# Intro. to Computer Architecture

CSCI 3300

## Instructor Info

- Kelvin Gao
- Office Hrs: Tue & Thu 9:00a-10:15a
- by Zoom
- https://calendly.com/zgao1
- zgao1@aum.edu

## Course Info

- Prereq: CSCI 3000 or C/C++ Placement Test
- Mon & Wed
- 8:00a-9:15a
- Clement Hall 217

## Lab Info

- N/A
- N/A
- N/A

## TA Info

- TBD
- Office Hrs: TBD
- TBD

## Overview

Logic design, principles of operation of digital computers, and analysis of major components: arithmetic processing, memory, control, and input/output units, instruction pipelining, SIMD, and multiprocessor systems.

## Material

### Required Texts

Patterson and Hennessey, *Computer Organization & Design: The Hardware/Software Interface*.

## Attendance

You need to show up in every class in order to receive full credit of attendance. The TA/Instructor will call the roll.

## Grading Scheme

| | |
|---|---|
| 5% | Attendance/Participation |
| 15% | Quiz |
| 40% | Programming Assignment |
| 20% | Midterm Exam |
| 20% | Final Exam |

Grades will follow the standard scale: A = 89.5-100; B = 79.5-89.4; C = 69.5-79.4; D = 60-69.4; F <60. Curving is at the discretion of the professor.

## Late Submission Policy

Except in the cases outlined above for excused absences, programming assignments must be submitted before the specified deadline in order to receive full credit.

- 0 to 24 hours late: 10% of points will be deducted from the original score.
- 24 to 48 hours late: 20% of points will be deducted from the original score.
- Others: 30% of points will be deducted from the original score.

Note: No late submissions will be accepted after the final exam.

## Learning Objectives

- Learn computer abstractions and technologies
- Understand instructions as to the language of computer hardware,
- Understand arithmetic for computers, processors, memory hierarchies, storage and I/O, and multicores and multiprocessors.
- Learn detailed information on graphics and GPU processes
- Understand the fundamental concept of operating system

# FAQs

**?** What is Computer Architecture?

**!** It is a set of rules and methods that describe the functionality, organization, and implementation of computer systems. The architecture of a system refers to its structure in terms of separately specified components of that system and their interrelationships. [Wikipedia: https://en.wikipedia.org/wiki/Computer_architecture]

**?** Any programming work in this course?

**!** Yes, we do have several class project that require programming works.

**?** What is the difference between CSCI 3300 and CSCI 6790?

**!** CSCI 6150 is for graduate students. It may require more research-related works, e.g., paper review.

**?** Will it include mobile operating system?

**!** Yes, we will have a week or two discussing mobile operating system.

## Make-up Policy

Make-up exams or assignments will only be allowed for students who have a substantiated excuse approved by the instructor *before the due date*. Leaving a phone message or sending an e-mail without confirmation is not acceptable.

## Diversity and Inclusivity Statement

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

## Accommodations for Students with Disabilities

Students who need accommodations are asked to arrange a meeting during office hours to discuss your accommodations. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not registered for accommodation services through the Center for Disability Services (CDS), but need accommodations, make an appointment with CDS, 147 Taylor Center, or call 334-244-3631 or e-mail CDS at cds@aum.edu.

## Free Academic Support

All students have the opportunity to receive free academic support at AUM. Visit the Learning Center (LC) in the WASC on second floor Library or the Instructional Support Lab (ISL) in 203 Goodwyn Hall. The LC.ISL offers writing consulting as well as tutoring in almost every class through graduate school. The LC may be reached at 244-3470 (call or walk-in for a session), and the ISL may be reached at 244-3265. ISL tutoring is first-come-first served. Current operating hours can be found at www.aum.edu/learningcenter

Blackboard support: Students may seek technology assistance from the ITS Help Desk located in the computer lab on the first floor of the Taylor Center. You may also call 334-244-3500 or email helpdesk@aum.edu.

## Academic Integrity

The University Code of Academic Integrity is central to the ideals of this course. Students are expected to be independently familiar with the Code and to recognize that their work in the course is to be their own original work that truthfully represents the time and effort applied. Violations of the Code are most serious and will be handled in a manner that fully represents the extent of the Code and that befits the seriousness of its violation.

Specific Rules:

- If plagiarism is detected, all students get 0 points for the assignment.
- If you cheat in the quiz/exam, you get 0 points.
- There is no chance to change your grade back.
- If you have any doubts, I can forward your request to the department and let they evaluate it. Keep in mind that once the department makes the decision, it will be written in your academic record. And once they report that you do cheat in the assignments/exams, you won't receive any scholarship in the future.

## Class Schedule

### MODULE 1: Introduction

| Week 1 | Introduction | August 15: introduction.pptx, syllabus |
|---|---|---|

### MODULE 2: Computer Logic and Organization

| Week 2 | Number System and Gates | August 22: CompOrg-Lec01-Number-System-and-Gates.pptx, CompOrg-Lec02-Gates.pptx, Programming Assignment 1 |
|---|---|---|
| Week 3 | Combinational Logic, Mux/DeMux/Decoder | August 29: CompOrg-Lec03-Combinational-Logic.pptx, CompOrg-Lec04-Mux-DeMux-Decoder.pptx Programming Assignment 1 |
| Week 4 | ALU | Sep 7: CompOrg-Lec05-ALU.pptx |
| Week 5 | Sequential Logic and Memory | Sep 12: CompOrg-Lec06-Sequential.pptx, CompOrg-Lec07-Memory.pptx |
| Week 6 | MISP | Sep 19: CompOrg-Lec08-MIPS.pptx, CompOrg-Lec08-MIPS-2.pptx, Programming Assignment 2 <br><br> Due: Programming Assignment 1 |
| Week 7 | Review &Midterm Exam | Sep 26: Exam: Module 1-3 (excluded scheduling) |

### MODULE 3: Processor and ISA

| Week 8 | Data Path and Performance | Oct 3: CompOrg-Lec10-Datapath.pptx, CompOrg-Lec11-Performance.pptx |
|---|---|---|
| Week 9 | Pipeline | Oct 10: CompOrg-Lec12-Pipeline.pptx, CompOrg-Lec13-Pipeline-Control.pptx, CompOrg-Lec14-Pipeline-Hazards.pptx |
| Week 10 | ILP and Data Dependencies | Oct 17: CompOrg-Lec15-ILP.pptx, CompOrg-Lec16-Data-Dependencies.pptx |
| Week 11 | Out-of-Order Execution | Oct 24: CompOrg-Lec17-OOO.pptx, CompOrg-Lec18-OOO-Example-and-ROB.pptx |
| Week 12 | Branch Prediction | Oct 30: CompOrg-Lec19-BranchPrediction.pptx, CompOrg-Lec20-More-BPs.pptx, Programming Assignment 3 <br><br> Due: Programming Assignment 2 |

### MODULE 4: Memory Hierarchy

| Week 13 | Cache I | Nov 7: CompOrg-Lec21-Cache.pptx, CompOrg-Lec22-Direct-Mapped-Cache.pptx |
|---|---|---|
| Week 14 | Cache II | Nov 14: CompOrg-Lec23-Cache-Performance.pptx, CompOrg-Lec24-Cache-Examples-and-ML-Cache.pptx |
| Week 15 | Thanksgiving | No class |
| Week 16 | Multicore, FINAL EXAM | Nov 28: CompOrg-Lec25-Multicore <br><br> Due: Programming Assignment 3 (Dec 1) |