Digital Signal Processing for Music

Part 0: Meta

Andrew Beck

Contact Info

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Class Info

- Completely asynchronous for maximum flexibility!
- M 3:30-4:45pm virtual group office hours
- W 3:30-4:45pm optional in-person in WV175

Resources

Canvas is the main hub

Class Goals

1. Ability to comprehend typical representations of digital systems such as block diagrams and difference equations,
2. understanding of typical transforms in DSP such as the Fourier transform or the Z-transform,
3. ability to use this understanding to design audio processing systems such as audio effects, and
4. ability to implement such design in a programming language such as Python.

Class Requirements

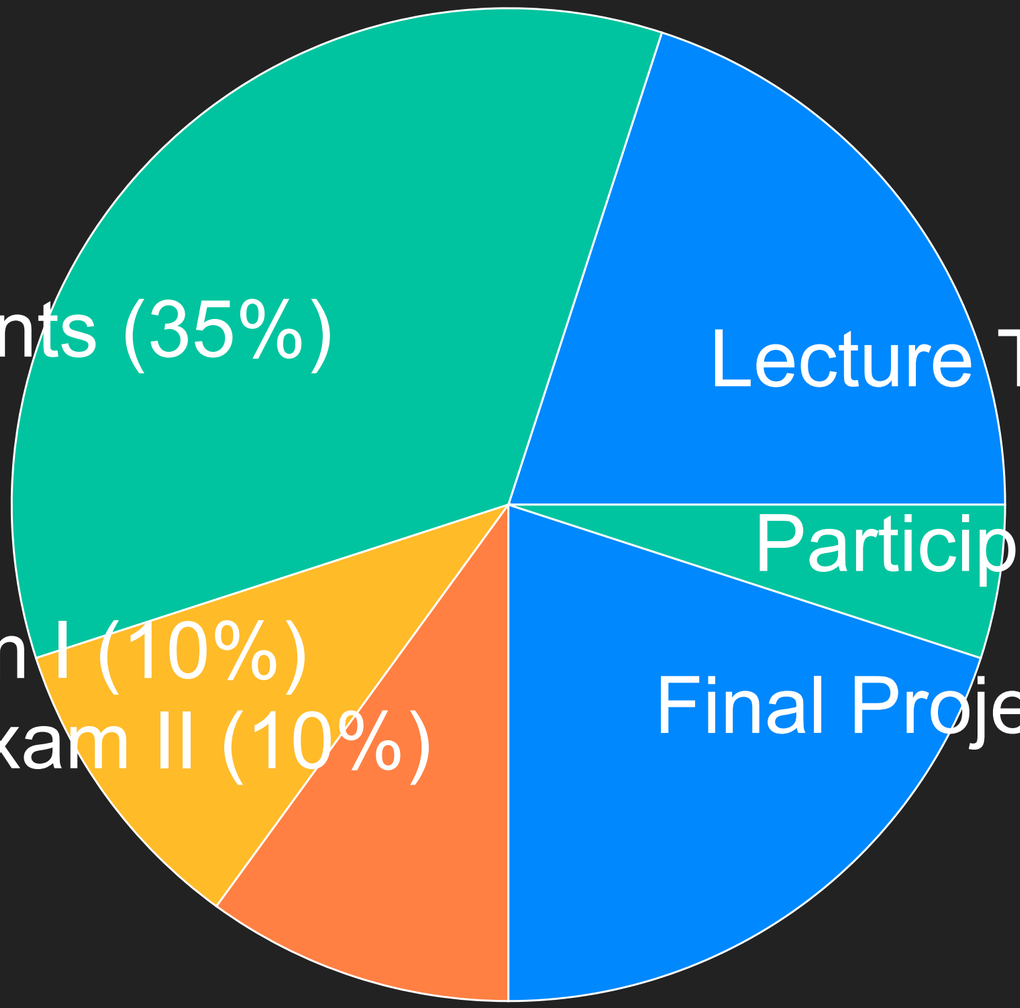
- Math
- Rudimentary programming skills, familiarity with Python

Date	Topics	Exercise	Assignment	Notes
01/18	Introduction, signals, periodicity, random processes		Git Setup	MLK Holiday
01/25	pdf, expectation values/moments, correlation, Convolution, power spectral density	Correlation & FIR Filter	Filter & Convolution	
02/01	Fourier series & Fourier transform	DFT	Fourier Analysis	
02/08	Sampling, quantization, SNR, number formats	Quantization		
02/15	Oversampling, dither, noise-shaping, non-linear quantization		Dither, ns	
02/22	Z-Tranform, digital audio filters, FIR/IIR, FFT filtering	Biquad Filter	Midterm I	
03/01	Sample Rate Conversion, Real-time systems	Resampling		
03/08	Delay-based FX and reverb	Virbrato	Mod. FX	
03/15	Dynamics Processing	PPM	Limiter	
03/22	Time-Segment Processing (OLA)	OLA		No Class Wednesday
03/29	Phase-Vocoder		Phase-Vocoder	
04/05	Source Coding: LPC, ADPCM, Huffman, AAC			Midterm II
04/12	Design and Application			
04/19	Denoising			
04/26	Final Project Presentations			

Recommended Reading

Mathematical Context	Zölzer, Udo (2008) *Digital Audio Signal Processing*, Wiley
DSP Overview	Smith, Steven W. (1997)*The Scientist and Engineer's Guide to Digital Signal Processing*, CA Tech. Pub
Implementation	Pirkle, Will (2012) *Designing Audio Effect Plug-Ins in C++: With Digital Audio Signal Processing Theory*, Focal Press
Architecture & Creative Context	Roads, Curtis (1996) *The Computer Music Tutorial*, MIT Press

Assessment


Assignments (35%)
Lecture Tests (20%)
Participation (5%)
Midterm Exam I (10%)
Midterm Exam II (10%)
Final Project (20%)

Next Steps

1. Install Python3 --- *Dependencies: SciPy, NumPy and PyPlot*
2. Create a public git repo (on Github or your preferred host) **--- It is your responsibility to make sure we can access it before any deadlines**
3. Buckle up