CS 4400: Computer Systems
Course Details and Objectives
Spring 2019

Description of CS 4400
The objective of this course is to help students bridge the gap between high-level programming and actual computer systems: processors, the memory hierarchy, operating systems, compilers, linkers, assemblers, networks, and more. Our basic goal is to understand how a computer works, so that as programmers we can make it work efficiently, correctly, and securely. Thus, this course is an introduction to computer systems from a programmer’s point of view.

Requirements
The official prerequisite for this course is CS 3810 (Computer Organization). It is also recommended that you complete CS 3505 (Software Practice II) before taking this class, unless you are already comfortable with Linux and command-line interfaces, and C or C++.

Meetings
Class sessions are Mondays and Wednesdays from 3:00-4:20p in WEB L105. These will consist of lectures, problem solving, and group activities. Attendance is required.

Instructor
Daniel Kopta, Email: dkopta@cs.utah.edu Office: MEB 3124

TAs
- Haisley Brooking
- Alex Smith
- Sachin Boban

Textbook
The textbook for this course is Computer Systems: A Programmer’s Perspective by Randal E. Bryant and David R. O’Hallaron, 3rd edition.
A recommended supplemental C programming book is The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie.

Website
The class web site uses Canvas: utah.instructure.com. It will contain all pertinent course info and materials, such as lecture slides and class announcements. It will also contain all assignments, and will be where you hand in most of your work. All of your grades will be posted on this site
so you can keep up with them throughout the semester. We will send messages to everyone in the class, such as corrections to assignments, changes to due dates, clarifications, etc. through Canvas. Students are required to check their email and the class web page regularly until final grades are posted.

Assignments

Because this is a 4-unit course, there is a significant amount of work in the form of programming assignments. The assignments make heavy use of C, Unix, and the x86-64 architecture. Students not currently fluent in any of these three topics should not panic, as this course will cover them in more detail throughout the semester. However, there is an assumption that students have some familiarity with C or C++. Students should be prepared to learn some of the C programming language on their own, for which the Kernighan and Ritchie supplemental text may be useful. All work must use an x86-64 processor running a Unix OS. Code must be written in C11 standard C — nothing else will work. Unless explicitly noted otherwise, grading of assignments will be done using CADE Lab 1 machines using the default path installed gcc. Students who choose to develop their code on any other machine must verify their solutions work on a CADE Lab 1 machine before turning it in. There will be no credit for programs that do not compile and run on a CADE Lab 1 machine, even if they run somewhere else.

Late Assignments

Late assignments will receive a 15% penalty per day, up to 3 days. Work submitted more than 3 days late will not receive credit.

Exams

The two midterms will be on February 4 and March 4 during regular class time. The final exam is on Thursday, April 25 from 3:30 - 5:30pm. All exams are in the regular class room. Students with an average score on all three exams of 65% or lower will receive that score for their final grade.

Quizzes

There is a quiz associated with each reading assignment/lecture. Quizzes will be due the same week as the reading/lecture. Quizzes will not be accepted late. The lowest two quiz scores will be dropped.

Labs

There will be labs (discussion sections) almost every week consisting of TA-guided exercises. Attendance and completion is required for credit.
Grading

Students with an average score on all three exams of 65% or lower will receive that score for their final grade. Otherwise, the total course score is based on the following weights:

- 45% assignments
- 25% midterm exams
- 15% final exam
- 10% quizzes
- 5% labs

Letter grades will be assigned using the below scale, and scores will not be rounded.

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
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<tbody>
<tr>
<td>90 &gt; X ≥ 87</td>
<td>B+</td>
</tr>
<tr>
<td>87 &gt; X ≥ 83</td>
<td>B</td>
</tr>
<tr>
<td>80 &gt; X ≥ 77</td>
<td>C+</td>
</tr>
<tr>
<td>77 &gt; X ≥ 73</td>
<td>C</td>
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<tr>
<td>70 &gt; X ≥ 67</td>
<td>D+</td>
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<tr>
<td>67 &gt; X ≥ 63</td>
<td>D</td>
</tr>
<tr>
<td>60 &gt; X ≥ 0</td>
<td>E</td>
</tr>
<tr>
<td>93 &gt; X ≥ 90</td>
<td>A-</td>
</tr>
<tr>
<td>83 &gt; X ≥ 80</td>
<td>B-</td>
</tr>
<tr>
<td>73 &gt; X ≥ 70</td>
<td>C-</td>
</tr>
<tr>
<td>63 &gt; X ≥ 60</td>
<td>D-</td>
</tr>
</tbody>
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Getting Help

The TAs and I are here to help you. We are available outside of scheduled class time/office hours by appointment. You are welcome to stop by my office any time, and if I am there, I will be happy to help.

It is strongly encouraged that you do your homework during TA help hours in the CADE lab. I will also hold office hours for any help with the material, including help with homework. Help and office hours will be posted online shortly after the start of the semester.

Please use Piazza to contact the course staff. For sensitive or private issues, please contact me directly. Do not try to contact us via Canvas submission comments on your assignment, we will not see them.

Attendance

By enrolling in this course you are implying your availability to complete and attend all lectures, labs, assignments, and exams. There will be no extensions due to absence, unless there is a legitimate documented emergency. Specifically, vacation time and job responsibilities are not a legitimate emergency.

Working Together

Students are encouraged to discuss assignments and problem sets with fellow classmates, but each student is responsible for writing his/her own answer. Cheating is: sharing code or other electronic files either by copying, retyping, looking at, or supplying a copy of a file. Cheating is not: discussing concepts, answering questions about concepts or clarifying ambiguities, helping someone understand how to use the computer systems or basic tools (compiler, debugger, etc.), or helping with high-level design issues or general debugging. Except when explicitly designated otherwise, each assignment is to be done individually. For all assignments, the solution submitted by each student will be checked against the solutions of other students (from this year’s class, as
well as previous years) for anomalies. If an anomaly is found that cannot be explained satisfactorily, the students involved will fail the course. There must be no collaboration during exams. Please see the University of Utah Student Code for a detailed description of the university policy on cheating, also read the Cheating Policy for this class posted on Canvas. Any student found cheating will fail the entire course.

College of Engineering Guidelines
For information on withdrawing from courses, appealing grades, and more, see:

https://www.coe.utah.edu/semester-guidelines

School of Computing Guidelines
For guidelines specific to the School of Computing, see:

https://www.cs.utah.edu/socguidelines/

Students with Disabilities
The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

Tentative Course Content
- Number representations
- Control flow and procedures
- Arrays and structs
- Performance optimization
- Memory hierarchy
- Processes
- Signals
- File descriptors, inter-process communication
- Virtual memory
- Dynamic memory allocation
- Network programming
- Concurrency and threads
- Linking