

Math 168

Algebraic Topology
Course Information

Spring 2009

BLOCK: G+, MW, 1:30 -2:45 pm

INSTRUCTOR: Zbigniew Nitecki

EMAIL: zbigniew.nitecki@tufts.edu

OFFICE: Bromfield-Pearson 214

OFFICE HOURS: (Spring 2008) M 9:00-10:00 am, T 10:30-11:30 am, WF noon-1:00 pm

PHONE: 7-3843

PREREQUISITES: Math 135 and 145 or consent.

TEXT: John Stillwell, *Classical Topology and Combinatorial Group Theory* Springer Graduate Texts in Mathematics vol. 72, 2nd. ed, 1993. ISBN 978-0-387-97970-0

COURSE DESCRIPTION:

Algebraic topology grew out of several mathematical concerns in the late nineteenth century and played a central role in mathematics during the twentieth century. It seeks to encode certain qualitative geometric properties of spaces—e.g., the difference between a line and a circle, or between a sphere and a torus (surface of a doughnut)—in algebraic *invariants*: computable quantities that can distinguish spaces based on these properties. The recent highly-publicized proof by Perelman of the Poincare conjecture in dimension 3 concerned the extent to which certain algebraic invariants distinguish the three-dimensional sphere from other spaces. Although the original intent of algebraic topology was to study *spaces* using algebra—primarily *groups*—in recent years there has also been a movement in the other direction: studying properties of *groups* via the properties of *spaces*.

This course will serve as an introduction to this interplay between group theory and topology, primarily via the study of graphs and surfaces. Our primary object of study will be the *fundamental group* of a space, whose elements are closed curves in the space (identified via deformations). We will cover the classification of compact surfaces, covering spaces, and basic properties of fundamental groups, and hopefully we will also get to study the first homology group as well as the use of groups in the study of knots and braids. The textbook by Stillwell is a bit concise (but don't panic at the fact that it is designated as part of a "graduate texts" series: it was written for an undergraduate audience) but has among other virtues a strong sense of the historical roots of the subject, which I hope we will be able to consider at least in part.