Course Syllabus: 15-346 Computer Architecture: Design and Simulation

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Prerequisites: 15-213

Units: 6 (mini)

Description:

This course will help students develop an understanding of basic microarchitectural principles and designs. Starting with creating benchmarks and simulators, students will learn the practice of computer architecture design. The emphasis will be on how processors exploit instruction-level parallelism for performance, as well as the supporting technologies such as caches and branch prediction that are required. Several frontiers of current research will be explored in energy efficiency and security threats.

Learning Objectives

- Identify different benchmark designs and their usage in performance measurement and simulation

- Describe the components of processor pipelines and architectural techniques to improve cycles per instruction and instruction level parallelism, as well as the trade-offs imposed by these techniques

- Analyze assembly sequences to estimate performance based on different architectural designs

- Describe the path of a memory request from instruction to DRAM

- Demonstrate understanding of computer architecture by developing simple simulators of different components

- Analyze how architectural techniques are exposed through the memory model and through timing of instruction sequences

Your involvement in class

Students are expected to attend either in-person or online, each of the lectures. Each student is excused from three lectures without need to ask. If your commitments, life, or other issues are preventing you from attending lectures, please contact your instructor and advisor about how we might create the best possible circumstances for your success.

Assessment Mechanisms

- Simulator development through a series of separate programming assignments that will collectively simulate an out-of-order processor with branch predictor and cache.
- Written Assignments
- Final exam during exam week to explore content from course

Handin Policy

Students will have three grace days that can be applied to any programming assignment. Otherwise, each day late is 10% of the grade. As the simulators build on each other, we are incentivizing you to stay on track with the work.

Written assignments will be accepted late, at a cost of 10% per day.

For all submissions, the management systems are configured with “slack” time to account for small issues with clock drift, etc.

If you have any issue, circumstance, or are otherwise not able to meet the deadlines of the course. Please contact the instructor and your advisor to arrange for a new schedule. The earlier we are involved, the better opportunity we have to craft a new arrangement that gives you the opportunity to demonstrate your learning.

Grading

Programming assignments - 60%

Written assignments - 20%

Final exam - 20%

Textbook

We recommend that you have a copy of Hennessey and Patterson, Computer Architecture: A Quantitative Approach (currently 6th edition).

Collaboration

15-346 students are expected to develop each project with a partner. You should plan on meeting together regularly (online) and sharing your work. You are encouraged to talk with other students in the class about all of the material and your learning. But your submissions should be your own, and therefore discussions about the programming should be kept to a high-level.

Within the written assignments, you are also welcome to discuss the problems with your peers (course staff and those students currently in the course), but you should list those students and the scope of your discussions as part of acknowledging their “contributions”. Other sources, such as textbooks, wikipedia, etc, should also be cited appropriately. Ultimately, your solution should be written individually by you.

Students who are caught plagiarizing or cheating will be given a university-level Academic Integrity Violation (AIV). The penalty for an AIV will range from getting a −100% score for the particular assignment to failing the class. Students who provide resources to students in future instances of the course can be subject to a retroactive AIV violation in this course. This can lead to a change in grade and even a revocation of your diploma.

New Course

This is a new course. Some things might go wrong, but we will do our best to be fair and reasonable to all students. We will greatly value your input and feedback throughout this course, so that we can determine reasonable difficulties and workloads.