Music 170 assignment 4

1. In the Western tempered scale, if A is tuned to 440 Hz., what is the frequency of the C below it?

2. What is the frequency of the same C, under the same conditions, using the just-intoned scale in C instead of the tempered one?

3. How many half-tones, in the Western tempered scale, are there between the fundamental and the seventh partial? If the fundamental is tuned to a note on the Western Scale, how far is the nearest note on the scale to the seventh partial?

4. How many distinct major thirds can be formed using the 7-note diatonic scale (in equal temperament)? (Count two of them as being 'the same' if they differ by an octave).

5. What is the frequency ratio (as an exact number) between B and the next F above it in the Western tempered scale?

6. How many half-tones is the syntonic comma (as defined in Section 4.4)?

Project: How much detuning makes an interval sound sour? This project is a test of the Helmholz theory of consonance and dissonance. The interval we'll work on is the fourth below 440 Hz. (and later, 220 Hz.)

First, using "sinusoid" objects, make a perfect fourth using the frequencies 440 and 330. You can connect them to the same "output" object so that they have the same amplitude as each other. Now drag the 330 Hz. tone down in frequency until, to your ears, the result starts to sound "sour". How many Hz. did you have to decrease the 330-Hz. tone to make it sour? (If it never sounds sour to you at all, just report that.)

Now do the same things with pulse trains. You'll need the "pulse" object which is in version 2 of the Music 170 library (a folder named m170-function-library-v2, uploaded Oct. 15) - if you have version 1 get the new one (and change Pd's path or your working directory accordingly). When you've got it updated you can type "pulse" into a box to make a pulse generator.

Make two of them, frequencies 440 and 330, with "BW" (bandwidth) set to 2000, and connect them to an "output" object as you did with the sinusoids. Now reduce the 330-Hz. one to 329. What do you hear?

Now reduce it further until it sounds sour. How many Hz. less than 330 did you have to go? Was it further away than the tempered fourth (329.628)?

One could think that the number of Hz. you have to mis-tune an interval to get sourness might be a constant or else that it might be a constant proportion (i.e., interval). To find out, repeat the experiment for 220 Hz. and 165 Hz. Again, decrease the lower frequency (165) until you think it sounds sour. How many Hz. did it take and is it more nearly the same frequency difference or the same proportion?