.2 |
| Mar 30 | Embeddings in projective space 1 | IV.3 |
| Apr 4 | Embeddings in projective space 2 | IV.3 |
| Apr 6 | Plane models | IV.3 |
| Apr 11 | Canonical embeddings 1 | IV.5 |
| Apr 13 | Canonical embeddings 2 | IV.5 |
| Apr 18 | Space curves | IV.5, IV.6 |
| Apr 20 | Student presentations | Surfaces, K-theory |
| Apr 25 | Student presentations | MinDeg, Sites |

