

CSCI 410: Elements of Computing Systems

Winter/Spring 2012, M/W/F 2-3PM, Alderson 330

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Office hours are M/W/F from 12PM – 2PM, or by appointment.

Course Web home: <http://mines.humanoriented.com/410/>

Prerequisites: (CSCI261 && CSCI341 || approval of instructor) && a passion for programming.

Texts: Code. Petzold. Microsoft Press. 2000.

The Elements of Computing Systems. Nisam, Schocken. MIT Press. 2005.

Both of these texts are available at the campus bookstore.

Course Objectives

The goal of this course is to understand the entire abstraction stack of a modern computer system by building a computer from the ground up, from NAND to Tetris. Topics include:

- Boolean and sequential logic
- Machine language and architecture, assemblers
- Virtual machines
- High-level languages, compilers, operating systems
- History & future of computing

At the end of this course you should have a complete functioning computer and a thorough understanding of all the components therein.

Grading

- Attendance & Participation 10%
- Projects 70%
- Reading assignments / quizzes 20%

Attendance & Participation

You are expected to be present for class (of course!). This is a fun but challenging class that demands your consistent participation. In the end, you will be a CS ninja ready to take on any binary machine (and the creatures it unleashes upon you). If you know you will be absent, your instructor appreciates a 24-hour advance notice via email. *More than three unexcused absences will be met with his evil wrath.*

Project

Most of your labor in this class will involve continuous work on a semester-long project. You will build an entire computer (hardware & software) from the ground up using a hardware emulator and development environment. At the end of the semester you will have a completely functional computer that *you* will have built and can extend (to play games, take over the world, etc).

Homework (Reading)

You will receive short homework assignments that will almost always be reading assignments from Code. You will be given take-home quizzes on the reading material and these will be due at the **beginning** of each class. No quizzes are accepted at the end of class, via email or after the due date *without prior discussion with the instructor*.

Late Work Policy

Late work is accepted in this class. Submissions that are within twenty-four hours of the deadline will receive a 10% deduction. Work submitted between two and seven days of the deadline will receive a 25% deduction. No work is accepted more than seven days past the due date.

Exams

There are no exams in this class. Yay!

Accommodation

If you need certain accommodation based on disability, talk to the instructor in person so that appropriate arrangements can be made. **If you will be absent from class, you will be excused if you send me an email or tell me in person ahead of your absence.**

Course Schedule

This schedule is not fixed in stone and is subject to change according to the actual progress of the course.

| <u>Week</u> | <u>Lecture</u> | <u>Reading</u> |
|-------------|---|-------------------------|
| 1 | Introduction, Setup, Binary Systems | CODE 0-4 |
| 2 | Binary Systems, Boolean Logic & Logic Gates | CODE 5-11, ECS 0, ECS 1 |
| 3 | Boolean Math, Adders, ALU | CODE 12-13, ECS 2 |
| 4 | Sequential Logic, Flip Flops & Memory | CODE 14-16, ECS 3 |
| 5 | Machine Language | CODE 17, ECS 4 |
| 6 | Computer Architecture & CPUs | CODE 18-19, ECS 5 |
| 7 | Assembler | ECS 6 |
| 8 | Virtual Machine Stack Arithmetic | ECS 7 |
| 9 | Virtual Machine Program Control | ECS 8 |
| 10 | Spring Break | |
| 11 | High-Level Language | CODE 24, ECS 9 |
| 12 | Compiler I: Syntax Analysis | ECS 10 |
| 13 | Compiler I: Syntax Analysis | ECS 10 |
| 14 | Compiler II: Code Generation | ECS 11 |
| 15 | Compiler II: Code Generation | ECS 11 |
| 16 | Operating System | CODE 20-23, ECS 12 |
| 17 | Operating System (Dead Week) | ECS 12 & 13 |

On Collaboration & Academic Integrity

Students are encouraged to discuss and collaborate as much as possible! However, it is obviously not acceptable to copy another student's solution. Your work must be your own. In addition, simply copying solutions found online is not acceptable. Be aware that homework assignments, project and quizzes will not just focus on producing correct code, but explaining how things work.

Please see the Student Handbook for details on academic dishonesty. No exceptions will be made for students found simply giving away or taking another's solutions.

Examples of Academic Misconduct

To clarify what constitutes illegitimate collaboration, please note the following examples of what is considered inappropriate.

- Viewing another student's quiz, test, paper, or code while working on your own.
- Providing another student a copy, electronic or otherwise, of your work.
- Accepting a copy, electronic or otherwise, of another student's work.
- Copying and pasting *any* component of another student's work into your own.
- Copying solutions found online or otherwise, pasting it into your own work without proper citation.

These scenarios will be considered as academic misconduct except when involving an assigned project partner.

Academic Integrity Pledge

Your enrollment in this class means that you pledge to uphold the high standards of academic ethics and integrity expressed by the Colorado School of Mines Student Honor Code by which you are bound. In particular, you will not misrepresent the work of others as my own, nor will you give or receive unauthorized assistance in the performance of academic coursework. You should understand that my instructor will report any infraction of academic integrity to the Department Head and that any such matter will be investigated and prosecuted fully.