CS 2200 - Introduction to Systems and Networking

Course Organization

Course workload:

- 10 Homeworks
- 5 Quizzes
- 5 Projects
- 4 Project demos

Course schedule: Living schedule [Links to an external site].

Lectures

Each section has two lecture periods each week.

All sections

- Lectures will be **live-streamed via Zoom** and **recorded**.
- Slides will be posted on Canvas (**Files → Lecture Slides**) immediately before class.
- Recordings will appear on Canvas several hours after the lecture ends. (The automatically posted unedited version will be available first, outside the playlists under the Media tab; we'll trim, label, and insert the video in the respective playlist soon after.)
- To ask questions, you must attend either in person or via livestream.
- We'll monitor the Zoom chat during lectures to answer questions in real time.

Attendance expectations:

- You are expected to attend lectures in person. The livestream and recordings are not intended as a replacement for in-person attendance, but can be used in case of unavoidable absences.

Lecture attendance quizzes:

- Very short quizzes are given for each lecture starting from Week 2
- Must be completed **within 24 hours** of the lecture to count for the Lecture Attendance grade.
- Answers will be discussed during lecture and can be found from:
    - The in-person lecture
    - The livestream
    - The recorded lecture
    - The posted slides
- This helps keep everyone on the same schedule without requiring substantial effort.

Startup Assignments

There are three assignments that you should complete by the end of the second week of classes.

- Start of Semester Survey
- Diagnostic
- Syllabus Quiz

Labs

- **Mandatory** and **in-person**. Attendance is recorded.
- Labs include group/individual exercises, problem-solving, review, and Q&A.
- **Quizzes 1–4** will be given during labs—attendance is required except for an approved absence.

TA Office Hours

- TA schedules will be posted on Canvas (bottom of Home page).
- All TA hours are **in-person** in Room 206 (see CCB map on Canvas).

Important warning:

- The day before and the day of a project deadline are *extremely busy* (40+ students may be in the queue).
- If you finish less than **5 days before** the deadline, we **cannot guarantee** timely TA help.
- If you haven't started debugging at least **1 week before** the deadline, you're very likely to fall behind.

Purpose and Outcomes

Purpose

Provide a broad exposure to computer system structure and networking including software abstractions in operating systems for orchestrating the usage of the computing resources:

- Organization of the processor
- Memory hierarchy
- Storage devices
- Parallel processors
- Networking hardware
- Software abstractions in the operating systems for orchestrating their usage
- Networking protocols to connect the computer system to its environment

Outcomes

- (Competency Knowledge) Understand the difference between RISC and CISC architectures. Be able to identify the strengths and weaknesses of each paradigm.

- (Competency Knowledge) Understand and be able to explain runtime system concepts such as procedure calls and register saving. Be able to write recursive subroutines in assembly.
- (Competency Application) Understand how a processor is controlled. Given a datapath and an instruction set be able to write the finite state machine steps in a high-level meta language.
- (Competency Knowledge) Understand and be able to explain (at a high level) hardware modifications required to implement an interrupt system and to understand the basic concepts required to write an interrupt handler (in assembly language).
- (Competency Knowledge) Understand the basic principles of pipelining:
    - Pipelining registers
    - Potential performance improvements with pipelining
    - Pipelining Hazards: Structural, Data, and Control
- (Competency Knowledge) Understand basic concepts of processor scheduling: Process vs program, PCB, scheduling algorithms (Round Robin, Shortest Job First, First Come First Served, Priority, Multilevel Queues), types of scheduler (short, medium, and long term), and context switching.
- (Competency Comprehension) Given a set of processes with appropriate parameters show scheduling behavior under different scheduling algorithms.
- (Competency Application) Be able to calculate the proper size required for pipeline register and speedups with pipelining.
- (Competency Application) Be able to solve basic word problems involving Amdahl's Law.
- (Competency Knowledge) Be able to identify and explain how to avoid or minimize the effect of the different types of pipelining hazards.
- (Competency Knowledge) Understand the drivers of memory cache designs: Temporal locality, spatial locality, and working set. Be able to match the design with the motivator.
- (Competency Knowledge) Understand the basic operation of virtual memory and typical components: Page table, virtual pages, physical frames, TLB, page/frame offset, page replacement algorithms (LRU, Random, FCFS, Optimum). Be able to describe the basic operation and identify the necessary subsystems.
- (Competency Knowledge) Understand the basic design of typical caches including indexes, tags, dirty and valid bits as well as multi-word blocks, set-associative, and fully associative caches. Given selected design parameters (i.e. word size, memory available for data storage, etc.), be able to describe the implementation of such a cache.
- (Competency Knowledge) Understand basic concepts of parallel processing: UMA (SMP) vs NUMA configurations, multiprocessor cache coherency, network interconnection schemes, threads, mutex, condition variables.
- (Accomplishment Application) Be able to write multi-threaded programs using the pthreads package. An example would be a multithreaded producer-consumer application.
- (Competency Knowledge) Understand basic networking concepts: Ethernet (CSMA/CD), Token Ring, Payload vs. header and trailer, checksums, bandwidth, effective bandwidth, latency, MAC addresses, Network (IP) addresses, protocol stacks, TCP/IP, routing, hubs/repeaters, bridges, VLANS, routers.
- (Competency Knowledge) Understand fundamentals of I/O devices such as polling versus interrupts, memory-mapped I/O, device registers (data, control, and status), disk

memory concepts (sectors, tracks, platters, cylinders, seek time, rotational latency), disk scheduling algorithms (FCFS, SSTF, scan, c-scan, look, c-look).
- (Accomplishment Synthesis) Write and debug medium-sized C programs that simulate various of the above subsystems, i.e., interrupt enabled processor, virtual memory, multi-threaded operating system schedulers, reliable transport layer protocol all as examples of operating-system-like coding.

Textbooks and Software

Textbook

Ramachandran & Leahy
Computer Systems: An Integrated Approach to Architecture and Operating Systems
Publisher: PEARSON
ISBN: 9780321486134
[A used book or an international edition will be satisfactory. Even if you acquire a PDF copy of the book somehow (ask your fellow students) we are happy! The authors of the book want you to enjoy the book one way or the other! Reading the book correlates with getting good letter grades from past experience.]

Textbook Errata

Recommended Reference

Brian "Beej Jorgensen" Hall
Beej's Guide to C Programming
v0.10.5, Copyright © April 18, 2026
https://beej.us/guide/bgc [Links to an external site.]

Software

CircuitSim

CircuitSim is a tool for modeling digital circuits that will be used for the first few projects. You must download the latest version (currently CircuitSim CE 1.11.2) from Canvas Files and follow the instructions there to download/install it, even if you have a version from a previous semester. Other versions may not load or save versions properly!

CircuitSim Download: Canvas Files > Software > CircuitSim

Course Prerequisites

CS 2110
or
ECE 2020 and ECE 2035

Grading Breakdown

Startup Assignments (Survey, Diagnostic, and Syllabus Quiz)	1%
Lecture Attendance	2%
Lab Attendance Quizzes	2%
Homework	10%
Projects (5 of them weighted equally)	25%
Quizzes (5 of them weighted equally)	60%
Total	**100%**

Letter grades will be assigned using traditional 10 point ranges: A is 90-100, B is 80-89, etc.

Course Rules

CS 2200 Rules and Regulations

1. Official announcements about course matters, including changes to the syllabus, will be posted on Canvas. The Canvas announcements should be read every day, so **be sure you have the Canvas announcement forwarding set up**. In other words, a policy change that doesn't show up in Canvas announcements is just a nasty rumor.
2. The schedule spreadsheet of the syllabus is linked on the Canvas course page. Minor changes may be made as we adjust the topics of lectures and labs to fit the pace of the class. Any significant changes will be announced on Canvas as will any other syllabus change. Dates should not change except in extreme circumstances.
3. **Ed Discussion** is for posting questions regarding the course materials, assignments, quizzes, etc. Please answer your fellow students' questions if you are reasonably sure of the answer, especially if you have a reference.
4. **Complaints in general**, complaints about TAs, questions about your personal problems, etc. should be discussed with your instructor in person or via email.
5. **If you have major personal issues** (family/illness/etc.) that may impact your academic performance, please contact the Dean of Student's office located in the Student Services Building (Flag Building) next to the Student Center or make a request through

https://studentlife.gatech.edu. They are best equipped to verify problems and provide assistance -- and they are pretty good at it. The office will issue a note to all your instructors making them aware of the problem and requesting whatever extension, etc. is necessary. You may also contact your instructor who can, if appropriate, make a referral for you.

6. **If you need a certain grade in order to stay in school, maintain a scholarship, etc.,** the time to worry about this is right from the beginning of the course, not during the week before finals. Grades are based on demonstrated performance, not individual needs based on factors external to the course. Please do not request special consideration based on external factors unless you go through official channels. See the next item.
7. **If you find yourself slipping behind** or face other barriers to your success in this course, please talk with your TAs, see a head TA, or go see the instructor as soon as you can. We can't help if we don't know you are having problems and, no matter what, we can't turn back the calendar. From experience, we know some tricks that may help you, so please ask.
8. **If you need academic accommodation, please coordinate that with the Office of Disability Services.** If you have been granted accommodations by ODS, your instructor will be notified and will have access to your accommodations via a web portal provided by ODS. We recommend that you drop by in office hours or make an appointment to discuss your accommodations with your instructor so full consideration can be given to your specific needs.
9. Final grades will be available from Banner normally on the day after grades are due. You may review your final and discuss your grades during the following semester in which you are attending GT. Grades will not be discussed over break.
10. Out of consideration to your fellow students please turn off cell phones, beepers, wristwatch alarms, etc. Also, make every effort to be on time for class. If you are unavoidably late, please sit near the back and try to avoid as much disruption to the class as possible.
11. Please be courteous in your correspondence with TAs and instructor.

Assignments

1. All submissions, grading, & regrades for homeworks & projects will be on **Gradescope**
2. Deadlines are posted on Gradescope, Canvas, and in the Live Schedule on the Canvas home page.
3. Each homework/project will have a late deadline **3 days** after the normal deadline with possible penalties. See the ***Late Policy*** section for more details.
4. Regrade requests will be open through **Gradescope** for homeworks for **7 days** after grades are posted. **Do NOT email TAs or a head TA about regrade requests** until after the requests have been closed in Gradescope.

Projects

1. All projects have an autograder on Gradescope which will give you a score. In most (but not all) cases, that will be your grade on the project (excluding demo score & late

penalties). You may request human consideration of the autograder's results if it is not correctly evaluating your project.
2. We may manually check for autograder subversion, honor code violations, and non-deterministic logic for any of the projects.
3. You are allowed unlimited submissions, but keep in mind that the autograder takes time to run depending on the autograder, and **in some cases can end in a server error**.
4. Gradescope allows you to view and download all your submissions. You are required to **download your submission to ensure that what you turned in is what you meant to turn in**. Failing to do so may lead to a penalty up to 100% on that assignment.
5. Gradescope allows you to change which submission you want to count for your grade up until the late deadline.
6. **If you have any problems submitting**, email your Lab TA or a Head TA what you would have submitted BEFORE the deadline for the assignment(s).

Project Checkpoints

1. Some projects will be broken up into checkpoints that will be due before the final due date.
2. Each checkpoint will have a separate assignment in Gradescope for which the points will make up the total project grade.
3. Refer to the course schedule or Gradescope to see when each checkpoint is due.
4. The late policy will apply to each checkpoint as if they were individual assignments.
5. Note: Later parts of a project build upon earlier checkpoints, so be warned that missing checkpoints and falling behind is ill-advised.

Demos

1. Demos will be required for **Projects 1 to 4**
2. During your demo, you will have 10 minutes to answer questions from the TA about your implementation of the project (though it is typical to finish in < 5 minutes if you are prepared).
3. Your **final project grade** is calculated as final_score = max(raw_score, 25%) * demo_score. For example, if you get an 80% from manual grading and a 75% on the demo, then your project grade will be 60%. (Note: this does not account for late penalty/forgiveness. See the Late Policy section below for more details.)
4. If you receive less than 25% on your project's raw score but you still do your demo, you can still earn 25% * *demo_score*

Demo Bookings

1. The week of the project due date, the TAs will post available demo slots on the **Canvas calendar**.
2. Students must then book a demo with any TA in the course (it doesn't have to be your lab TA).
3. The booking window will **close the day before demos start**. Typically this means that the window closes on Sunday, and the demos will run from Monday to Friday.

4. If you are not available during any of the open slots, email a head TA to find an alternate slot.
5. If you sign up for a demo and ...
    1. ... know you won't be able to make it (before the demo), then simply re-book a different slot OR contact your demo TA if the booking window is closed **as long as it is before the demo**
    2. ... miss it due to a valid excuse, email a head TA and your Demo TA and fill out the Absence form on Canvas.
    3. ... miss it without a valid excuse OR show up more than 5 minutes late, you will incur a 25% penalty and will be required to make-up the demo after your next lab with your lab TA. Failure to do the make-up demo will result in a 0% for the project.
6. Speeding tickets, sleeping late, etc. are NOT valid excuses for missed/late demos.
7. As with any other assignment, failure to perform the demo at all results in a 0 (which means you receive a 0 for the corresponding project).

Project Submission Options

1. **Do your own project:** Your raw project score is graded normally, with a 25% minimum used when applying the demo multiplier.
2. **Don't submit code, but learn from someone else's:** Only demo is graded, max 25% credit. Note: Once you have substantial implementation code from a peer, you should NOT submit code to Gradescope for that project.
3. **Submit code that isn't yours (plagiarism)**: 0% on the project + reported to the Office of Student Integrity.

Assignment Submission Instructions

The following list is designed to help you submit assignments that can be effectively graded giving you the best possible results.

1. ALWAYS retrieve your files from Gradescope and check that what you turned in is what you intended to turn in.
2. If you have any problems submitting, email your Lab TA or a Head TA what you would have submitted BEFORE the deadline for the assignment(s).
3. Homework and Project Assignments may be worked on collaboratively. What that means is you can work with fellow students to learn how to do the project, post project and homework-related questions to Ed Discussion, and seek help from fellow students and TAs. But what you turn in should be YOUR OWN work.
4. YOU CANNOT COPY CODE OR HOMEWORK SOLUTIONS WITHOUT CITATION FROM THE INTERNET OR AI AGENTS. MISREPRESENTING THEM AS YOUR OWN IS PLAGIARISM.
5. If you are not sure about the collaboration policy in this class please ask a TA or stop by the instructor's office during office hours.
6. Quizzes and Project demos are individual efforts.
7. Put your name and GT username at the top of each file (if code, as a comment).

8. Refer to submission instructions in the assignment for details on what/how to submit.

Please be careful when submitting assignments, and double-check each one! Ask a TA if you are unsure of the procedure.

Late Policy

1. For each day late you submit an assignment (HW/Project), you will receive a **-25% penalty** applied after the assignment is graded. For example, for a project that received an 80% score after grading, if it was submitted 2 days late, the final grade would be 80 % * 50% = 40%
2. However, we understand that life happens, so we provide a **ONE-time-forgiveness** over the course of the semester.
    A. At the end of the semester, we will automatically forgive the eligible late penalty whose removal produces the largest increase in your final course grade. For a project with checkpoints, the forgiveness applies to all late penalties associated with that project, provided that the final project submission is no more than 3 days late. The forgiveness is all-or-nothing and applies to only one homework or one project during the semester. It does not apply to missed demos or failure to register for demos.
    B. The forgiveness applies to one entire homework or project; it cannot be divided among multiple assignments.
    C. The one forgiven lateness penalty will NOT be reflected on Canvas until the end of the semester.
3. Assignments submitted more than 72 hours late, i.e., after the late deadline will not receive any credit (0%).

Quizzes

1. The first 4 quizzes will be held in your lab section (Wednesday at 6:30 PM). **Make sure you attend the section for which you are registered otherwise you may not receive credit.**
2. **The 5th quiz will take the place of the final and is scheduled during finals week by the Registrar. Except for the date/time/location, the 5th quiz will be structured the same as the first 4 quizzes in time-limit (typically 60 minutes), length, and format.**
3. None of the quizzes are designed to be cumulative; however content from the topic list for later quizzes may inherently build upon earlier concepts.
4. Refer to the schedule on the Canvas Home page for the exact quiz dates
5. The quizzes will be given on Canvas.
6. The quiz will be closed-note and HonorLock will be used to proctor the quiz.
7. You must bring your **buzzcard** with you to the quiz.
8. Prior to the quiz, take the **practice honorlock quiz** to make sure everything works. Ask a TA if you have any issues.
9. Physical calculators or the built-in Canvas calculator are permitted during the quiz.

10. As a rule, makeup quizzes will be given ONLY for absences authorized by the institute and/or medical conditions (for either of them providing documentary evidence and requesting a make-up date is the responsibility of the student).
11. No exceptions will be made for family-related personal travel unless the travel is necessitated due to the health condition of a family member; the onus is on the student to provide documentary evidence.
12. Travel for an interview will be handled on a case-by-case basis. It is the student's responsibility to make every attempt to ensure that the interview does not conflict with a posted quiz date. Nine out of ten times, the company will respect such conflicts and give a different date. If the company is not able to offer a different date, the student should provide convincing evidence to get an exception. Any exception should be obtained PRIOR TO THE QUIZ DATE.
13. Quizzes must be taken at the scheduled date and time. **Please do not ask for special treatment because you (or your parents) have purchased non-refundable airline tickets**. The safe time to travel is at the end of or after finals week. The finals schedule published at the beginning of the semester is TENTATIVE. The official schedule gets published very late in the semester.

Absences, Make-ups, and Extensions

1. Use the link found at the top of the course home page to request an excuse or to receive a make-up or extension. This makes sure your request isn't lost in the depths of someone's mailbox.
2. For **make-up** quizzes or **extensions** on assignments, please wait 24 hours before emailing a Head TA. Do NOT email the instructors for such accommodations.
3. Lecture or lab **absences** will be processed by the end of the semester. Please check that the attendance is marked "excused" in the Canvas gradebook at the end of the semester.

Artificial Intelligence & Academic Honesty

We treat AI-based assistance, such as but not limited to ChatGPT, Copilot, Claude, and Gemini, the same way we treat collaboration with other people: you are welcome to talk about your ideas and work with other people, both inside and outside the class, as well as with AI-based assistants.

All work you submit should be your own. Properly quoted and cited material is not plagiarism, although excessive reliance on quoted material may receive reduced credit depending on its extent and purpose. We strongly recommend using AI for discussion and learning rather than incorporating AI-generated material into your submission.

Including anything you did not write in your assignment without proper citation will be treated as an academic misconduct case. If you are unsure where the line is between collaborating with AI and copying AI, we recommend the following heuristics:

1. Heuristic 1: Never hit "Copy" within your conversation with an AI assistant. You can copy your own work into your own conversation, but do not copy anything from the

conversation back into your assignment. Instead, use your interaction with the AI assistant as a learning experience, then let your assignment reflect your improved understanding.

2. Heuristic 2: Do not have your assignment and the AI agent open at the same time. Similar to the above, use your conversation with the AI as a learning experience, then close the interaction down, open your assignment, and let your assignment reflect your revised knowledge. This heuristic includes avoiding using AI directly integrated into your composition environment: just as you should not let a classmate write content or code directly into your submission, so also you should avoid using tools that directly add content to your submission.

Deviating from these heuristics does not automatically qualify as academic misconduct; however, following these heuristics essentially guarantees your collaboration will not cross the line into misconduct.