

# Music 270a: Digital Audio Processing

## Fall 2019

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## Course Information

### Meeting Time and Place

(Meeting Dates: 09/30/2019 - 12/02/2019)

**Lecture:** Monday 2:00PM - 4:50PM, CPMC 367.

**Office hours:** by appointment, CPMC 233.

**HOLIDAYS (no class):**

- Nov. 11 (week 7), Veterans Day

### Course Description

This course introduces the fundamentals of digital audio and sampling theory, digital techniques for analysis, sound synthesis/processing algorithms, and basic digital filter theory. Understanding of theoretical concepts will be consolidated through practical programming assignments in Matlab.

### Prerequisites

Music 171 and 172, equivalent, or permission from instructor.

### Grading

- Assignments 30%

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- Project presentations (preliminary and final) and class participation 20%
  - Project 50%

## Required Textbooks

- Music 270a on-line notes.

## Resources

Matlab is available in the Music Lab, the Library, the Price Center, and any number of labs across the campus managed by ACMS. A list of the general access labs on campus is available here.

## Reference

- A Digital Signal Processing Primer, Ken Steiglitz, Addison Wesley, 1996, 9780805316841

## Schedule and Online Lecture Notes (subject to change)

- Week 1
  - Review: Sound and Audio:
  - Sinusoids: sine/cosine functions, sinusoids and circular motion, projection.
- Week 2
  - Digital Audio: sampled sinusoids, sampling/quantization, Nyquist sampling theorem.
  - Matlab Tutorial 1
  - Matlab Tutorial 2
- Week 3
  - Complex Exponentials and Spectral Representation: Euler's formula, Hilbert transform.
- Week 4
  - Complex Exponentials and Spectral Representation: DFT, LTI systems.
  - Matlab Tutorial 3
- Week 5

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- Modulation: amplitude and frequency modulation.
  - FM examples: bell.m, fmclar.m, adsr.m, twocarbrass.m,
  - Week 6
    - Waveshaping: waveshaping synthesis
  - Week 7
    - Digital Filters: digital filters, simple lowpass, z-transfers, poles and zeros, biquad section
    - Paper presentations (presentation of literature related to project).
  - Week 8
    - Digital Filters II:
  - Week 9
    - Signal Analysis: envelope follower, peak detection, linear prediction (LPC), cross synthesis,
  - Week 10
    - Project presentations.

## Assignments

Assignments will be handed out and due every Monday.

- Assignment 1, **due Monday, October 14, 2019.**
  - We will go over solutions in class.
- Assignment 2, **due Monday, October 21, 2019.**
  - BbClar\_ff\_D3.wav
- Assignment 3, **due Monday, November 4, 2019.**
- Assignment 4,
  - Instrument sounds are available at <http://theremin.music.uiowa.edu/MIS.html>
- Assignment 5), **optional**

## Projects

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To be presented on the final day of class or during exam week (TBD in class). Preliminary project presentations will be week 6.