Spring 2011
Math 8307: Algebraic Topology

Lectures: MWF 10:10–11:00 in Vincent Hall 301.

Tentative Office Hours: F 11:05–12:00pm and F 1:00–2:00pm in Vincent Hall 355.

E-mail: akhmedov@math.umn.edu

Text: Allen Hatcher, *Algebraic Topology*, Cambridge University Press 2002. The textbook is available at the University bookstore. Our textbook is also available free online, at http://www.math.cornell.edu/ hatcher/AT/ATpage.html

Prerequisites: Math 8306 or instructor's consent.

Course web page: www.math.umn.edu/~akhmedov/M8307.html

Course Outline: This is a second course in algebraic topology, a continuation of MATH 8306. The spring semester we plan to cover the remaining sections of Chapter 3 and Chapter 4 of the textbook. If time permits, I'll also discuss a few chapters (vector bundles, Stiefel-Whitney classes, Grassmann manifolds, etc) of the textbook *Characteristic Classes* by J. Milnor and J. Stasheff.

Grading: The course grade will be based on homework assignments, in-class presentation and a comprehensive take-home final, with the following weights:

Homework (50%)

In-Class Presentation (20%)

Take Home Final (30%)

Homework: There will be a weekly homework assignments. The homework will normally be due the following week. Each homework worth 10 points. *NO LATE HOMEWORK WILL BE ACCEPTED*. Most assignments will come from the course textbook, though occasionally I will assign additional problems. Please check the course webpage for homework assignments and due dates: www.math.umn.edu/~akhmedov/M8307.html

In-Class Presentation: Each student will be asked to give a presentation about a project related to the course. See below for a list of possible projects. I also encourage you to talk to me about your interests to find other possible projects.

Possible topics:

Cohomology of SO(n) (A. Hatcher, Section 3.D)

Cech Cohomology (R. Bott and L. Tu, R. Hartshorne, *Algebraic Geometry*)

K(G,1) Spaces and Graphs of Groups(A. Hatcher, Section 1.B)

Simplicial Approximation (A. Hatcher, Section 2.C)

H Spaces and Hopf Algebras (A. Hatcher, Section 3.C)

Cohomology of Sheaves (R. Hartshorne, *Algebraic Geometry*)

Smooth Structures on Spheres (J. Milnor, *Differentiable structures on spheres*, American Journal of Mathematics, 81 (4): 962 - 972)

Vector Fields and the Euler Characteristic (J. Milnor, *Topology from the Differentiable Viewpoint*, Section 6)

Morse Theory (Y. Matsumoto, *An Introduction to Morse Theory*, J. Milnor, *Morse Theory*)

Postnikov Towers (A. Hatcher, Section 4.3)

Bott Periodicity (A. Hatcher, *Vector Bundles and K-Theory*, Section 2.2)

Chern Classes (J. Milnor and J. Stasheff, Section 14)

Cobordism Ring (J. Milnor and J. Stasheff, Section 17; R. Stong, *Notes on cobordism theory*)

Oriented Bundles and the Euler Class (J. Milnor and J. Stasheff, Section 9)

Multiplicative Sequences and the Signature Theorem (J. Milnor and J. Stasheff, Section 19)

Stable Homotopy Groups of Spheres (D. Ravanel, *Complex Cobordism and Stable Homotopy Groups of Spheres*)

Cohomology of Fiber Bundles (A. Hatcher, Section 4D)

Final Exam: There will be a comprehensive take-home final examination which will worth 30% of the final course grade.