CS 2261-A Media Device Architecture – Syllabus

Instructor: Aaron Hansen - He/Him (aaron.hansen@gatech.edu)

Teaching Assistants: See Canvas for details

Mode of Instruction: In person. Please attend!

Though they should occur in person, **if they occur online for any reason, exams will take place during officially scheduled lecture time (synchronously) via Canvas.**

Please do not attend class if you are feeling ill or have a fever. Lecture slides are provided on Canvas to prevent you from falling behind if you need to miss for any reason. So, please don't attend class if you aren't feeling well (even on an exam day, we can make accommodations due to illness, provided you at least send an email before the exam).

If you choose to attend when you aren't feeling 100%, please consider wearing a surgical-style mask to protect those around you.

Lecture Monday / Wednesday: 3:30 - 4:45 pm ET (Klaus 2456)

Please be prepared/willing to participate! This fosters more interaction, which is better for everyone involved! Questions about the material during lectures are welcome! If you don't understand something, then you're probably not alone! Lecture participation is an important component in teaching/learning.

Recitation / "Lab" Tuesday / Thursday: 5:00 - 6:15 pm ET (IC 109)

Generally, sessions on Thursdays will be focused on that week's lab and Tuesdays will be more generally about the material itself, but that is subject to some variability.

Recitation is designed to help you understand the course material and complete assignments. The TAs will present some information here that extends the topics covered during lecture. Recitation attendance is not required, but *strongly recommended*.

Instructor Office Hours Monday / Wednesday: after class until 6pm (CCB 224)

Otherwise, by appointment (preferably Thursday or Friday mornings). Please request a meeting via email or MS Teams message. I am happy to meet via MS Teams/Zoom, as long as we can find a mutually agreeable time.

TA Office Hours

Schedule and procedures forthcoming on Class Website (Canvas).

TA office hours will not begin until the second week of class.

Class Website: Canvas

Textbooks/Resources

- Required Readings will be provided on Canvas

- *Recommended* resources:
    - TONC - https://www.coranac.com/tonc/text/
        - This resource is very relevant to this course!
    - The C Programming Language - Kernighan and Ritchie (a.k.a., “K&R”)
        - The first de facto standard of C -- no need to run out and buy it.
    - GBATek - https://problemkaputt.de/gbatek.htm
        - *Very technical* explanations of GBA hardware -- useful only late in the course.

Course Description

Controlling the interface between hardware and software in media devices. Machine-level programming (e.g., in C) to create graphics, generate sound, and support user interaction.

Purpose and Goals

This course is intended to greatly demystify what a computer is and how exactly it works. By the end of this course, the 0s and 1s of computing should no longer be an abstract mystery that exists "somewhere" in the computer. This course is intended to have students understand how hardware and software architecture affects what is easy vs hard to program on a given machine. It should provide an understanding of programming at the level of shuffling bits and bytes, as well as at the “higher level” (yes, C is considered a high-level language) and in between.

To those ends, by the end of the course students should:

- Understand data representation. Be able to convert numbers between various representations: Binary, octal, decimal and hexadecimal.
- Be able to identify the component parts of the Von Neumann Model of computer and be able to explain the purpose of each component.
- Be able to use utilities for conversion of image and sound files into C data structures
- Be able to write C programs that are hundreds to thousands of lines long that manipulate device hardware and perform some logical functions such as creating a playable video game.
- Be able to design, write and debug code to perform operations such as:
    - Displaying images in multiple formats
    - Creating simple animations used in bit-mapped games
    - Using page flipping / double buffering for smooth animation
    - Using Dynamic Memory Access (DMA) to speed up animations
    - Effectively use indexed color, tiles and sprites.
    - Starting, stopping and looping sounds
    - Reading button inputs
    - Maintaining and changing program state
    - Servicing hardware interrupts

Note: This course is not designed to train students to be “C developers,” although some may take away information useful in such an endeavor.

Grading Policy and Breakdown

Grades will be handled through Canvas. Grades will only be distributed on Canvas and in the final grade reports at the end of the semester. Per federal law, grades will not be reported or details disclosed via email. Canvas is normally used to report individual grades during the term, but final grades are computed externally (this is where assignment drop policies are applied, for example). At the end of the term, any class-wide discretionary curves (don't hold your breath!) will not be updated and posted again on Canvas. Therefore, your overall class grade in Canvas should not be seen as the absolute source of truth.

Attendance 5%

Attendance will be pseudo-randomly taken seven (7) times during the semester. If you are not present on at least five (5) of the days, you will lose one percentage point on your final grade per day below that threshold (e.g. if you are only present on 3 of the 7 attendance checks, you will lose 2% from this category).

There will be no exceptions made to this policy beyond <u>extreme</u> circumstances approved by the Dean of Students.

Participation Exercises / "Daily" Mini-Quizzes 5%

For each lecture day, there will be an associated mini-quiz on Canvas. You are encouraged to complete each mini-quiz the day of the associated lecture, but the mini-quizzes will *generally* not be due until Friday of each week (allowing for some individual scheduling flexibility). These mini-quizzes are low-stakes and you will have unlimited attempts to complete them (up to the due date).

Late Participation Exercises will not be accepted or excused for any reason.

Homework / Milestones 25%

Homeworks for this course are typically larger assignments that span a week or two. They are often open-ended with specific technical requirements. Each homework submission must be completely original (meaning completely new code must be written, by you, for each submission), unless otherwise specified. There will be roughly five (5) homework assignments.

Milestones come at the end of the semester as work on the Final Project begins. Milestones are generally similarly scoped to homeworks, but each Milestone should build upon the previous one as you make incremental progress towards completion of the Final Project. Milestone grading criteria include specific "follow-through" points, based on how well you responded to direction given by your TA on your previous Milestone. There will be four (4) Milestones, barring any unforeseen schedule changes. One or more Milestones may be required to undergo a demo process where you answer questions about how your submitted code accomplishes project behavior -- an inability to adequately explain your own code during this demo will lead to a reduction in your score on the assignment.

Late Homework/Milestones <u>will</u> be accepted in accordance with the Late Policy below.

Exams 40%

There will be three (3) exams over the course of the semester. Each will cover roughly five (5) weeks worth of course material. Exams will occur during lecture hours in lieu of covering new material that day. Each exam will be equally weighted when calculating your exam average.

Should an exam need to be conducted online for any reason, they will still occur **during officially-scheduled lecture hours** and will most likely make use of Honorlock, Lockdown Browser, or another Georgia Tech approved proctoring/academic integrity solution to ensure fairness.

Failure to complete an exam during the assigned period will result in a zero for that exam.

Students requiring testing accommodation should schedule their exams with the Testing Center as soon as the schedule is posted.

Final Project (in-lieu of a Final Exam) 25%

The Final Project will be the culmination of roughly a month's worth of work at the end of the semester. It is an *individually* imagined, designed, and developed game. Demoing the project will be *required*, but will be worth very little of the final project grade. Exact details and requirements will be announced over the course of the semester.

The Final Project will be due during the Final Exam period. Late Final Projects will not be accepted.

Every student must submit a Final Project to complete the course.

Grade Cutoffs

A: 90.0 B: 80.0 C: 70.0 D: 60.0

Grade Dispute Policy

Should you have any issue with the grading on any assignment, you must contest grading issues within **one week** of the grade being provided. Please discuss such issues first with the grading TA. If there is still a dispute, only then should you approach the course instructor seeking a resolution (note: for exams, please proceed directly to the instructor).

Late Homework / Milestone Policy

Late Assignments in the Homeworks / Milestones category only will be accepted with the following penalty based on how late the assignment is submitted:

Number of Hours Late	Grade Penalty
up to 24	-10% of earned points on the assignment
> 24 hours	Will not be accepted.

Exceptions to this late policy will only be made for emergencies and will generally not exceed 24 hours. Please contact the Head TA or the instructor to request such an exception *in advance* of the due date.

Schedule

A "Living Schedule" document will be made available on Canvas. The specific topics/dates are subject to potential changes, but the provided schedule will be kept up-to-date as changes are announced. Please make use of this schedule as you make plans around your required participation in this course. The one assignment due date that cannot be changed is the Final Project Due date

(this can only be changed by the registrar, and any change will be communicated as soon as possible).

Attendance / Make-up Policy

Conduct during lecture, recitation, and office hours should be in accordance with the Student-Faculty Expectations Agreement. Please bring any issues of disrespect or exclusionary behavior to the Instructor's attention as soon as possible.

Students are responsible for all material covered in class, including changes in schedules announced during class or on Canvas. Make-up assignments are not permitted, except due to an officially excused absence or extreme circumstance. **Students missing an assignment (including an exam!) without an excused absence will receive a grade of zero on that assignment. All non-emergency exceptions to the late policy must be approved *in advance* by the Head TA or the instructor.** Excused absences or requests for grades of incomplete must be approved through the CoC academic office and/or the Dean of Students office. Any approved make-up exams are not guaranteed to be the same as the original given in class or subject to the same (if any) curve.

If there is a problem submitting an assignment (including due to a diagnosed illness), email the course instructor and the Head TA as soon as possible! We are human beings and will try to be reasonable and fair, but you must make every effort to notify us promptly.

Back up your source code early and often. An external git repository with a local working copy (via a *private* repo on Bitbucket, GitHub, etc.) is a good option. Even then, you might want to make sure your project folder is automatically backed up to some off-site/offline location. If you experience catastrophic hardware failure, we will work with you while your equipment is being repaired. However no extensions will be granted due to your lack of backups.

Academic Honesty

Although students are encouraged to work together to learn the course material, all students are expected to complete exams, homeworks, milestones, and projects *individually*, following all instructions stated in conjunction with the given assignment. To that end, Georgia Tech approved academic integrity tools may be used to ensure the originality of assignment submissions. ***You MAY NOT copy code from others in any way. You MAY NOT use solutions that others have developed as the basis for your solutions.*** However, you MAY discuss the problems with others, including fellow students, teaching assistants, and the instructor.

Periodically, automatic plagiarism detection algorithms may be used to compare source code against all students in the course. You ARE allowed to solicit and obtain help in designing and debugging your solutions. You MAY show others your code and ask for advice about why it is not working or how to make it work better. But to be totally clear, you MUST implement your own solution. If someone helps you, you still MUST enter every line of code of your solution personally, and you MUST fully *understand* every part of your submission. **Students should be prepared to explain each assignment and their work when demoing work to a TA.** All conduct in this course will be governed by the Georgia Tech honor code. Additionally, it is expected that students will respect their peers and the instructor such that no one takes unfair advantage of any other person associated with the course. Any suspected cases of academic dishonesty will be reported to the Office of Student Integrity for further action. Please consult the Academic Honor Code for additional guidance.

AI Tools Clarification

Using ChatGPT, GitHub Copilot, or any other code generation tool is forbidden in this course. You can ask ChatGPT, Copilot, etc. conceptual or technical questions (as you would the instructor or a TA), but you should not allow an LLM to write code for you.

Work for this course must be completed this semester -- previous work may not be resubmitted.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate 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.

Internet Connectivity and Computer Ownership Expectations

Your computer must meet the requirements laid out by the Georgia Tech computer ownership policy which may be found here: https://sco.gatech.edu/hardware-requirements/.

Please make a plan in advance of what to do if your laptop dies during the semester. The institute provides loaner laptops (as available) for students with equipment malfunctions via a request here: https://b.gatech.edu/laptop-loaner

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404) 894-2563 or https://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email the instructor as soon as possible in order to set up a time to discuss your learning needs.

Additional Help

Visit the instructor during office hours. See TAs during posted hours. The Center for Academic Success has many programs to help students improve their study habits and time management. There is a list of such services provided on the Syllabus page of the Class Website. The Dean Of Students Office helps students who have personal or medical issues that impact their academic performance.