CS 4290 / ECE 4100 Advanced Computer Organization
CS 6290 / ECE 6100 High Performance Computer Architecture

Course Information

Course Prefix and Number: CS 4290, ECE 4100, CS 6290, and ECE 6100

Credit Hours: 3

Instructor: Milos Prvulovic

Course Description

Description

This course covers modern computer architecture, including branch prediction, out-of-order instruction execution, cache optimizations, multi-level caches, memory and storage, cache coherence and consistency, and multi- and many-core processors.

Learning Outcomes

Upon successful completion of this course, you should be able to understand the design and operation of modern in-order and out-of-order processors, use benchmarking and simulation to make informed choices about the design and parameters for key parts of the processor core, understand and model functionality of on-chip interconnects, cache coherence, and consistency models, and make informed decisions regarding the interaction between the processor hardware and the system and application software.

Required Course Materials

There are no required readings. When appropriate, additional class materials will be available as instructor notes that are associated with the video lectures. Although we do not require, and do not officially recommend, a textbook, students who prefer to learn from a textbook should consider “Computer Architecture: A Quantitative Approach” by John L. Hennessy and David A. Patterson. A recent edition should work, but editions 1-4 put less emphasis on multi-core topics than our course does.

Grading Policy:

The grade is determined by your performance on projects and exams. You will receive these grades through Canvas. The projects and exams will count toward the final grade as follows:

- Projects (50% of overall grade): You will be given four projects, each requiring more work than the previous one. Each project is to be completed individually or in two-student teams, as specified in each project assignment.
    - Project 0 (5% of overall grade)
    - Project 1 (10% of overall grade)
    - Project 2 (15% of overall grade)
    - Project 3 (20% of overall grade)
- Exams (50% of overall grade)
    - Midterm (20% of overall grade)
    - Final (30% of overall grade), it **does** include questions about material covered in the Midterm

The plan is to assign final (letter) grades based on your total score, with 90% and above earning an A, 80% and above earning a B, etc. If this results in too few As, we may decide to lower the thresholds somewhat, or to use some sort of a curve - the final decision whether and what to do in this regard is up to the instructor.

There will be **no make-up assignments**, so if you need a particular grade plan to perform accordingly on projects and exams. After a project or exam is graded, the only way the score on that assignment or exam will be changed is if a legitimate mistake in grading has been made. Due to the large number of students in this class, assignment and exam re-grades can only be requested during the 14 days that follow the release of scores from that assignment/exam. When requesting a re-grade, keep in mind **that the entire submitted project/exam will be regraded**, so a request for a regrade may result in a net loss of points.

The grade in this class will be based solely on demonstrated performance. No grade will ever be changed because the student **needs** a better grade to stay in the program, to keep a fellowship, to get a job, or any other reason. If you believe you need some particular grade in this class, the only way to get that grade is to earn it on projects and exams.

Course Policies

Attendance and/or Participation

While we will not track lecture attendance or use lecture attendance in determining your grade, you are expected to know what was covered in the lectures, be aware of any

announcements that are made in the lectures, and complete exams and projects on time. Please be aware that terminology for some of the key concepts in modern computer architecture varies in the literature, and that in the lectures we will clearly specify the terms we will use for each concept to avoid confusion. Therefore, it is highly recommended that you do attend each lecture, even if you are already familiar with the topic that is covered in that lecture.

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. Review Georgia Tech's Honor Code and the student Code of Conduct.

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

Collaboration, Group Work, and Use of Generative AI

For exams and projects, students are required to complete the assignment on their own, without trying to acquire information that is specific to thew assignment from any other person, tool, or anyone/anything else. Examples of this include getting help from other students in the class, any other person, artificial intelligence agents (e.g. ChatGPT), AI-based generative or transformation tools for program code, looking up CS 6290 project code posted by former students of this class, and any other methods that would cause the answers and program code submitted by a student to not be entirely their own.

The only exceptions to this is that 1) seeking help from the instructor or the TAs is allowed, although we will not give you any of the answers and/or code beyond those that are provided with the assignment to all of the students in the class, and 2) work on program code and discussion of project concepts with your project partner is allowed, but only on Project 2 and Project 3 (which allow having a partner).

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) 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.

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.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

No late assignments or exams will be accepted unless we are advised to do so by the Dean of Students. Please contact the office of the Dean of Students with health emergencies, family emergencies, personal disabilities, or other significant events. The Dean's office is equipped to verify these exceptions better than us, and provides a level of uniformity across courses on how emergencies are handled.

Campus Resources for Students

Graduate Student Academic and Professional Success Resources:

A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- *Professional Development such as the programming from the Career Center and other professional development resources and events"*

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being (student-resource-guide (gatech.edu)