Music 147 - Topics, Lessons, and Activities (Brainstorm)

# HTML, CSS and JavaScript - Basics

Essential HTML (tags)

Essential CSS (styles)

# Music Theory for Programmers

• Pitch and frequency: What is frequency? What is a complex tone? What is a harmonic tone? What is the harmonic series? What is fundamental frequency? What is pitch? What is a (chromatic) scale? How are the frequencies of the equal tempered twelve-tone scale derived?)

• MIDI note numbers

• Pitch classes

• Keys, scales, chords

• Rhythm: Duration (time units), inter-onset interval, beat (periodic occurrences of onsets), tempo, tempo-relative timing, divisions of beats, groupings of beats (meter and time signature), underlying pulse, ticks, the standard sixteen-pulse grid/sequencer, syncopation, backbeat.

Form/structure?

# Fundamentals of Digital Audio

# Fundamentals of Synthesis

• Generating a sinusoid mathematically

• Filling and using a wavetable: allocating memory, filling memory, lookup, increments for obtaining frequencies, interpolation methods (linear, polynomial, etc.)

• The Music-N unit generator model: compare with the modular analog synthesizer  
• Envelope generator: ADSR as applied to amplitude and eventually other parameters

• Modulation: LFO, classic waveforms

• Amplitude modulation: tremolo, ring modulation

• Frequency modulation: vibrato, bend/portamento, audio-rate FM synthesis

• Additive synthesis

• Hybrid synthesis (eventually, after sampling)

• Subtractive synthesis (eventually, after filters)

• Waveshaping

• Phase distortion  
• Granular synthesis

# Sampling

AIFF/WAVE file format

Recording into a sound file

Recording into RAM  
Simple playback

Altered playback

Granulation, concatenative synthesis

# Delay and delay-based effects

Circular buffer (understanding, building, using)

Delay usages: short, medium, long (5-20, 20-200, 200-2000ms)

Comb filtering (<30ms with feedback)

Flanging

Chorusing

Reverberation

* Schroeder model
* Feedback delay network model
* Impulse response convolution

# Filters

# MIDI

# Max/MSP Basics

# Web Audio

# Other

• Basic wave types (sine, square, triangle, saw)

• Basic noise types (white, pink, brown, etc)

• Using basic waves or noise as control oscillators

• Randomness, filtering randomness

• MIDI (Musical Instrument Digital Interface)

• Algorithmic composition

• Interface and design issues in audio and music software

• Programming audio processes in Max/MSP

• Programming audio in HTML 5 with the Web Audio API

• Managing audio and MIDI file formats

• Managing I/O streams

• Interpolation, for both audio and control signals:

* For control signals: linear, exponential, spline, easing functions, etc.
* For audio: 2-point and 4-point polynomial

• Control functions and low-frequency oscillators for frequency and amplitude modulation

• Windows and envelopes in the time domain

• Convolution

• Panning, localization, and spatialization

• Amplitude compression and expansion

• Fourier analysis and resynthesis, cross-synthesis, and time compression/expansion

# Potential Tasks (i.e. HW assignments)

-Web-based keyboard

-Guitar hero clone (play sound files, synchronize timing)

-Voice memo app (to learn how to record)

-OWL Pedal? (make a guitar effect? Works with pd, Gen, and C I think)

-Make a generative/algorithmic composition that will run (and stop itself) with the click of a button

-Control the ‘amount’ of randomness in a given system (totally random pitch to a set scale?)

-Create a series of modular effects (delay, chorus, flanger, etc) than can be turned on and off

-Be able to control ‘degrees of randomness’ within a patch

-GUI exercises (make a patch that is intuitive or able to be used by a complete stranger)