CS 208.00   **Introduction to**   **Fall 2024**
Computer Systems

General Course Info

Time:	5a (MW 1:50pm-3:00pm, F 2:20pm–3:20pm)
Location:	Leighton 305
Website:	https://www.cs.carleton.edu/faculty/tamert/courses/cs208-f24

Instructor Info

Name:	Dr. Tanya Amert
Office:	Olin 301D
Email:	tamert@carleton.edu
Office Hours:	M 9:50am-11:00am (2a), W 3:10pm-4:20pm (6a), Th 2:00pm-3:00pm, F 12:00pm-1:00pm (3a), or by appt.

Course Staff Info

Course Staff: Sky Lu (lus2@carleton.edu)

Textbook

Required textbook: *Dive into Systems*, by Suzanne J. Matthews, Tia Newhall, and Kevin C. Webb (free online at https://diveintosystems.org)

Recommended (but very much <u>not</u> required) textbook: *Computer Systems: A Programmer's Perspective*, 3rd edition, by Randal E. Bryant and David R. O'Hallaron (ISBN: 978-0134092669).

All lecture and homework materials will be available on the course website: https://www.cs.carleton.edu/faculty/tamert/courses/cs208-f24. In addition, your programming assignments will be submitted through Gradescope.

We are using Slack for questions and announcements. You can ask questions about any of the course material on Slack, but you must refrain from posting solutions to the assignments.

Course Description

Are you curious what's really going on when a computer runs your code? In this course we will demystify the machine and the tools that we use to program it. Our broad survey of how computer systems execute programs, store information, and communicate will focus on the hardware/software interface, including data representation, instruction set architecture, the C programming language, memory management, and the operating system process model.

Prerequisites

Computer Science 200/201 or instructor permission.

Target Audience

This course is designed for students majoring in Computer Science.

In this course, we will utilize the C programming language as we explore different system-level details, including how data is represented in a computer and how memory is accessed and managed. Given that CS 200/201 is a prerequisite, you are expected to have a working knowledge of a programming language; we will, from time to time, refer to features in Java and Python and compare them to how we use C.

Learning Objectives and Course Content

Throughout this term, we will explore the following questions:
- o How does a computer represent data (variables, programs, etc.)?
- o What happens during program compilation? What does compilation mean?
- o How does a computer execute a program?
- o What kinds of attacks do we need to watch out for when designing systems?
- o How do computers communicate?
- o How does the operating system manage multiple programs?
- o What are the trade-offs when storing previously used values for future accesses?

The course content is divided into five units, of varying durations:
1. Bits and Bytes: number and data representations, C operations
2. Instruction Set Architecture + Security: x86-64 ISA, buffer overflow attacks
3. Networking: HTTP requests, web servers
4. Operating Systems: OS process model, shells
5. Memory hierarchies: cache implementations and designs

Specific Learning Outcomes for this course are detailed on the course webpage.

Key Dates

First day of class: Monday, September 16th
Last day of class: Wednesday, November 20th

No class: Monday, October 21st (Midterm Break)

Exam Day: Friday, October 11th
Exam Day: Friday, November 8th
Final exam: Saturday, November 23rd, 8:30am – 11:00am

Technology Requirements

In this course, we will make use of a CS departmental server named `mantis`. You will need to be able to connect to this server; it is easiest to do so from your own laptop. If you do not have your own laptop, or your laptop ceases to work, let me know.

You are, generally, expected to refrain from laptop use during regular class periods (notetaking on a tablet is the exception). However, there will be special parts of classes, typically Fridays, when you should plan to have your laptop in class for some paired practice. Check the course schedule page for more info on labs.

Course Components and Grading

Course Components

Lessons: Class will usually be a mixture of lecture and small-group exercises. Students are expected to have completed a reading assignment prior to each lesson; in class, we may focus on some of the more complex topics from the readings. Periodically (typically Fridays), part of the class period will be devoted to hands-on lab activities.

Classwork: Many class periods will include in-class exercises ("classwork") designed to gauge pacing and general understanding of the material. You need not prepare outside of class aside from doing the assigned readings.

Assignments: The programming assignments in this course are a fundamental means of student learning. Students are encouraged to work together on high-level topics, and with a single partner on the code itself, but you should review the collaboration policy carefully before discussing more detailed aspects of your work. You are always expected to type up your own code yourself (even if copying from a sample program on the course website!).

Quizzes: In addition to the programming assignments, frequent quizzes are the primary means of demonstrating mastery of course Learning Outcomes. Each Learning Outcome will appear on at least two quizzes; two "Exam Days" will be dedicated to alternate versions of prior quizzes to provide you with additional opportunities to demonstrate your mastery. The final exam will consist of a new quiz covering the last week of the term, as well as alternate versions of prior quizzes. All quizzes will be pencil-and-paper and completed in class.

Grading Criteria

In this course, your grade will *not* be determined by a weighted average of points, but instead by the mastery you have demonstrated in the various course components listed above. The specific rubrics used for the grading scale will be described in a separate document for each type of assessment.

Instead of reporting a letter grade or points for various assessments throughout the term, each assessment will be made using the following scale:

    M   Mastery
    P   Proficient
    NY   Not Yet
    IE   Insufficient Evidence

Grading will be as follows:

- Assignments: graded using the full M/P/NY/IE scale, with rubrics detailed on each assignment page on the course website

- Quizzes: graded using the full M/P/NY/IE scale, with *individual questions* graded via Learning Outcomes (listed on the course website)

- Classwork: will not contribute to your course grade, but grades of P/NY/IE will be recorded in Moodle so you can track your own understanding

This grading approach will translate into your overall grade for the course based on how many of the programming assignments and quiz Learning Outcomes you have demonstrated at specific levels of mastery. Your course grade will be the highest one for which you meet *__all__* criteria. The specifics are laid out in the table below:

Grade	Assignments ~~(~10 total)~~ (9 total)			Quiz LOs ~~(~32 total)~~ (33 total)		
	M	P (or M)	NY/IE	M	P (or M)	NY/IE
A	~~10~~ 9	~~10~~ 9	0	~~100%~~ ≥ 95%	100%	0
A-	≥ 8	~~10~~ 9	0	≥ 90%	100%	0
B+	≥ 7	~~10~~ 9	0	≥ 80%	100%	0
B	≥ 5	~~10~~ 9	0	≥ 60%	100%	0
B-	≥ 3	~~10~~ 9	0	≥ 40%	100%	0
C+	≥ 1	~~10~~ 9	0	≥ 20%	100%	0
C	0	~~10~~ 9	0	0	100%	0
C-	0	≥ ~~9~~ 8	1 NY and 0 IE	0	≥ 80%	≤ 20% NY and 0 IE
D+	0	≥ 7	≤ 3 NY and 0 IE	0	≥ 60%	≤ 40% NY and 0 IE
D	0	≥ 5	≤ 4 NY and ≤ 1 IE	0	≥ 40%	≤ 60% NY and ≤ 1 IE
D-	0	≥ 3	≤ 5 NY and ≤ 2 IE	0	≥ 20%	≤ 70% NY and ≤ 2 IE

For example, a student with nine assignments at Mastery and one at Proficient, plus 84% of Quiz Learning Outcomes at Mastery and 16% at Proficient, will earn a B+, as they have not reached the required 90% LOs at Mastery to earn an A-.

Note that changes may be made throughout the semester, but the requirements will only change in students' favor; no changes will be made that decrease students' earned grades relative to those using the expectations outlined at the start of the term. All changes will be communicated as early as possible.

Note: The number of assignments and quiz learning outcomes, and the minimum number of LOs at Mastery, was updated on October 30th, 2024.

Late Policy

The late policy for this course is designed to provide flexibility for you while also ensuring a reasonable grading workload for me and the grader, and to help you avoid procrastination to the point that the end of the term becomes unmanageable.

All programming assignments have a posted deadline. Any assignment submitted to Gradescope by the deadline will be graded and feedback given.

After you receive feedback and an initial assessment of an assignment, you will have a one-week window to individually revise and resubmit for regrading. Your grade will be the higher of the two. If you miss the deadline for an assignment, you will still be able to submit during the revision period, but you lose the opportunity for early feedback. I strongly encourage you to submit *something*, even if it isn't complete, to benefit from as much feedback as possible.

You may individually further revise afterwards, although there is *no guarantee about timeliness of grading for additional revisions*—it may not happen until the end of the term! There will be a link on the course website to a form for submitting revisions.

All revisions of Assignments #1-#4 must be submitted by 10pm on November 1st ~~October 25th~~ (the end of Week 7 ~~Week 6~~), revisions of Assignments ~~#5-#9~~ #5-#8 must be submitted by the last day of class (5pm on November 20th), and revisions of Assignment ~~#10~~ #9 ~~must be submitted by the end of finals (9:30pm on November 25th)~~ will be done as part of the final exam.

Note: The final due date of Assignments #1-#4 was updated on October 22nd, 2024.

Note: The final due date of Assignment #9 (and lack of a #10) was updated on October 30th, 2024.

Note: The revision policy for Assignment #9 was updated on November 15th, 2024. (See Slack for more details.)

Course Schedule

Note that the schedule is tentative, and subject to change.

Unit 1	Weeks 1-4	Bits and Bytes
Unit 2	Weeks 5-7	Instruction Set Architecture + Security
Unit 3	Week 7	Networking
Unit 4	Weeks 8-9	Operating Systems
Unit 5	Weeks 9-10	Memory Hierarchies

We will not meet for class on Monday October 21st due to Midterm Break.

Course Policies

Attendance Policy

Students are expected to attend all class periods. If you must miss class, you are responsible for checking the schedule to determine what you missed and studying that material on your own. If you know of an absence in advance, check with me for how you may best prepare.

Quizzes cannot be taken after the day on which they occur. Also, each Learning Outcome will appear on at least two quizzes, so you will have a future opportunity to demonstrate your knowledge. If you know you must miss class, you may be able to take a quiz in advance; discuss with me before your absence. If you're feeling unwell the day of the quiz, we can arrange a separate room for you; if you're too sick to take a quiz, you will need to rely on later quizzes to demonstrate those Learning Outcomes.

2024 Election

Election Day this year will be Tuesday, November 5th. All eligible students are strongly encouraged to participate in this important civic duty. There will also be an opportunity for students to vote early on campus on October 10th.

There will be our regular assignments and quizzes throughout the term, including around these dates. Of course I want you to keep up with your studies, but I also want you to have the time to vote and process for yourself the result of the election at all levels. As always, I recommend that you submit whatever you have for the assignments due around these dates, and you will have the chance to resubmit after you receive initial feedback. For quizzes, remember that you will see the new Learning Outcomes on at least one later quiz.

Student Hours ("Office Hours")

Student hours, also known as office hours, are a time that you can (and are encouraged to!) stop by to chat with me about anything. This includes questions about material covered in class or in the textbook, questions regarding assignments,

quiz preparation, opinions on WoW expansions or D&D editions, the major in general, board games, or any other topic.

You are welcome to stop by my office during any scheduled office hours; if you have a schedule conflict, send an email and we'll find a different time. You can also visit the departmental lab hours (of our course staff or those for other courses) for help with the course material.

Classroom Etiquette

In class, you are expected to maintain proper etiquette. This includes arriving on time, not having conversations during lecture, not using your phone in class, etc.
You are, generally, expected to refrain from computer use during regular class periods. However, there will be in-class time devoted to paired lab exercises, typically on Fridays. You should not be checking email, etc. during these times.

You are expected to take your own notes during class (this can be done on a tablet, but it must behave like a notebook); you should not be taking pictures of the board.

Collaboration Policy

For programming assignments, you are encouraged to work with up to one other student. You may look at your partner's code and help with debugging, but *you are expected to type up all of your code yourself*. You may, however, discuss general approaches with others (for example at a white board, or "I found the strncpy function useful"), but you should never look at the code of anyone but your partner.

If you worked with someone else, you must each include each other's names at the top of your C source files (see assignment instructions for more information). *You should never be looking at the code of anyone other than your one partner for a given programming assignment.*

Quizzes are always closed-book and closed-note, and must be completed individually.

Academic Integrity and Generative AI

You are expected to refrain from using any online source to provide the answers to your assignments, but you can use them for C mechanics.
- o Acceptable: Searching for the structure of a for loop in C.
- o Not acceptable: Searching for how to sort the lines of a file in C.

You should never be in possession of anyone else's assignment code, and never look at anyone else's assignment code but your partner's.

You *should not be using any AI text/code generation tools when completing your assignments*. This includes the GitHub Co-pilot extension in VS Code, which you are expected to disable if you have installed.

If any student is suspected to have violated the academic integrity policy, a report will immediately be made to the Academic Standing Committee, as described at https://apps.carleton.edu/campus/doc/integrity. Ask me if you are unsure about what constitutes acceptable collaboration.

Illness/COVID-19 Policy

Some of the policies stated in this syllabus may need to be modified at times due to COVID-19 or other illnesses. For example, if I have COVID, we may need to have some class periods over Zoom. If you test positive, you should talk to a friend to get notes, and let me know so that we can work around your absences to enable you to still achieve mastery over the course content. We will work together to make this term a success, and you will be informed about any necessary changes as soon as possible.

Inclusion

I strive to create an inclusive and respectful classroom that values diversity. Our individual differences enrich and enhance our understanding of one another and of the world around us. This class welcomes the perspectives of all ethnicities, cultures, gender identities, religions, ages, sexual orientations, disabilities, socioeconomic backgrounds, regions, and nationalities.

College Policies

Accommodations for Students with Disabilities

Carleton College is committed to providing equitable access to learning opportunities for all students. The Office of Accessibility Resources (107 College Street) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, autism spectrum disorders, chronic health, traumatic brain injury and concussions, vision, hearing, mobility, or speech impairments), please contact OAR@carleton.edu to arrange a confidential discussion regarding equitable access and reasonable accommodations

Student Well Being

Your health and well-being should always be your first priority. At Carleton, we have a wide array of resources to support students. It is important to recognize stressors you may be facing, which can be personal, emotional, physical, financial, mental, or academic. Sleep, exercise, and connecting with others can be strategies to help you flourish at Carleton. For more information, check out Student Health and Counseling (SHAC), the Office of Health Promotion, or the Office of the Chaplain.

Reporting Sexual Misconduct

Carleton is committed to fostering an environment free of sexual misconduct. Please be aware all Carleton faculty and staff members, with the exception of Chaplains and SHAC staff, are "responsible employees." Responsible employees are required to share any information they have regarding incidents of sexual misconduct with the Title IX Coordinator. Carleton's goal is to ensure campus community members are aware of all the options available and have access to the resources they need. If you have questions, please contact Carleton's Title IX Coordinator (titleix@carleton.edu) or visit the Title IX website.

Math Tutoring

The Math Skills Center supports all Carleton students in any mathematics course they are taking in which they are experiencing difficulty, either with the mathematical concepts or with the mathematical tools needed to succeed in the course. Their mission is to "level the playing field" by giving students who enter Carleton without strong mathematics backgrounds the tools they need to succeed here at Carleton.

Writing Center

The Writing Center provides a space staffed with peer writing consultants who can work with you during any stage of the writing process (brainstorming to final proofreading). Hours and more information can be found on the writing center website. You can reserve specific times for conferences by using their online appointment system.

Support for Students who use English in Addition to Other Languages

If English is not your primary or home language and you believe you might benefit from working regularly with a writing consultant this term, email Melanie Cashin, Multilingual Writing Coordinator, at mcashin@carleton.edu. She can arrange once- or twice-a-week meetings between you and a specific writing consultant throughout the term.

Disclaimer

As instructor, I reserve the right to make changes to the syllabus, including assignment due dates, exam dates, and class cancellations or modality changes, for example due to weather or illness. These changes will be announced as early as possible.