C PROGRAMMING FOR MUSIC TECHNOLOGY Syllabus – Spring 2023

COURSE INFORMATION

INSTRUCTOR: Schuyler Quackenbush EMAIL: srq1@nyu.edu OFFICE HOURS: On Request (Zoom)

OVERVIEW

- MPATE-GE 2618: C Programming for Music Technology (Lecture)
- Students must also register for Lab: MPATE-GE 2617
- Spring 2023, 3 Credits
- Lab Co-Requisite: 1 Credit
- C Programming Introduction with emphasis on audio applications
- Meeting times:

Tu 12 N – 1:40 PM (Lecture) Thu 3 :30 PM – 4 :45 PM (Lab)

COURSE DESCRIPTION

This is a comprehensive graduate-level introductory course to the C programming language, with an emphasis on applications for music. No prior programming experience is required or assumed. Coding assignments and lectures cover fundamental programming topics including software design, basic algorithms, data structures, and common audio libraries.

LEARNING OUTCOMES

UPON COMPLETION OF THE COURSE, STUDENTS WILL BE ABLE TO:

- Implement C programming syntax, primitive types, iteration and looping, conditional expressions, functions, arrays, pointers, dynamic memory allocation, standard libraries.
- Develop software applications encompassing problem decomposition, abstraction, data structures, implementation, debugging, and testing.
- Analyze and code common computer science algorithms.
- Understand data representations for audio signal processing and audio applications.
- Use common C libraries for audio applications.

COURSE REQUIREMENTS

CLASS PARTICIPATION

Course attendance is mandatory. Lateness or absences should be reported to the instructor before they occur.

ASSIGNMENTS

Students will have seven (7) programming assignments ("Problem Sets"). Grading rubrics for each assignment will be provided to the students. Students will have at least one week to complete assignments. Problem sets will be distributed via NYU Brightspace, and each will have a posted due date and time. Students should post completed assignments via the same NYU Brightspace Assignment mechanism.

Note: Late submissions will lose 10 points.

QUIZES, EXAMS

There will be no exams. There may be oral or written quizes.

SUGGESTED READINGS

- Programming in C, Fourth Edition by Stephen Kochan
- Absolute Beginner's Guide to C, Second Edition by Greg Perry
- DAFX, Digital Audio Effects, 2011 or 2012 editions, by Udo Zölzer

There is no required textbook.

PREREQUISITES

None

CO-REQUISITES

Lab time is an opportunity to work on problem sets and ask questions. Please have your computer available for each lab session.

• MPATE-GE 2617: C Programming for Music Technology Lab

REQUIRED COURSE MATERIALS

- A computer with Internet access
- MacOS (preferred), Windows, or Linux

GRADING

The grade for this course will be determined according to the following score percentages:

ASSIGNMENTS/ACTIVITIE	% OF FINAL GRADI
Homeworks	100%

Topics Covered

Unit 1: C-language statements

Introduction to Programming

- Programming Problem Statement
- Algorithms
- C and Other Languages
- Reserved Words in C
- Setting up programming environment
- "Hello, World!"

Basic Data Types, Variables, and Operators

- Introduction to strong typing
- Declaring variables
- Basic arithmetic operations

Flow of Program Execution

- Logic and looping
- Switch statements and breaking out of a loop

Pointers and Arrays

- Declaring and accessing arrays
- Pointers

Assignment PS01: Loops, Arrays, Strings

Review

Unit 2: Command line, Functions, File I/O, Structures and Memory allocation

Command Line and Functions

- main() and command line arguments
- Functions
- Recursion

Assignment PS02: Maze and Command Line Calculator

File I/0, Memory allocation

- Read/write files in text and binary
- Memory allocation

Structures, Sorting

- Structures, arrays of structures and advanced operators
- Sorting data

Assignment PS03: Structures and Sorting

Searching

- Searching data
- Time Complexity

Assignment PS04: Linear, binary search

Review

Unit 3: Using Audio Libraries

Installing and using libraries

- Introduction to sndfile
- Reading and writing audio files with sndfile library
- Introduce portaudio and callbacks

Assignment PS05: Playout of WAV file

Unit 4: Audio Applications

Digital Filtering

- Implementing FIR and IIR digital filters
- Real-time filtering in portaudio callback
- Threads
- FFT-based convolution and reverberation

Assignment PS06: FIR digital filter

Synthesizers

- Play multiple tones in real-time using a computer keyboard
- Implement attack and decay envelope

Assignment PS07: Synthesizer

Audio effects

• Overview of audio effects

Architectural Acoustics

- Simple model of early arrivals
- Model for reverberation

Review

COURSE POLICIES

Laptops During Class

Please bring your laptop to each class. The class will be taught in person, but all lecture slides will be made available for students.

Student Conduct

Please be respectful of your fellow students. An open, inclusive environment will help foster a more productive and positive learning experience. Please let the instructor know if you have any questions or concerns at any point during the semester.

Attendance and Tardiness

Attendance is mandatory. Don't be late.

Incomplete Grade Policy

See the instructor if this applies to you.

DISABILITY DISCLOSURE STATEMENT

Academic accommodations are available for students with disabilities. Please contact the Moses Center for Students with Disabilities (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

STATEMENT ON ACADEMIC INTEGRITY

The relationship between students and faculty is the keystone of the educational experience in The Steinhardt School of Culture, Education, and Human Development at New York University. This relationship takes an honor code for granted. Mutual trust, respect, and responsibility are foundational requirements. Thus, how you learn is as important as what you learn. A university education aims not only to produce high-quality scholars but to also cultivate honorable citizens.

Academic integrity is the guiding principle for all that you do; from taking exams, making oral presentations to writing term papers. It requires that you recognize and acknowledge information derived from others, and take credit only for ideas and work that are yours. All students will be held to the standards set forth by the university and if found in violation of this policy will be subject to disciplinary action. Review the full university policy on academic integrity here:

https://steinhardt.nyu.edu/statement-academic-integrity

RESOURCES

Access your course materials: <u>NYU Brightspace</u> (brightspace.nyu.edu) Databases, journal articles, and more: <u>Bobst Library</u> (library.nyu.edu) Assistance with strengthening your writing: <u>NYU Writing Center</u> (nyu.mywconline.com) Obtain 24/7 technology assistance: <u>IT Service Desk</u> (nyu.edu/it/servicedesk) <u>University Policy on Academic Integrity</u> <u>Moses Center for Students with Disabilities</u>