Math 250-01 Coxeter Groups and Hyperbolic Geometry Fall 2012
Course Information

Instructor: Genevieve Walsh
Genevieve's webpage: http://www.tufts.edu/∼gwalsh01/
Course meets: G+, Monday and Wednesday 10:30-11:45 pm, in BP 1.
Office: 213 BP
Office hours: Monday 3 - 4:30 pm Thursday 9-10:30 am
Course webpage: I will post material related to the class on my webpage above.
Text: There is no official text, but there are approximately 12 books on reserve at the library. (At this writing it was unclear if the library could get them all.) They are all highly recommended.

Prerequisites: Graduate standing or permission of the instructor

What is this course about? This course is designed to introduce students to research at the interface of hyperbolic geometry and geometric group theory. This is a huge and very active area, and the syllabus is tainted with my own personal preferences. Orbifolds and Coxeter groups are two subjects where the connection between hyperbolic geometry and geometric group theory is very evident, and we will explore these at length. Topics such as 2-dimensional hyperbolic geometry, knots, and 3-manifolds will be discussed to give intuition. We will also cover some very significant recent results. To allow students to pursue some of the other directions in this area, short student presentations will be given a couple of times during the semester and at the end of the semester.

Learning Objectives: As in the Arts and Sciences learning objectives, at http://ase.tufts.edu/faculty-committees/assessment/math.htm : Basic Understanding of Higher Mathematics: A,C,D,E. Written Communication: A,B. Oral Communication: A,B,C,D Research Skills: A,B

Important Dates:

- **University Holidays:** October 8, 2012 (Columbus Day) November 12, 2012 (Veterans' Day) November 21 - 23, 2012 (Thanksgiving)
- **Last Day to Drop Classes or Declare P/F:** Tuesday, October 9.
- **Monday Schedule:** Tuesday, October 9 will be a Monday schedule at Tufts.
- **Reading Period:** December 11-12

Homework: Homework will be given out roughly every two weeks. I will not officially collect this homework; it is for your own benefit and you are more than welcome to show me

your solutions or come talk to me about the problems. Occasionally, there will be problems marked with a star. These will be more difficult. As below, students who are taking the class for a grade are encouraged to give a short (30 minute) presentation or present some star problems.

Grading:

Class participation: % 40

Presentation of related topic or of solutions to star problems: % 60.

Students with disabilities: If you are requesting an accommodation due to a documented disability, you must register with the Disability Services Office at the beginning of the semester. To do so, call the Student Services Desk at 617-627-2000 to arrange an appointment with Linda Sullivan, Program Director of Disability Services.

Math 250 (Approximate! I mean it!) Schedule of Classes

Lecture 1: 9/5 2-dimensional orbifolds and 2-dimensional geometries
Lecture 2: 9/10 Hyperbolic geometry: Fuchsian groups
Lecture 3: 9/12 Introduction to 3-dimensional hyperbolic geometry
Lecture 4: 9/17 Hyperbolic geometry Kleinian groups
Lecture 5: 9/19 3-dimensional hyperbolic orbifolds
Lecture 6: 9/24 Problem/Presentation Day
Lecture 7: 9/26 Aspects of negative curvature in groups
Lecture 8: 10/01 Hyperbolic knot complements - the figure-8
Lecture 9: 10/03 Hyperbolic Dehn Filling
Lecture 10: 10/09 Hyperbolic geometry - the limit set and domain of discontinuity
Lecture 11: 10/10 Aspects of negative curvature in groups
Lecture 12: 10/15 Symmetries of hyperbolic manifolds and of hyperbolic knot complements
Lecture 13: 10/17 Commensurability
Lecture 14: 10/22 Reflection groups
Lecture 15: 10/24 CAT(0) Cubed geometry
Lecture 16: 10/29 Coxeter Groups
Lecture 17: 10/31 Coxeter Groups and cube complexes
Lecture 18: 11/5 Problem/Presentation Day
Lecture 19: 11/7 Sageev's complex
Lecture 20: 11/14 More on this complex
Lecture 21: 11/19 3-manifold theory: basics
Lecture 22: 11/26 3-manifold theory: geometrization
Lecture 23: 11/28 Covering spaces of manifolds and orbifolds
Lecture 24: 12/3 Surfaces in 3-manifolds: incompressible surfaces and fibers
Lecture 25: 12/5 Proof of the virtually Haken conjecture
Lecture 26: 12/10 Proof of the virtually Haken conjecture
More presentations will be scheduled during exam week.