Math 307/507: Mathematics and Music

1. Scales and Musical Keys
   * Octaves and overtones
   * Harmonies and consonance
   * Classical scales in Western music
   * The diatonic scale and the circle of fifths
   * Other scales

2. Graphs of Pitch and Overtones over Time: Spectrograms
   * How musical gestures (tones, percussive strikes, etc) appear in spectrograms
   * Mathematical models for pure tones and instrumental tones
   * Localized analysis: spectrograms

Test 1

3. Spectrograms and Time-Frequency Analysis of Music
   * Spectrograms and singing
   * Spectrograms and analysis of tonal instruments
   * Analyzing musical compositions with spectrograms

4. Melody and Mathematics
   * Chord Progressions
   * Melodic Motives
   * Transformations of Melodic Motives, relation to chord progressions

5. Analyzing Rhythm
   * Relation between pitch classes and cyclic rhythm, mod arithmetic
   * Cyclic rhythms and the Euclidean algorithm
   * Measuring consonance and cyclic rhythm frequencies
   * Serialism, musical matrices

Test 2

6. Creating New Music
   * Electronic music
     – granular synthesis
     – phase vocoding
     – time-stretching and shrinking
   * MIDI synthesis

7. Final Essay
   * Analyzing music of your own choosing

8. Extra Credit
   * Neo-riemannian chord transformations
   * The Tonnetz, a network of chords and pitch classes
   * Tonnetz transformations and their applications to music theory