

Music 170 / ICAM 103: Problem Set #5 (due Oct. 30)

1. The harmonic overtone series (the ratios 1:2:3:...) defines a sequence of intervals between successive harmonics (first an octave, then a fifth, and so on.) Which is the first of these intervals that is less than a tempered whole tone? A tempered semitone?
2. In the just scale (Rossing page 179), C to E is a perfect major third and E to G is a perfect minor third. What other intervals arise between notes two apart in the scale (e.g., B and D)? Don't forget to look at the interval from B to D (not shown in the book because it wraps around to the next octave).
3. Two trumpets play the interval of a tritone (six half steps on the tempered scale). Two clarinets play the same interval (assume trumpets put out all partials and clarinets only make odd ones). Which is more dissonant, the two trumpets or the two clarinets? Why?
4. A series of bells has partials in a 5:3 ratio. Suppose you play an E, G, and C (in increasing order of pitch) on the tempered scale with these bells. This is called a C major triad, first inversion; the intervals are 3 and 5 half tones. Although the pitches all belong to a major chord, something sounds discordant. What are the relative frequencies of the 6 partials and where does the discord come from? Would the discord disappear if you played the chord in just intonation?
5. A particular piano note has two strings tuned almost to the same pitch, but detuned by $1/6$ Hz. Suppose all the partials of both strings are present and in phase with each other at the beginning of the note. Which partials should be present after 1 second? After 3 seconds?