CIS*2030: Structure and Application of Microcomputers
Computer Science, Fall 2022

General Description

This course introduces the topic of *Computer Architecture*. Computer architecture refers to those attributes of a computer system that are visible to a programmer, or put another way, those attributes that have a direct impact on the logical execution of a program. As a result of this course, students will gain insight into the operation of the major components of a computer system, assembly-language programming, and computer interfacing. The Motorola 68000 has been selected as the example architecture to study, due to the simplicity and clarity of its architecture, and the availability of a simulation tool that supports many facets of the 68000 architecture, including its data types, memory organization, registers, instruction set, address modes, processor states, exceptions and exception processing facility, memory-mapped I/O, and assembler language.

Course Outline

Each bullet corresponds to *roughly* 1-2 weeks of the semester.

- Binary encoding and data representation: number systems, binary arithmetic, complement arithmetic, ranges, arithmetic overflow, other code systems, and fixed-point and floating-point representations (bonus material)
- Basic computer components, importance of Instruction-Set Architecture (ISA) role of memory versus registers, and simplified instruction cycle
- An assembler language view of the Motorola 68000's ISA
- Hardware support for high-level language (i.e., C): data types, data structures, loops, conditional statements, hardware stack, functions, parameter passing, return values, stack frames, local variables, recursion and re-entrant code
- Hardware support for Operating Systems: privileged states; exception processing
- Interaction among components: device operation, device control, bus signals, input/output protocols: polling, interrupts, direct-memory access
- Memory Hierarchy and Caching

Required Textbook

- MacKenzie S., (1995). *The 68000 Microprocessor*, Prentice-Hall. (Required)
- Lab Exercises will be provided
- Any additional readings (PDFs) will be provided online

Additonal Requirements

Students are required to:

- Attend weekly lectures. These will be held face-to-face during the hours allocated by the registrar. (See Webadvisor for details.) Lectures will not be recorded and will not be posted online.

- Attend weekly labs. These will be held face-to-face during the hours allocated by the registrar. (See Webadvisor for details.) Labs are 3-hours and to be taken seriously! You are expected to attend and work through the lab exercises in the lab under the guidance and evaluation of a lab instructor. All marking will be performed in real time by the lab instructor (in an incremental fashion) during the 3-hour lab session. No marking will take place outside of the regularly scheduled lab times; labs cannot be submitted online.

Course Evaluation

Successful demonstration of proficiency with the course material will be based on the following types of evaluations:

- Lab exercises (face-to-face),
- Homework problems,
- In-class (face-to-face) term test(s), and
- Final exam (face-to-face).