Mathematics and Music
Math 109/Music 109M
Spring 2002

Instructor: David Wright
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Office Hours: MWF 2:00-3:00

Class Meetings: MWF 1:00-2:00 in Life Sciences, Rm 118

Computer/Synthesizer Work Stations: Five work stations located in the Natural Sciences Learning Center, Life Sciences Rm 117, will be dedicated to the course. Each station has a Macintosh G3 computer connected via a MIDI interface to a Kurzweil K2600 synthesizer. Except for a few exceptional days, the hours for the lab are:

- M-Th: 9:00am - midnight
- F: 9:00am – 5:00pm
- Sat: 1:00pm – 6:00pm
- Sun: noon – midnight

Students should view the NSLC web page at www.nslc.wustl.edu for further information.

Equipment and Supplies: Students will need a scientific calculator with graphing and numerical integration capabilities. The TI-83 is recommended. In addition students will need one or more 100 MB zip disks (formatted for Mac or PC) on which to store compositions and projects, and perhaps a floppy disk (PC format) on which to store synthesizer configurations. (Purchase of the latter item can be delayed until it is needed.)

Text: No published text. Notes in math and music are in preparation. Chapters will be handed out and posted online as the course progresses.

Prerequisites: We assume familiarity with algebra, trigonometry, functions and graphs at the high school level. We assume familiarity with musical staffs, standard clefs, and key signatures.

Content: This course is a study of interrelationships between mathematics and music. It will review some background concepts in music and mathematics as they are encountered. Music concepts covered include diatonic and chromatic scales (standard and non-standard), intervals, rhythm, meter, form, chords, progressions, equal and
meantone temperament, just intonation, overtones, timbre, formants. Mathematical concepts covered include integers, rational and real numbers, equivalence relations, groups, rings, modular arithmetic, logarithms, periodic functions, and numerical integration.

**Goals:**
1. Understand relationships between mathematics and music.
2. Develop/enhance the students’ musical knowledge and creativity.
3. Develop/enhance the students’ skills in abstract reasoning and computation.
4. Integrate the students’ artistic and analytic skills.
5. Introduce the computer and synthesizer as interactive tools for musical creativity and mathematical computation.

**Exams:**

*In Class Exams:* February 8, March 15, April 12 (all Fridays)

*Final Exam:* Thursday, April 25, 10:30am-12:30pm

Legitimate excuses for missing an exam (such as verified illness or serious family emergency) must be approved, preferably in advance. In such cases there is no make-up exam. Instead, a grade for the missed exam will be calculated based on the other exam scores.

**Homework:** Assignments will be given out approximately every two weeks. The due dates of the assignments are: 1/16, 1/30, 2/13, 2/27, 3/20, 4/3, 4/17 (all Wednesdays). Each assignment will be collected in class, graded, and returned within a week. No late homework will be accepted. The two lowest homework scores will be dropped in calculating the homework score. Graded assignments will be returned with solutions.

**Project:** Each student is required to turn in a project consisting of one or more musical examples/compositions that demonstrate concepts learned in the course. Examples might employ non-standard scales, micro tuning, modular arithmetic, 12-tone (or n-tone) games, and/or created sounds. Various ideas for projects will be offered in class. The project should include audio examples in the form of mp3 files on a zip disk with accompanying hard copy of musical scores and/or documentation. The project is due on Friday, April 19 (the last day of class). Projects turned in late will receive half credit.

**Homework Grader and Assistant:** Alex Basson  
*Office:* Room 10, Cupples I  
*Office hours:* M 11-12 in Rm 10,  
Tu 4-6 in LS Rm117  
*E-mail:* alex@math.wustl.edu

**Grading:** The final grade will be based on the exams, homework, and project as follows: 1/2 weighting on the exams, 1/4 weighting on the homework, and 1/4 weighting on the project.