CDA5155/CDA4150 Computer Architecture
Course Overview
Spring 2026

Computer architecture has been a very dynamic field for over six decades. Every year several manufacturers design and implement new architectures for machines. Many trends, such as the RISC approach to simplify decoding and facilitate pipelining, effective use of memory hierarchies, and exploitation of instruction-level parallelism (ILP), data-level parallelism (DLP), and thread-level parallelism (TLP), have spurred current computer architecture research.

In this course we will concentrate on the study of memory-hierarchy design, ILP, DLP, and TLP. The text, "Computer Architecture: A Quantitative Approach. Sixth Edition" by Hennessy and Patterson, is regarded as the definitive text for computer architecture and design. Reading this text will help reinforce your understanding of these concepts. We may also examine some research papers that will allow a closer inspection of specific topics.

The class will be divided into three parts. The first part will concentrate on memory hierarchies. The second part will be about pipelining and exploiting instruction-level parallelism. The third part will cover data-level parallelism, thread-level parallelism, warehouse-scale computing, and domain-specific architectures. There will be an examination at the end of each part of the course.

You will be assigned three programming projects and a few other smaller projects. The first programming assignment will be to write a memory hierarchy simulator. Not only will this assignment help you to understand how memory hierarchies operate, but it should also help you grasp the impact that design alternatives for a memory hierarchy can have on performance. The second programming assignment will be to write a simulator for a branch target buffer and branch prediction buffer. This assignment will help you understand how these two architectural techniques can be used to avoid delays associated with transfers of control. The third programming assignment will be to exploit streaming SIMD extensions. This assignment will help you understand the benefits of exploiting SIMD features available on a current processor. You will also be required to write a short paper on some computer architecture topic. Finally, you will be assigned some small supplementary assignments on other topics that will be discussed in this class during the semester.

While most of you will not have careers designing the architecture of computers, it is important to understand concepts in computer architecture. These concepts will be useful for determining what types of systems to purchase, how to write programs so that they efficiently execute on processors, and understanding related concepts that can be applied at higher levels to develop more efficient computing systems.