Architecture, Systems, Concurrency, and Energy in Computation

ECE 3058

Course Overview

This course introduces the basic organizational principles of the major components of a processor: the core, memory hierarchy, and the I/O subsystem. Students gain an understanding of the sources of performance and energy dissipation in modern processors and learn the multiple forms and levels of parallelism that have been employed to sustain performance improvements in the industry. Basic principles of the operating system, focusing on threads and networks, are also introduced. Assignments using architecture-level simulators enable the students to explore the operation and tradeoffs in performance and energy and reinforce the concepts learned in the classroom.

Prerequisites

ECE 2031 and ECE 2035

Course Staff

Instructor	Diego Fratta
Email	fratta@gatech.edu
Office	Klaus 3354
Office Hours	See Canvas
	And by Appointment (Email)
GTA	
UTA	
UTA	
UTA	
UTA	
TA OH	See Canvas

Grading

Lab Assignments	40%
Midterm 1	20%
Midterm 2	20%
Final	20%
CIOS Bonus	Up to 1%

I understand that Grades are quite important, and I'm not going to post any official grade scale. Typically, the course grade scale will follow the general A = 90, B = 80 and so on. This scale may change if the average GPA of the course is below 3.00 and will be curved to reach that. But an A will never be more than 90%. So don't worry about that.

Additionally, at the end of the semester, once the grades are finalized, please don't email me about a grade bump. I know you may provide a good reason, but I need to be fair to all students and keep the grade scale applied consistently. I am very happy to talk about your grades and concerns about them throughout the semester.

The CIOS bonus is .5% if 70% of the CIOS is completed per section, and 1% if 85% of the CIOS is completed per section.

I reserve the right to introduce an attendance grade/pop quizzes if class attendance declines greatly.

Lastly, if you think I made a mistake with your grades, please don't hesitate to reach out!!

Course Material

Syllabus and Lecture Material: Via Canvas

Recommended (Not Required) Textbook:

> Patterson and Hennessey, *Computer Organization & Design RISC-V Edition: The Hardware/Software Interface (2nd),* Morgan Kaufmann, 2020, ISBN 978-0128203316

Lab Resources

There are 6 graded labs (Lab 0 – Lab 5). Lab 6 is not graded but questions from it will appear on the Final Exam. Individual Labs can be found on the lab resources page.

- Lab Resources Page: https://github.gatech.edu/pages/ECE3058/website/

Exams

There will be 2 Midterms and a Final Exam in this course. Exams will be delivered on paper.

Collaboration is not allowed on the exam with other students. Any collaboration on the exam that is caught will result in an 'F' in the course for all students involved regardless of circumstances. Exams are to be taken **individually** for all students regardless of section!

Course Objectives

By the end of this course, I believe you all will be able to do the following:

- Describe in detail the 5-stage pipelined model of a computer and consider how changes to it affect its performance.
- Understand how cache memory systems work with context to computer systems.
- Understand how virtual memory systems work, and how to analyze a virtual memory implementation to find addresses and data values.
- Understand how computers implement concurrency paradigms.
- Become familiar with Verilog and its applications for Computer Engineering.
- Gain a breadth level understanding of network communications.
- Gain a breadth level understanding of Energy and Power consumption in computer systems.

Ed Discussion

We will be using Ed Discussion for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TAs, and myself.

Rather than emailing questions to the teaching staff, I strongly encourage you to post your questions on Ed Discussion.

Ed Discussion is directly accessible via Canvas.

Attendance:

Students are responsible for all material covered in class, including changes in exam schedules announced in class. There will be no make-up exams without good reason. In case you must miss an exam, please inform the instructor of the absence prior to the exam date.

We will abide by the Institute policy on attendance, see http://catalog.gatech.edu/rules/4/. The following policies apply to this course: Students are required to complete all course assignments and in-class activities. Please discuss all absences with the course instructors, prior to the absence if they are planned. If there is not an excused absence, credit will be deducted from project work and other assignments will not be accepted late.

The class is recorded. If you do miss a class, it is on you to watch the recording. Please ask any questions you have that come up while watching the recording on Ed Discussion.

Religious Considerations:

If you are going to miss class due to religious observances, you must provide a letter with the dates of the absences within the first two weeks of class. The instructors will work with the students on an individual basis to try to accommodate as best as possible. https://catalog.gatech.edu/rules/4/ Section IV.B.5

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/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

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/, and http://disabilityservices.gatech.edu/content/welcome-accommodate 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 to set up a time to discuss your learning needs.

Accommodations are not applied automatically. You must email me at least 1 week before Lab Due dates and 2 weeks before exams to establish extra time or extended due dates.

Honor Code:

Students are expected to abide by the Georgia Tech Academic Honor Code. Honest and ethical behavior is always expected. All incidents of suspected dishonesty will be reported to and handled by the office of student affairs. You will have to do all assignments individually unless explicitly told otherwise. You may discuss with classmates, but you may not copy any solution (or any part of a solution).

Late Submissions:

Every student gets a 1-time no questions asked 5-day extension for any lab assignment. After that, you will need an appropriate note, such as doctor, athletics, or Dean of Students.

Please see the https://catalog.gatech.edu/rules/4/ for more details.

Student Illness

The class is offered in-person and remote with all lectures being recorded. If you feel ill, please join remotely. All submissions are online and unless you are too ill to work, you should be able to complete your remote work while in quarantine or isolation.

If you are ill and unable to do course work please contact the Dean of Students, https://studentlife.gatech.edu/request-assistance. Your instructor will not be told the reason, and will work with you to facilitate your learning needs.

Accommodations for Students at Higher Risk for Severe Illness due to any reason

Students may request an accommodation through the Office of Disability Services (ODS) due to presence of a condition as defined by the Americans with Disabilities Act (ADA). Registering with ODS is a 3-step process that includes completing an application, uploading documentation related to the accommodation request, and scheduling an appointment for an "intake meeting" (either in person or via phone or video conference) with a disability coordinator.

If you have been approved by ODS for accommodations, I will work closely with you to understand your needs and make a good faith effort to investigate whether or not requested accommodations are possible for this course. If the accommodation request results in a fundamental alteration of the stated learning outcome of this course, ODS, academic advisors, and the school offering the course will work with you to find a suitable alternative that as far as possible preserves your progress toward graduation.

Statement on Diversity

All students of all walks of life are welcome in my classroom. We, this includes you, respect the diverse makeup of students here at Georgia Tech. I strive to create an inclusive environment where all students feel valued no matter their gender identity, sexual orientation, race, ethnicity, religion, and any other protected class not listed. An inclusive classroom is a classroom where students learn best.

For more information about Georgia Tech's DEI mission, visit https://diversity.gatech.edu/