

Mathematics 526 — Algebraic Topology II

Fall 2022

(1–2 MWF, in 447 Altgeld)

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Course description:

This is second semester course in algebraic topology. In the first semester (Math 525), invariants called homology groups were constructed in terms of the singular chain complex of a space. One of the themes of this course is thinking about the singular chain complex itself as a kind of invariant, from which other invariants (homology and cohomology groups, possibly with coefficients) can be derived, as well as additional structure on them (cup products, cohomology operations).

Homework: There will be approximately six homework assignments, to be given out approximately once every two weeks.

Prerequisites: Math 525, or instructor consent.

Texts: The primary text will be:

- Allen Hatcher, *Algebraic Topology*, Cambridge University Press, 2001. This book is also available for free at <http://www.math.cornell.edu/~hatcher/>

This will be supplemented with additional course notes. Other useful references include:

- Bredon, *Geometry and Topology*.
- Bott & Tu, *Differential Forms in Algebraic Topology*.
- Davis & Kirk, *Lecture notes in Algebraic Topology*.
- May, *A Consise Course in Algebraic Topology*.

Course topics:

The course will include the following topics.

- Singular cohomology.
- The cup product and the Künneth theorem.
- Čech cohomology and its relationship to singular cohomology.
- Poincaré Duality.

After this, some of the following topics may be covered, time and student interest permitting.

- Classifying spaces and characteristic classes.
- Spectral sequences and applications.
- Cohomology operations.
- Basic homotopy theory and homotopy groups.