

Math 310 Mathematics of Music, Spring 2010

Tuesday & Thursday, 1:00 - 2:00 p.m

Location TBA



Instructor : Rolf Ryham (ryham@rice.edu)

Textbook : Music: A Mathematical Offering, David J. Benson, Cambridge University Press

Course Description : This course will survey the many places in which mathematics plays a role in music. The topics and mathematical tools used are diverse; simple number theory in musical scales and tunings, differential equations in the physics of musical instruments and symmetry in music explained in terms of mathematical group theory. Throughout the course, Csound, a compiler language for creating sound, will be used to give concrete examples. Topics will include sound, harmonic motion, Fourier theory, Bessel

functions, eigenvalues of the Laplace operator, spectrum and the orchestra, scales, digital music and synthesis and mathematical group theory.

Some interesting questions we will address are

- What is sound, what dictates the sound of musical instruments?
- Can you "hear" the shape of a region?
- Why and how do you construct a 19, 24, 31 or 43 tone scale?
- How do you synthesize sounds which the ear doesn't find boring?
- What are the symmetries from this excerpt of Schoenberg?



References : CSound <http://www.csounds.com>

Prerequisites : Math 211 or Math 213 (or permission of the instructor).

Assignments and Grading Schedule : Assessment will be based on 10 (weekly) homework assignments, a midterm, final and project with weight

15% - Homework, 30% - Midterm, 30% - Final, 25% - Project.

Semester Project : The semester project will allow you to look more thoroughly into some aspect of the subject as well as to get some practice in technical writing and presentation. You will pick a topic which is interesting to you and which is narrow enough that you can gain more than a superficial knowledge in the time available. Each student will submit an abstract of a proposed topic. The report will be accompanied by a ten minute presentation during the last week(s) of class.