Course Syllabus

Course 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.

Professor and TAs

Professor
Milos Prvulovic
Office hours: Fridays noon to 1pm (US Eastern time) via Zoom (use the Zoom link in the navigation bar on the left side of the course website.

TAs
TBD

Prerequisites

Undergraduate computer architecture course that covers basic computer organization; working knowledge of topics such as instruction sets, pipelining, etc. For the course project, you will also need to be familiar with C/C++, Linux, and be comfortable making modifications to large programs.

If you answer "no" to any of the following questions, it may be beneficial to refresh your knowledge of the prerequisite material prior to taking CS 6290:

- Have you taken a computer organization course before?
- Are you familiar with at least one RISC instruction set and would you feel comfortable reading and writing small assembler programs?
- Are you familiar with basic computer architecture concepts, such as pipelines and caches?
- Are you familiar with C/C++ and would you be comfortable writing and/or modifying 100+ lines of code in a program that has over 100,000 lines of code?
- Are you comfortable with, or even excited about, learning about how real processors work and using simulation to see how changes in processor design affect its performance?
- Have you successfully completed the HPCA0 "course" at Udacity?

Textbook

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, a useful textbook for this course is "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

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. Once a homework, project, or exam is over and 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.

Emergencies and Late Policy

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.

Academic Integrity

All Georgia Tech students are expected to uphold the **Georgia Tech Honor Code** ⬀ **(http://osi.gatech.edu/content/honor-code)** . **You should read it (including the Graduate Addendum)!** We take cheating **very** seriously. Note that all Georgia Tech faculty (including the instructor for this course) are **required** to report cases of academic dishonesty to the Dean of Students' office at Georgia Tech.

Class Schedule

This schedule lists important dates (exams, project release and due dates, etc.). The white-background items show the recommended schedule for completing lessons. Of course, you can complete lessons at a faster pace, but projects and exams are timed assuming that you will take the lectures according to the provided schedule - so do not fall behind!

Week	Dates	Topics
1	May 13-17	Introduction, Metrics and Evaluation; Pipelining Review; Branch Prediction

Week	Dates	Topics
	May 13	Project 0 Released
2	May 20-24	Predication; ILP and Instruction Scheduling
	May 20	Project 1 Released
	May 22	Project 0 Due at midnight AOE (GMT-12)
3	May 27	Official School Holiday
	May 28-31	ROB; Memory Ordering; Compiler ILP and VLIW
	May 31	Project 2 Released
4	Jun 3-7	Cache Review and Virtual Memory
	Jun 7-9	Midterm Exam (2-hour proctored exam)
	Jun 12	Project 1 Due at midnight AOE (GMT-12)
5	Jun 10-14	Advanced Caches, Memory
6	Jun 19	Official School Holiday
	Jun 17-21	Storage and Fault Tolerance
	Jun 18	Project 3 Released
	Jun 23	Project 2 Due at midnight AOE (GMT-12)
7	Jun 24-28	Multi-Processing; Begin Cache Coherence
	Jun 29	Last day to drop course with "W" grade
8	Jul 4-5	Official School Holiday
	Jul 1-3	Finish Cache Coherence
9	July 8-12	Synchronization; Begin Memory Consistency
10	Jul 15-19	Finish Memory Consistency; Many-Core
	Jul 21	Project 3 Due at midnight AOE (GMT-12)
11	Jul 22-24	Final Instructional Class Days and Reading Day (Prepare for Exams)
	Jul 27-29	Final Exam (3-hour proctored exam)

Course Summary:

Date	Details	Due
Fri May 17, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366919&include_contexts=course_388950)**	11am to 12pm
Tue May 21, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366921&include_contexts=course_388950)**	11am to 12pm

Date	Details	Due
Thu May 23, 2024	📝 **Project 0** **(https://gatech.instructure.com/courses/388950/assignments/1724384)**	due by 7am
Fri May 24, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366923&include_contexts=course_388950)**	11am to 12pm
Tue May 28, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366925&include_contexts=course_388950)**	11am to 12pm
Fri May 31, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366927&include_contexts=course_388950)**	11am to 12pm
Tue Jun 4, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366929&include_contexts=course_388950)**	11am to 12pm
Fri Jun 7, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366931&include_contexts=course_388950)**	11am to 12pm
Mon Jun 10, 2024	🚀 **Midterm (https://gatech.instructure.com/courses/388950/assignments/1724382)**	due by 9am
Tue Jun 11, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366933&include_contexts=course_388950)**	11am to 12pm
Wed Jun 12, 2024	📝 **Project 1 (https://gatech.instructure.com/courses/388950/assignments/1724386)**	due by 7am
Fri Jun 14, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366935&include_contexts=course_388950)**	11am to 12pm
Tue Jun 18, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366937&include_contexts=course_388950)**	11am to 12pm

Date	Details	Due
Fri Jun 21, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366939&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366939&include_contexts=course_388950)**	11am to 12pm
Mon Jun 24, 2024	📝 **[Project 2 (https://gatech.instructure.com/courses/388950/assignments/1724388)](https://gatech.instructure.com/courses/388950/assignments/1724388)**	due by 7am
Tue Jun 25, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366941&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366941&include_contexts=course_388950)**	11am to 12pm
Fri Jun 28, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366943&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366943&include_contexts=course_388950)**	11am to 12pm
Tue Jul 2, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366945&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366945&include_contexts=course_388950)**	11am to 12pm
Fri Jul 5, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366947&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366947&include_contexts=course_388950)**	11am to 12pm
Tue Jul 9, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366949&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366949&include_contexts=course_388950)**	11am to 12pm
Fri Jul 12, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366951&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366951&include_contexts=course_388950)**	11am to 12pm
Tue Jul 16, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366953&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366953&include_contexts=course_388950)**	11am to 12pm
Fri Jul 19, 2024	📅 **[OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar?event_id=4366955&include_contexts=course_388950)](https://gatech.instructure.com/calendar?event_id=4366955&include_contexts=course_388950)**	11am to 12pm
Mon Jul 22, 2024	📝 **[Project 3 (https://gatech.instructure.com/courses/388950/assignments/1724390)](https://gatech.instructure.com/courses/388950/assignments/1724390)**	due by 7am

Date	Details	Due
Tue Jul 23, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366957&include_contexts=course_388950)**	11am to 12pm
Fri Jul 26, 2024	📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366959&include_contexts=course_388950)**	11am to 12pm
Tue Jul 30, 2024	🚀 **Final (https://gatech.instructure.com/courses/388950/assignments/1724380)**	due by 10am

📅 **OMS CS 6290 Office Hours (Optional) (https://gatech.instructure.com/calendar? event_id=4366957&include_contexts=course_388950)**