MATH 7520 Algebraic Topology

Fall 2002

Course Information

Course: MATH 7520 Algebraic Topology

Time and Place: Tuesday & Thursday, 1:40 - 3:00 PM, in 135 Lockett

Instructor: Dan Cohen

Prerequisites: MATH 7200 and MATH 7510, or the equivalents
The exposure to algebraic topology provided by MATH 7512 would be useful, but not absolutely essential.

Text: Elements of Algebraic Topology, by J. R. Munkres, Perseus Books, 1984
We will probably cover the first four chapters in the text, and some additional topics from other sources.

Course Description

A fundamental problem in topology is that of determining, for two spaces, whether or not they are topologically equivalent. The basic idea of algebraic topology is to associate algebraic objects (groups, rings, etc.) to a topological space in such a way that topologically equivalent spaces get assigned isomorphic objects. The fundamental group introduced in MATH 7512 is one example. Such algebraic objects are invariants of the space, and provide a means for distinguishing between topological spaces. Two spaces with inequivalent invariants cannot be topologically equivalent.

The focus of this course will be on homology theory (which complements the study of algebraic topology begun in MATH 7512). To a topological space, we will associate a sequence of abelian groups, called the homology groups. These homology groups are often more accessible than the fundamental group, so sometimes provide an easier means for distinguishing between topological spaces. We will concretely study simplicial and singular homology, the homology of CW-complexes, and related topic such as homology with coefficients, Mayer-Vietoris sequences, degrees of maps, and Euler characteristics. Geometric examples, including surfaces, projective spaces, lens spaces, etc., will be used to illustrate the techniques. We will also discuss a number of applications, including Brouwer and Lefschetz Fixed Point Theorems, and the Jordan Curve Theorem.

A continuation of this course will be offered in Spring 2003. There, we will study cohomology (dual to homology), and duality on (compact) manifolds.

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