Computer Architecture

CS 220
Fall 2011

Instructor: Tom Kelliher
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Office hours: MWThF 1:30–2:30pm. Other times by appointment.

Class: Hoffberger 149, MWF 10:00–10:50am.
`http://phoenix.goucher.edu/~kelliher/f2011/cs220/`

Objectives: The main objective of this class is for you to learn how a computer is organized to execute programs. A secondary objective is learning how the organizational building blocks of a computer are constructed from smaller building blocks (i.e., combinational gates and memory elements).

We will consider the major organizational components of modern computer systems: arithmetic logic unit (ALU), control, memory hierarchy, and I/O. We will study things such as high speed addition and multiplication circuits, ways of implementing control logic, pipelining, caches, and paging hardware. Some of these are basic requirements of all general purpose computers, while others, such as pipelining and caches, are performance enhancements.

We will also study how microarchitectural techniques are employed to speed execution, learn about multiprocessors, and learn how an architect designs an architecture to solve a specified class of problems.

At the end of this course, you will be able to:

1. Explain the context of the environment in which computing systems are designed and in which they must perform. (This context includes the dimensions of power, performance, and technology.)
2. Evaluate competing designs or implementations using the tools of performance measurement.
3. Differentiate between the components of instruction set design.
4. Distinguish between architectural and organizational features of an implementation.
5. Apply the basic techniques of compilation in translating high level language programs into assembly language programs. Specifically, achieve a deep understanding of the stack model employed by many high level languages.
6. Design datapath and control elements capable of executing a particular instruction set.
7. Categorize the various levels of the memory hierarchy.

Textbook: D. A. Patterson and J. L. Hennessy, "Computer Organization & Design: The Hardware/Software Interface," 4th ed., Morgan Kaufmann, 2009. Required.

Grading:

Grade Distribution

A = [92–100], A- = [90–92), B+ = [88–90), B = [82–88), B- = [80–82), etc. Grades are "one point rounded."

Course Point Distribution

There are tentatively 700 total points for the course:

1. Assignments. There will be approximately six written assignments. Each assignment will be worth 50 points and due in class. Except for emergencies, late assignments will not be accepted.
2. Semester exams. There will be two exams, on the following dates: Oct. 5 and Nov. 16. Each will be worth 100 points. If you need to re-schedule an exam, it is your responsibility to let me know a few days beforehand.
3. Final. There will be a cumulative final, scheduled by SAS. The final is worth 200 points.

Current grades (password protected) may be viewed on the class home page.

Integrity: Academic dishonesty will not be tolerated. We are all bound by the Academic Honor Code.

Course Handouts:

Course handouts may be made available once in class. After that, they may be obtained from the class home page.

Attendance: Attendance of classes is expected. It is your responsibility to catch up on missed class work.

Electronic Communication:

From time-to-time, I will need to send e-mail messages to the class. These messages will be addressed to your official Goucher e-mail addresses. You are responsible for checking your e-mail on a timely basis.

Distractions: Cell phones must be turned off or set to "silent" during class. If you must enter late, do so as unobtrusively as possible. Likewise if you must leave early. Please use mental telepathy if you must hold a personal conference during class. I have ways of making you not talk!

Disabilities: Any student with a documented disability should contact the Academic Center for Excellence (ACE) to arrange for academic accommodations for the course. Carefully follow all ACE's policies and procedures. Once you have coordinated with ACE, email me to make me aware of your accommodation. I will receive official correspondence from ACE; however, I would also like to receive an email from all students requiring accommodations for the semester. If your accommodation involves taking exams at ACE, it is your responsibility to schedule your exams with ACE. When scheduling exams with ACE, be sure to carbon copy me on any emails with ACE so that I have confirmation that everything is in order. This process is to be repeated for all exams throughout the semester.

Achieving Academic Success:

If you are struggling in this or other courses, I strongly encourage you to reach out for help sooner rather than later. Proactive strategies could include contacting the instructor directly, attending office hours, and/or taking advantage of the multitude of academic services that the Academic Center for Excellence offers. The responsibility is upon you to recognize when you need help and to take the steps necessary to succeed. Goucher College has a variety of resources available to help you succeed in your classes; use them!

Student-Athletes:

According to the Goucher College policy on Student-Athlete Responsibilities, all student-athletes are expected to contact me at the beginning of the semester to request approval for absences associated with athletic events (or scheduled departure times for such events) that conflict with the regularly scheduled class time. The approved absences will then be listed on a contract signed by both me and the student-athlete. Additionally, it is the responsibility of the student-athlete to complete all assignments covered in class during the approved absences and to obtain all handouts, assignments, and notes from the missed class(es). Student-athletes who fail to coordinate with me prior to any class absences will not be permitted to make-up missed assignments.

Student Responsibilities in Academic Conflicts (Field trips, Performances, etc.):

According to the Goucher College policy on Academic Conflicts, all students in situations in which you are confronted with obligations or responsibilities (ranging from participation in field trips in the visual arts or the sciences or rehearsals or performances in the performing arts to extra-curricula activities at which students are representing the college such as model senate events or varsity athletic contests) that conflict with regularly scheduled academic classes, are expected to contact me at the beginning of the semester, or as soon as the conflict is known, to request approval for absences that conflict with the regularly scheduled class time. The approved absences will then be listed on a contract signed by both myself and the student. Additionally, it is the responsibility of the student to complete all assignments covered in class during the approved absences and to obtain all handouts, assignments, and notes from the missed class(es). Students who fail to coordinate with me prior to any class absences will not be permitted to make-up missed assignments.