

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)  (<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	Jan 8-12	Introduction, Metrics and Evaluation; Pipelining Review
	Jan 10	Project 0 Released

Week	Dates	Topics
2	Jan 15	Official School Holiday
	Jan 16-19	Branch Prediction; Predication
	Jan 17	Project 1 Released
3	Jan 22-26	ILP and Instruction Scheduling
	Jan 28	Project 0 Due at midnight AOE (UTC-12)
4	Jan 29-Feb 2	ROB
	Jan 31	Project 2 Released
5	Feb 5-9	Memory Ordering
6	Feb 12-16	Compiler ILP and VLIW
	Feb 18	Project 1 Due at midnight AOE (UTC-12)
7	Feb 19-23	Cache Review and Virtual Memory
	Feb 23-25	Midterm Exam (2-hour proctored exam)
8	Feb 26-Mar 1	Advanced Caches; Memory
	Feb 28	Project 3 Released
9	Mar 4-8	Storage and Fault Tolerance
	Mar 10	Project 2 Due at midnight AOE (UTC-12)
10	Mar 11-15	Multi-Processing
	Mar 13	Last day to drop course with "W" grade
11	Mar 18-22	Spring Break
12	Mar 25-29	Cache Coherence
13	Apr 1-5	Synchronization
14	Apr 8-12	Memory Consistency
	Apr 14	Project 3 Due at midnight AOE (UTC-12)
15	Apr 15-19	Many-Core
16	Apr 22-24	Final Instructional Class Days and Reading Day (Prepare for Exams)
	Apr 26-28	Final Exam (3-hour proctored exam)

Course Summary:

Date	Details	Due
Fri Jan 12, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205317&include_contexts=course_370702	11am to 12pm
Fri Jan 19, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205319&include_contexts=course_370702	11am to 12pm
Fri Jan 26, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205321&include_contexts=course_370702	11am to 12pm
Mon Jan 29, 2024	 Project 0 https://gatech.instructure.com/courses/370702/assignments/1573486	due by 6am
Fri Feb 2, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205323&include_contexts=course_370702	11am to 12pm
Fri Feb 9, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205325&include_contexts=course_370702	11am to 12pm
Fri Feb 16, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205327&include_contexts=course_370702	11am to 12pm
Mon Feb 19, 2024	 Project 1 https://gatech.instructure.com/courses/370702/assignments/1573488	due by 6am
Fri Feb 23, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205329&include_contexts=course_370702	11am to 12pm
Mon Feb 26, 2024	 Midterm https://gatech.instructure.com/courses/370702/assignments/1573484	due by 8am
Fri Mar 1, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205331&include_contexts=course_370702	11am to 12pm

Date	Details	Due
Fri Mar 8, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205333&include_contexts=course_370702	11am to 12pm
Mon Mar 11, 2024	 Project 2 https://gatech.instructure.com/courses/370702/assignments/1573490	due by 7am
Fri Mar 15, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205335&include_contexts=course_370702	11am to 12pm
Fri Mar 22, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205337&include_contexts=course_370702	11am to 12pm
Fri Mar 29, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205339&include_contexts=course_370702	11am to 12pm
Fri Apr 5, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205341&include_contexts=course_370702	11am to 12pm
Fri Apr 12, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205343&include_contexts=course_370702	11am to 12pm
Mon Apr 15, 2024	 Project 3 https://gatech.instructure.com/courses/370702/assignments/1573492	due by 7am
Fri Apr 19, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205345&include_contexts=course_370702	11am to 12pm
Fri Apr 26, 2024	 OMS CS6290 Office Hours (Optional) https://gatech.instructure.com/calendar?event_id=4205347&include_contexts=course_370702	11am to 12pm
Mon Apr 29, 2024	 Final https://gatech.instructure.com/courses/370702/assignments/1573482	due by 10am