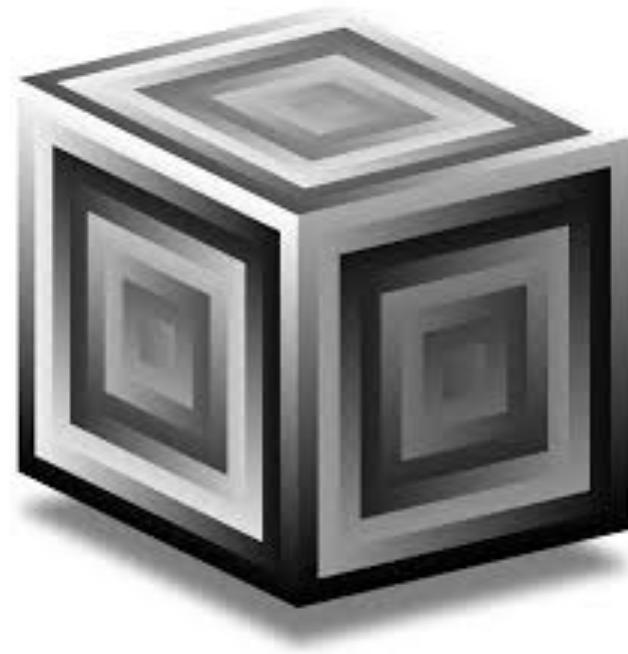


# CS203: Computer Music

# Topics Addressed

- What is CS203?
- Course Logistics
- Prerequisites
- The SuperCollider Language



# What is CS203?

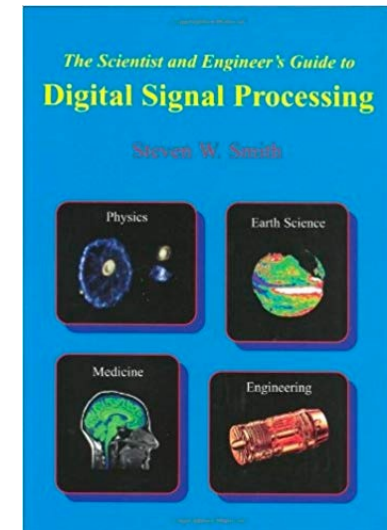
- CS203 is an interdisciplinary course combining concepts and tools from a variety of different subjects:
  - Digital Signal Processing – will define momentarily
  - Music
  - Computer Science
  - Mathematics
- What is the goal of CS203? Just a few of them...
  - To learn the principles of computer music through mathematics, computer science, digital signal processing, and the SuperCollider language
  - To explore and improve your creativity through the discipline of computer music

# What is Computer Music?

- The ever trustworthy Wikipedia... “the application of computing technology in music composition, to help human composers create new music or to have computers independently create music, such as with algorithmic composition programs.”
  - Pretty decent definition – but also incorporates fields like psychoacoustic research, music theory, musicology, etc...
  - It’s interdisciplinary!
  - Computer Music seeks to leverage the power of computing for a variety of musical applications, not only compositional ones. We use **algorithms** to solve musical problems!
- Computer Music is a subset of Electronic Music
  - What is electronic music? Essentially leveraging the power of all electronic devices, including computers.
  - Most people use the terms interchangeably
- Interesting TED Talk on Computer Music: <https://www.youtube.com/watch?v=S-T8kcSRLLO>

# What is Digital Signal Processing?

- Digital Signal Processing is the technique of representing and manipulating signals (like audio) in a digital context (like a computer)
- Topics:
  - Delay
  - Filters
  - Reverb
  - Unit Generators
  - Modulation
  - So much more...
- A complex and varied field that applies not only to audio signals but video and images and many other media and disciplines.



# What is Digital Signal Processing?



Digital Signal Processing is the collection of techniques that allow your favorite musical applications to create the songs you listen to every day!



# Math and Digital Signal Processing

- Many of the techniques for digital signal processing can be expressed and analyzed through mathematics for both analog and digital signals.
- Math gives us a rigorous theory to deepen and improve our understanding of digital signal techniques
- What math do I need to know?
  - For this class: a good understanding of trigonometry and precalculus
  - Beyond: multivariable calculus, differential equations, complex numbers/analysis, etc...



# What will you do in CS203?

- Write music through code
- Learn the foundations of sound synthesis and how to create the audio effects used on nearly all music you hear today
- Create your own digital audio effects
- Learn the mathematical underpinnings of digital signal processing to strengthen and deepen your knowledge of how to create music digitally
- Learn other core computer science topics like protocols and networking through the medium of computer music



# Coursework

- **Final Project:** a musical composition in the SuperCollider language or a research paper that demonstrates your creativity and your understanding of computer music theory and techniques
- **Assignments:** weekly assignments drawing on material from the previous week(s). An amalgam of coding, math, and creativity.
  - Warmups
  - Exercises
  - Challenges
- **Midterm:** one midterm on the first half of the course material. No final!

# Course Prerequisites

- See website for more details.
- A solid foundation of trigonometry and precalculus. Calculus can be helpful for getting a more complete picture during our discussion of Fourier transforms though not necessary.
- A background in music:
  - **Required: Ability to read music and rhythms**
  - Helpful: knowledge of scales, chords
- CS111: I assume knowledge of programming concepts like functions, data structures, variables, types, etc.

Info Depot

<http://cs.wellesley.edu/~cs203/>

# Math Prereqs

- A complete understanding of sine and cosine and their transformations
  - Understanding of the unit circle
  - Understanding of trigonometric identities
- Summation notation
- Complex Numbers
- Checkout the math review I have created for this class at <http://cs.wellesley.edu/~cs203/tools/>. You should read through this THOROUGHLY and make sure you have the requisite math knowledge before proceeding in this class.

# Tools/Resources for CS203

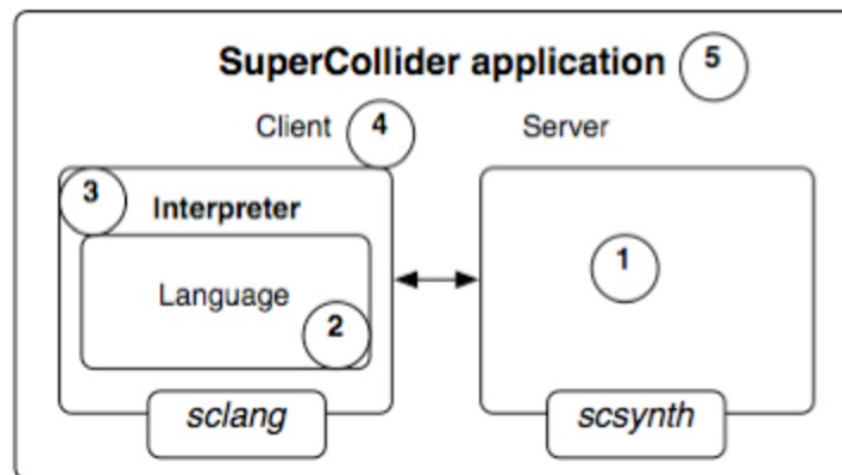
- SuperCollider: an audio programming language and platform devoted to implementing and creating computer music tools/composition
- Gradescope: online submission platform for assignments
- **Optional:** Jupyter Notebook kernel for the SuperCollider language
- Need Help?
  - We have two wonderful tutors: Nina Goodman and Grace Jiang.
  - I hold office hours.
  - **NEW:** lab!

# What is SuperCollider?

- SuperCollider is a platform specifically designed to support real-time and algorithmic music.
- SuperCollider comprises two main components:
  - A programming language: slang
  - An audio server: scsynth
- The programming language slang is capable of processing data just like any other language like Python, Java, C, etc. But it also provides an interface to communicate with an audio server like scsynth.
- scsynth is an audio server that responds to messages across a network to produce audio. It features “400+ unit generators”.
- Visit SuperCollider’s homepage: <https://supercollider.github.io/>

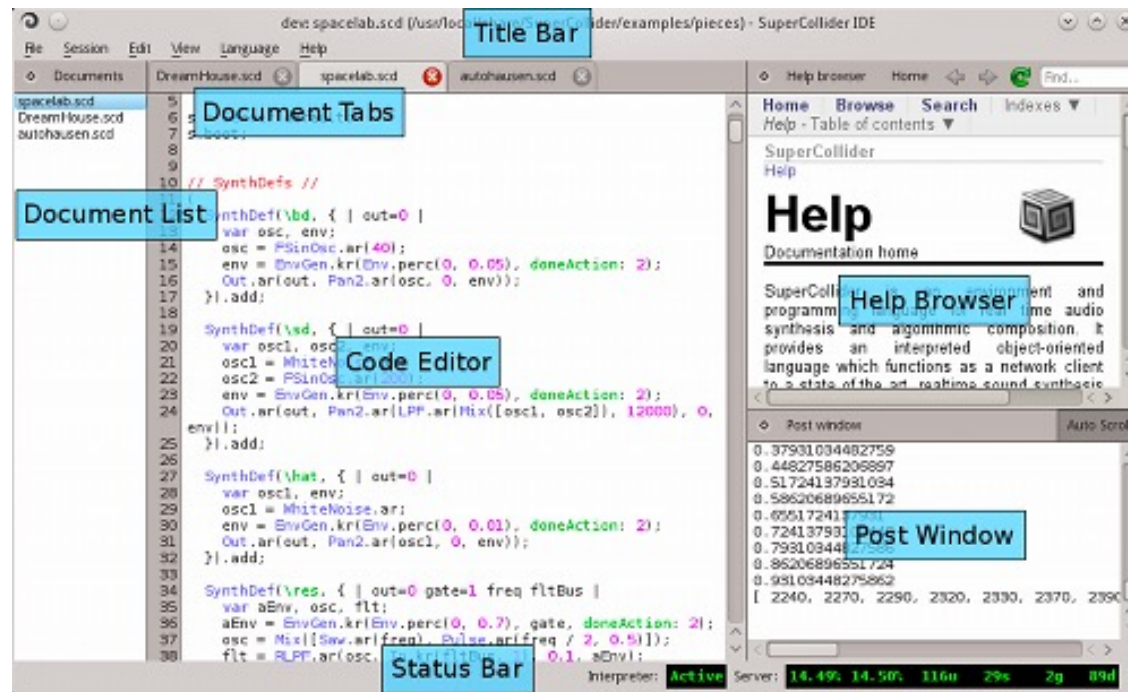
# What is SuperCollider?

- 1) An audio server
- 2) An audio programming language
- 3) An interpreter for the language, i.e., a program able to interpret it
- 4) The interpreter as a client for the server
- 5) The application includes the two programs and provided functionality to communicate between the two



The client and the server communicate through a protocol called Open Sound Control across a network (usually localhost).

# The SuperCollider IDE





# How do I get SuperCollider?

- Visit: <https://supercollider.github.io/download>
- See course website for instructions.
- Make sure to download 3.10.x or greater