# MATH M621: Algebraic Topology 1
# Fall 2022

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**Office hours:**
Tuesday 1:30-2:30
Friday 9:15-10:15
and by appointment.

**Textbook**:
Davis, Kirk, *Lecture Notes in Algebraic Topology*

I recommend that you buy a hardback copy. One can find an online version, but for some reason, the numbering of the exercises is off by 1, so if you use that, be careful that you do the right exercises. A secondary reference is the still unfinished second edition of Davis-Kirk.

The basic plan will be to cover Chapters 1-4, and some of Chapters 5 and 6. We will start with a quick review of singular and cellular homology (Chapter 1), and then proceed to discuss homology and cohomology with coefficients (Chapter 2). This will require developing the basics of homological algebra, which I view as a main point of the course – introducing homological algebra and category theory in context.

The diagonal map $X \to X \times X$ leads to a ring structure on the cohomology groups. This is the topic of Chapter 3. Chapter 4 switches to a geometric topic, that of fiber bundles – a subtle and important construction in topology, motivated by the tangent bundle of a smooth manifold. Chapter 4 connects homology with the fundamental group, and Chapter 5 abstracts the geometric concept of a fiber bundle with topological concept of a fibration. Chapter 6 develops the basics of homotopy theory, in particular, homotopy groups.

**How the course will be run**:

There will be no written homework or exams ! However, there will be *exercise days* where 6 or 8 students will be chosen at random to simultaneously present solutions to exercises (announced ahead of time). I will also ask students to pair up and present *projects* discussed at the end of the chapters of Davis-Kirk – these will be in meetings outside of class.