MUSI 6106: Audio Software Engineering

Syllabus

Spring 2018

Course Details

class time	MW 3:00–4:15pm
location	WV 163
credits	3 credit hours

Instructor Information

name	Alexander Lerch
email	alexander.lerch@gatech.edu
location	Couch 205 (840 McMillan St)
office hours	by online appointment (https://calendly.com/alexanderlerch)

1 General Information

1.1 Course Description

Introduction to software engineering for audio-related software projects. This course covers the main aspects of software production covering general software design, implementation, and software maintenance with a focus on more audio-specific problems such as real-time software requirements and performance analysis. Assignments and projects provide hands-on experience on the software development process.

1.2 Prerequisites

The course will be open to any interested students in the Music Tech MS and PhD programs. Prior coursework or experience in programming is expected, experience in C++ and software engineering is recommended, and experience in audio signal processing will be useful.

1.3 Learning Outcomes

After successful completion of the class, the students will be able to

- explain and apply fundamental concepts of object oriented programming in C++,

- describe and provide solutions for typical problems programming of audio and real-time systems, and

- implement audio plugins and audio software in general.

2 Grading

The overall grade consists of:

project — scope and code	25%
project — mid-term presentation	5%
project — final presentation	10%
project — video presentation	5%
assignment 1: comb filter class	10%
assignment 2: vibrato class	10%
assignment 3: vibrato plugin	10%
assignment 4: real-time peak meter	10%
assignment 5: fast convolution	10%
class participation	5%

The grades for all tasks will be released latest two weeks after the due date (if submitted on time).

2.1 Description of Graded Components

- **assignments**:
  All assignments will require C++ programming of the topic and corresponding test files.

- **participation:**
  Participation in class and in the forum with questions and answers.

- **project:**
  Each group (2 students) will work on a class project. The project has to be implemented in C++. It can be an audio plugin, an app, or a stand-alone application. The project will be done in groups of two, unless discussed otherwise with the instructor. The deliverables have to include a note or text file indicating each student's individual contributions.

2.2 Grading and Grading Policies

All graded components will be graded in points. The final grade for the course will be determined by dividing the total points earned by the number of points possible for each of the categories listed above.

These numbers will be converted into a letter grade according to the following scale:

A	100–90%
B	89–80%
C	79–70%
D	69–60%
F	59% and below

Grades may be assigned per group or individually as announced (e.g., projects are in some cases per group, quizzes are usually per individual).

3 Course Materials

3.1 Course Text

There will be no specific text book accompanying the course, but the assignments will be partly based on Matlab code from the following book

Zoelzer, U. (Ed)	"DAFX — Digital Audio Effects" (2011), John Wiley & Sons, 2nd Edition, ISBN: 978-0-470-66599-2

3.2 Recommended Reading

The following books are recommended:

Sutter, H. and Alexandrescu, A.	"C++ Coding Standards. 101 Rules, Guidelines, and Best Practices" (2004). Pearson Education, ISBN: 0-32-111358-6
Meyers, S.	"Effective C++: 55 Specific Ways to Improve Your Programs and Designs" (2005), Addison-Wesley Professional, 3rd Edition, ISBN: 978-0321334879

3.3 Software

The assignments, project work, and in-class exercises will be done in C++ in the environment of choice (e.g., Visual Studio, XCode, etc.). Basic familiarity with such tools is expected. Other tools such as CMake, UnitTest++, etc., will be introduced in class.
Additional tools and programming languages can be used if approved by the instructor.

4 Course Expectations & Guidelines

4.1 Course Schedule

week	topic	assignment	exercises
1	introduction		
2	C++ fundamentals		
3	C++ fundamentals	assignment 1	read/write audio files
4	audio programming concepts — buffering and overlap, ringbuffers		ringbuffer
5	project proposal and discussion	assignment 2	MA filter
6	fault prevention, detection, and testing		unit testing
7	object orientation and APIs	assignment 3	class interface design
8	software design and coding style		
9	plugin interfaces and JUCE		demo plugin
10	mid-term project presentation and discussion	assignment 4	
11			spring break
12	threads and semaphores		thread creation
13	software project management and processes		
14	software project management and processes	assignment 5	
15	guided project work		
16	guided project work		

Since all classes do not progress at the same rate, it may be necessary to modify the above schedule as circumstances dictate. For example, the number and frequency of assignments may be altered or the schedule of the classes may be changed. In either of these cases, adequate notification will be given and be discussed in class.

4.2 Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit:

- http://www.catalog.gatech.edu/rules/.

Students are encouraged to support each other, but each artifact has to be clearly executed by the individual/group being graded. Any student suspected of cheating or plagiarizing on a quiz, exam, assignment, or other artifact will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

4.3 Accommodations for Individuals with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (often referred to as ADAPTS) at (404)894-2563 or

- `http://disabilityservices.gatech.edu`

as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

4.4 Assignment Turn-In

All assignments as well as the project work including code have to be turned in as a link to a online repository such as github. Documentation has to be submitted to t-square unless announced otherwise.

4.5 Attendance and Participation

Regular attendance is expected. Missed classes might impact your learning experience and have negative influence on the participatory grade.

4.6 Extensions, Late Assignments, Missed Exams

All assignments, papers, and other artifacts are due **ON THE DUE DATE**. The due date will be announced per assignment/task on t-square. A penalty of **TEN POINTS PER DAY** will be applied to all late assignments/tasks and late project papers. Documented illnesses and family emergencies are excepted. Quizzes and exams cannot be made up unless you have a valid, documented excuse.

4.7 Student Use of Mobile Devices in the Classroom

The use of mobile devices in the classroom is not allowed unless explicitly allowed by the instructor.

4.8 Student-Faculty Expectations

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty members and the student body. See

- `http://www.catalog.gatech.edu/rules/`

for an articulation of some basic expectations — that you can have of me, and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

4.9 Grievances and Concerns

Students who have grievances or concerns may refer to the Georgia Tech Academic Policy

- `http://www.provost.gatech.edu/academic-grievance-policy`

for information and reporting details.

Additionally, if you need formal assistance, please contact please contact Associate Provost Jennifer Herazy (`mailto:herazy@gatech.edu`). For informal assistance or to speak to someone who can be a sounding board for you, please contact one of the Ombuds staff: Russ Callen (`mailto:russ.callen@ece.gatech.edu`) or Leigh Bottomley (`leigh.bottomley@gatech.edu`).