Programming HW/SW System - ECE-2035 C/D

Edit

Welcome to ECE2035!

COURSE DESCRIPTION: This course presents execution and storage mechanisms used to support high level programming languages and operating systems. This design-oriented course describes how complex mechanisms are created using operations and storage defined in an instruction set architecture. Assembly language examples illustrate key course concepts. Lecture material is reinforced by design projects that require C programming and RISC-V assembly language programming, focusing on performance and storage resource requirements on hardware platforms.

Course Delivery: This course is delivered in person. In the event of a campus closure due to inclement weather, lectures will be delivered remotely, in accordance with Georgia Tech policies that were **revised in August 2023 (https://policylibrary.gatech.edu/employment/hazardous-weatheremergency-conditions-plan)** . Refer to the **Campus Procedures for Hazardous Weather. (https://www.gatech.edu/emergency/weather) (https://www.gatech.edu/emergency/weather)**

TA's Office Hours Schedule: Here (https://gatech.instructure.com/courses/502396/files/71304951?wrap=1) (https://gatech.instructure.com/courses/502396/files/71304951/download?download_frd=1)

TA's Office Hours Location: Klaus 1448. On digital learning days or if otherwise announced: **https://gatech.zoom.us/j/96318413041 (https://gatech.zoom.us/j/96318413041)**

Instructor: Jeff Epstein **jeff.epstein@gatech.edu (mailto:jeff.epstein@gatech.edu)**

Class Time:

Section C: 2pm-3:15pm TTh

Section D: 3:30pm-4:45pm TTh

Class Location: COC 17

Point Solutions Participation: Point Solutions will normally be used only for attendance checks, possibly every class period. It may be used for interactive questions occasionally. *Active participation in the class during class time is expected and contributes to your participation grade.*

Office Hours: by appointment, Klaus 3308 or on Zoom

In addition to in class and office hours, feel free to ask (and answer) questions via:

- **Ed Discussion**: click on link in Canvas navigation window

At all times, everyone is expected to follow appropriate **online etiquette (https://**

gatech.instructure.com/courses/502396/files/69926507?wrap=1) (https://gatech.instructure.com/courses/502396/files/69926507/download?download_frd=1) .

COURSE OUTLINE (https://gatech.instructure.com/courses/502396/pages/ece2035-outline) < click there

COURSE GOALS: The learning objectives of this course are to:

- Understand how execution and storage constructs in high-level programming languages and operating systems are implemented on a hardware platform.
- Learn design principles for sequential, procedural programming, the C programming language and RISC-V assembly language, and the use of common tools for software development and performance evaluation.
- Build experience in systems-oriented design, focusing on performance and storage requirements of the target application and hardware platform.

COURSE OUTCOMES: Upon completion of this course, you should be able to:

- Develop a software design using appropriate data and procedural abstractions given an engineering problem specification.
- Implement high-level programming language storage, control, and procedural constructs in the assembly language of a hardware platform.
- Use commonly available tools for software development, system management, debugging, performance monitoring, and optimization.
- Develop a software system that uses multiple files and libraries.
- Develop, test, and deploy reliable software using appropriate operating system capabilities (e.g., file and directory access, I/O interface).

PREREQUISITES: ECE 2020. (http://ece2020.ece.gatech.edu/) It is imperative that you be very familiar with

- the concept of a **datapath** (https://ece2020.ece.gatech.edu/readings/datapaths/index.html) ,
- the major **components of a datapath** (https://ece2020.ece.gatech.edu/readings/datapaths/datapath-elements.pdf) ,
- **memory, and especially RAM** (https://ece2020.ece.gatech.edu/readings/memory/memory.pdf) , and
- the specifics of **a single-cycle datapath** (https://ece2020.ece.gatech.edu/readings/datapaths/1-cycle-dp.pdf) , such as that of the RISC-V processor.

That last point is particularly relevant to transfer students or anyone substituting a different prerequisite, since ECE 2020 specifically covered the single-cycle datapath. We will immediately begin with review of the single-cycle datapath and go into more detail about the RISC-V instruction set architecture (ISA).

GRADING: The final grades are determined based on totals earned during the course.

Assessment	Percentage of total grade:
Exams (3)	30%
Homework (3)	10%
Projects (2)	30%
Final Exam (1)	25%
Participation	5%

Grades are assigned as follows (assuming a passing project average): [90-100] = A, [80-90) = B, [70-80) = C, [60-70) = D, [0-60) = F.

Grading concerns should first be directed at the person grading the assignment (e.g., the GTA or UTA for homework & project grades, the course instructor for exams, participation, etc.), but any unresolved issue can be addressed to the course instructor as needed. Also, it is expected that any grading concerns be raised within one week of the grade being posted, because it isn't possible to address a large number of issues in the last weeks of the semester. Exam regrades are processed entirely within Gradescope and within the period of time specified there, possibly less than a week.

CLASS PARTICIPATION: Participation credit is earned by completing attendance checks in Point Solutions (formerly named "Turning Point," and still shown that way in Canvas menus), as well as completing practice exercises, lecture comprehension quizzes, and any other in-class activities that may be assigned.

Please create a Point Solutions account at **the echo360 site (https://account.turningtechnologies.com/account/authenticate/index)** if you don't already have one. Install the Point Solutions app to your smart phone and/or computer. You can check your attendance record at any time, and you should do it before you leave the classroom each time. Then, you can get any errors fixed on the spot while it is clear you are present.

MIDTERM EXAMS: There are three 50-minute midterm exams each given during our class period in our classroom. They are closed-book, closed-note. Calculators *are not* allowed on the exams. Each exam focuses on the material covered since the last exam. However, due to the cumulative nature of the material, all exams are comprehensive (i.e., they may draw on all material covered in the class thus far.) Each midterm exam contributes 10% of the overall grade.

EXAMS: Exams represent an opportunity to prove your new skills and knowledge. Exams are administered during class time. During the exam, use of outside resources, use of phones, communication between students, and use of any other program or web site is prohibited. Exams can be accessed on the **JQuiz (https://jquiz.ece.gatech.edu/)** system. Access to JQuiz may require use of the **GT VPN (https://gatech.service-now.com/home?**

id=kb_article_view&sysparm_article=KB0042139) : please make sure that you have correctly configured the VPN on your computer.

Exams are to be taken on your own personal computer, which you must bring with you to class on days when an exam is scheduled. If you anticipate not being able to bring your computer to class, please contact your instructor at least one week in advance, and we will find an alternative solution. If you do not have your computer on the day of an exam and have not already made alternative plans with your instructor, you will receive a grade of zero for that exam.

In order to get credit for an exam, you must be physically present in class during the administration of the exam, and must present your Georgia Tech ID card to a proctor upon request. Failure to comply will result in receiving a grade of zero for that exam. Attempting to circumvent these policies may constitute a violation of academic integrity.

FINAL EXAM: The final exam covers all material covered in the class. It is closed-book, closed-note and calculators *are not* allowed. The final exam contributes 25% of the overall grade.

ONE EXAM REPLACEMENT POLICY: If your score on the final exam is greater than your lowest midterm exam grade, it will be used to replace your lowest midterm exam score. It cannot replace a zero that results from either an unexcused absence or an Honor Code violation.

MISSED EXAM POLICY: Exams are taken at the scheduled class time or at the scheduled final period. A missed exam will be recorded as a zero. Family emergencies and extreme medical emergencies are handled specially.

TENTATIVE EXAM SCHEDULE (all held in our regular classroom):

Exam 1: Thursday, 19 February 2026
Exam 2: Thursday, 19 March 2026
Exam 3: Tuesday, 14 April 2026

Final Exam Schedule

Section C: Thursday, April 30, 2:40 PM - 5:30 PM

Section D: Tuesday, May 5, 2:40 PM - 5:30 PM

Check the Registrar Website (https://registrar.gatech.edu/current-students/exams) for changes

ASSIGNMENTS: Multiple homework assignments and projects are assigned throughout the semester. Homework is assigned more frequently, while projects have longer timeframes and are weighted more heavily. All homework assignments and projects are to be completed and submitted individually *with no collaboration or interaction with others* (except TAs and the instructor).

Note: The last part of Project 2 will be due on Tuesday April 28, which is the last Final Instructional Class Day.

LATE POLICY: The Canvas page for each homework and project assignment specifies the late policy. In general, for all assignments, *except parts of* Project 2, the assignment may be submitted up to 5 days after the posted due date, with a 10% per day late penalty.

Do not hesitate to contact the instructor if extenuating circumstances arise. Staying in communication is critical. If you are struggling or falling behind, make an appointment to discuss how to proceed.

ASSIGNMENT INFRASTRUCTURE: To perform the assignments, you need the following:

- **ERNIE RISC-V Emulator and Debugger** for running assembly language programs in VS Code. (FREE)
- **Linux**: Remote access to **ECE Linux servers (https://help.ece.gatech.edu/labs/names)**. (FREE)
- **ESP classroom kit**
  - Classroom kit consists of two packages (each student needs both):
    - **ESP-32-C6/uLCD/Parts Loaner Kit**: available for checkout at the Georgia Tech library for 120 days, which will cover the entire semester. To do this, visit the INFO Desk on the ground floor of Price Gilbert (hours: **https://library.gatech.edu/hours (https://library.gatech.edu/hours)**). *The kits have been made possible by the **ECE Cares program (https://ece.gatech.edu/academics/student-resources/ece-cares)** to help reduce the cost to students.*
    - **Breadboard & Wire kit**: available from Eta Kappa Nu (2nd week of classes only), Sparkfun, DigiKey, and others. If you purchased them for ECE 2031, those should be sufficient.

      Eta Kappa Nu sales Spring 2026:

      When: Jan. 19 - Jan. 23, 11am - 4pm

      Where: Van Leer 3rd Floor Middle Hallway

      How to Purchase: Cash, Credit ($2 surcharge), Debit, Check (to Eta Kappa Nu)

BACKING UP WORK: It is each student's responsibility to create back-ups of work performed in this class. Lost work or time due to computer/disk/web server failures is not a valid excuse for late submissions.

TEXTBOOK: Patt and Patel, *Introduction to Computing Systems*, 3rd edition, 2019. (2nd edition is fine, too.)

ACADEMIC HONESTY: Although students are encouraged to work together to learn the course material, graded class work must be completed individually. Specifically, while you are permitted to discuss the homework and project assignments and algorithms with other students in the class, **you must design, write, and debug your solutions individually. You must not accept/copy/solicit code from, share code with, debug code, or discuss its performance with any AI assistant or**

any person, except the instructors/TAs. Once you begin implementing your solution, you must work alone. You must not share any code, homework solution or any graded work before or after the due date.

This course is bound by Georgia Tech's **Student Code of Conduct** (https://policylibrary.gatech.edu/student-life/student-code-conduct) and **Honor Code** (https://policylibrary.gatech.edu/student-life/academic-honor-code). Suspected violations of academic integrity may be handled through **Faculty Conference Resolution** (https://osi.gatech.edu/faculty/faculty-conference-resolution), or students may have their case heard directly by the **Office of Student Integrity.** (https://osi.gatech.edu/process/academic-misconduct-process)

Students are responsible for understanding all of the detailed explanation of this policy at the page: Academic Integrity Specifics for ECE2035 (https://gatech.instructure.com/courses/502396/pages/academic-integrity-specifics) **.**

Additionally, all code and course materials provided in ECE2035 are copyrighted. They are for the use of the students currently enrolled in the course. Copyrighted course materials may not be further disseminated. You may not, nor may you knowingly allow others to reproduce or distribute code or other course materials publicly. This includes providing materials to commercial course material suppliers such as CourseHero, chegg, and other similar services, or posting your project code on github. Students who publicly distribute or display or help others publicly distribute or display copies or modified copies of ECE2035's course materials are in violation of Georgia Tech's Honor Code.

All exams are to be completed individually with no collaboration or interaction with anyone else. You may neither give nor receive unauthorized assistance on any exam. You may not work with others on the exam and you many not share questions or answers with anyone else, including looking for or posting questions/answers on any website.

All conduct in this course will be governed by the Georgia Tech **honor code** (https://policylibrary.gatech.edu/student-affairs/academic-honor-code). Additionally, it is expected that students will respect their peers and the instructor such that no one takes unfair advantage of anyone else associated with the course. Any suspected cases of academic dishonesty will be reported to the Office of Student Integrity for further action.

STUDENT WELL-BEING: Dean of Students Office, CARE Center, Counseling Center, Stamps Health Services, and the Student Center

The **CARE Center** (https://care.gatech.edu/) and the **Counseling Center** (https://counseling.gatech.edu/), Stamps Health Services, and the Dean of Students Office will offer both in-person and virtual appointments. Student Center services and operations are available on the **Student Center** (https://studentcenter.gatech.edu/) website. For more information on these and other student services, contact the Dean of Students or the **Division of Student Life** (https://

studentlife.gatech.edu/) .

In addition, please see the 🐝 **GT Student Resources** item on the left for links to these and many other types of campus resources.

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 http://disabilityservices.gatech.edu/ (http://disabilityservices.gatech.edu/) , as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. When I am notified of your status, I will assign a brief questionnaire for you to fill out on Canvas, which should give me all the information I need. Please contact me if you believe you have additional items to discuss regarding your learning needs. Also, note that accommodations are given as they arise. As an exam approaches, for example, and if you are a student who utilizes the Testing Center, then you must request accommodations according to their requirements. Merely having discussed accommodations at the start of the semester is not sufficient.

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. See this catalog page (http://www.catalog.gatech.edu/rules/22/) for an articulation of some basic expectation 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.

Course Summary:

Date	Details	Due