# Music 120
# Introduction to Audio / Multimedia Application Programming

**(Officially titled as "Auditory Remapping of Bioinformatics")**

## Instructor

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## Time and Place

Lecture: Monday, 1:15~3:05
Lab: Wednesday, 1:15~3:05
Knoll Seminar Room (660 Lomita Dr.)

## Course Website

http://ccrma.stanford.edu/courses/120/

## Introduction

This year's Music 120 is an introduction to various topics of audio/multimedia programming. We explore the basics of programming tools and environments, software libraries, graphic user interface design, audio plug-in architecture, and network communication.
As an introductory course, it is primarily targeted at musicians, artists, and/or entry-level programmers who want to develop their own softwares. On the other hand, it provides an overview of audio/multimedia programming topics to advanced programmers.

This course is also designed to serve as a series of practical programming tutorial sessions for a number of courses offered at the Center for Computer Research in Music and Acoustics (CCRMA).

## Outline of Topics:

**Programming:**

- Basic concepts of C/C++
- Integrated Development Environments (IDE)
- GUI design and implementation: Cocoa, Qt

**Audio:**

- Audio software design issue
- Audio APIs: Stk
- Introductory Audio DSP

**Audio Plug-ins:**

- VST plug-ins
- Max/MSP and/or Pd externals

**Visual/Multimedia:**

- Graphic APIs and basic drawing programming
- Multimedia application: merging audio with visual
- Sonification and visualization

**Network communication:**

- Audio streaming
- Open Sound Control (OSC)

## Pre-requisites

Beginner or intermediate level programming skill in C/C++. Given its introductory nature, this course is designed to be suitable for people without much software engineering background, and will cover some important programming topics in class. Please contact the instructor if you have any questions regarding your programming experience.

Some familiarity with graphic user interface libraries, such as Cocoa (OS X) or Qt will also help, but is not required.

## Homework

Students will be given two programming assignments. These assignments will involve the topics covered in class, and will require programming in C, C++, and/or Objective-C languages on Macintosh or Linux platform. For each assignment, detailed in-class demos and template projects will be provided.

## Final Project

For students who sign up for more than one unit, there will also be a final project with presentation. Your project will be in place of a formal final exam, and can be on any topic related to lectures and assignments. A one-page project proposal is due by the 7th week.

## Grading

Grading will be based on in-class participation, homework, and final project presentation.

## Course Materials

There is no required textbook: weekly reading materials will be posted on course website, or handed out in class.

## Weekly Schedule

### Week 1: Introduction

- Course overview & application demos

### Week 2: Audio Programming (1)

- C/C++ review
- Digital audio basics
- Overview of audio APIs: Stk and RtAudio

**- Assignment #1 (due in two weeks)**

### Week 3: Audio Programming (2)

- Callback function / Duplex mode
- Audio effect & DSP basics
- Stk effect/instrument classes
- Error handling
- (optional: FFTW)

### Week 4: Plug-ins

- IDE: Xcode
- VST SDK
- (optional: Pd and/or Max/MSP externals)

**- Assignment #2 (due in three weeks)**

### Week 5: GUI (1) - Qt

- Overview of GUI programming
- Qt API & Qt designer
- Stk & Qt

### Week 6: GUI (2) - Cocoa

- Cocoa API & Interface Builder
- Objective-C

### Week 7: GUI Programming & MVC

- More on GUI programming
- Model, view, & controller (MVC) model
- Images/OpenGL with Cocoa

**- Final project proposal due**

### Week 8: Image & Graphics with Sound

- Mappings between audio and visual domain: sonification and visualization
- Application demo: SonART
- (optional: iTunes plug-in)

### Week 9: Network Communications

- Audio streaming over network
- Open Sound Control (OSC)

### Week 10: Final Project Presentation