COS/MUS 314

Spectral madness!
Assignment due 28 April 2008**
** Start early: We'll be gone lots the weekend before and won't answer
your questions!

0. **Reading**
    a. Unit Analyzers in ChucK
    http://chuck.cs.princeton.edu/doc/language/uana.html
    b. LiSa tutorial and examples
    http://music.princeton.edu/~dan/LiSa/LiSa_tutorial.html
    http://wiki.cs.princeton.edu/index.php/LiSa_examples
    c. Perry's and Rebecca's examples at
    http://www.cs.princeton.edu/~prc/314/FFT/
    http://www.cs.princeton.edu/~fiebrink/314/features/

1. Define/describe, in your own words: (2.5 points)
    a. Window
    b. Hop size
    c. Bin
    d. Spectrum
    e. FFT size

2. Consider taking an FFT of the sound, transforming the spectrum in some way
(like Perry's examples), then taking an IFFT of the transformed spectrum and
playing it back (again, like Perry's examples).

Based on your knowledge of the FFT and IFFT (and perhaps some
experimentation in ChucK), what are the effects of executing the following
transformations of the spectrum? Describe what happens to the sound as best
you can, qualitatively and quantitatively. (2.5 points)
    a. Halving the values in all bins
    b. Doubling the values in the bins above 500Hz
    c. Shifting the spectrum up by 10 bins (e.g., bin 123's value is assigned to
bin 133)
    d. Setting all bins to be equal values
    e. Multiplying all bins below 300Hz and above 600Hz by 0, and leaving the
rest unchanged.

Bonus (1 point):
    f. Multiplying the n-th bin by the function function $\sin(2*pi*1/(2N)*n)$, where
N is the number of bins, for all n.
    g. What is the relationship of parts e and f above to *filters*?

3. Take a look at the code that Perry and Rebecca demoed in class. Steal freely from it. Pick one or more features (at least one has to be something other than FFT spectrum) that capture some interesting aspect of the sound. Extract it in real-time from the adc.

No do something COOL with it! (e.g., use it to drive some synthesis parameter, structure of your piece, LiSa parameters, ….) (5 points)

Need some ideas? Detect onsets, follow pitch, vowel or loudness, ….

Written part: In a few sentences, describe why you picked the feature(s) you did, and how you used it/them.

4. Bonus question (1 point): Do something cool and different using LiSa, and record it and show it to the class.

What to hand in:
- Your answers to questions 1 and 2, and the written part of question 3
- Zip of ChucK code for Question 3
- Sound file of a recording you made for Question 3
- Optional code + recording for Question 4

Be ready to demo in class!