College of Engineering and Mathematical Sciences
Computer Science

# CS / CMPE 2210 (A, B) / Computer Organization / 2025 Fall

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*Class meetings:*
A: MWF 1:10–2:00 PM, Kalkin 003
B: MWF 12:00–12:50 PM, Kalkin 003

*Instructor:* Clayton Cafiero
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*Office:* Innovation E309
*Office hours:*
M 02:30–04:00 PM, Th 09:00–10:30 AM,
F 08:30–09:30 AM, or by appointment
*Website:* https://www.uvm.edu/~cbcafier

*GTA:* Alex Stute
*Email:* alexander.stute@uvm.edu
*Office:* Innovation-Discovery common area, level 2
*Office hours:* T/Th 11:30 AM–01:00 PM

*UTA:* Surya Malik
*UTA:* Molly Fox

*UTA:* Lucy Hart
*UTA:* Zach Vanzura

*Evening help desk:* Su–Th, 5:00–7:00 PM (T/W/Th best)
*Locations:* Su/T/Th Votey 303; M/W Lafayette L411
*Dates:* Starting Tuesday 2025-09-02; closed during recesses / holidays

## Welcome to the course!

**Description (from the SOC):** Introduction to computer system organization including performance, assembly language, machine-level data representation, arithmetic for computers, processor datapath control, memory, and input/output. Includes significant semester project.

**Learning objectives (from the SOC):**

- Gain exposure to computer history and technology development.
- Be introduced to the integrated circuit fabrication process.
- Understand basic components of modern computer systems.
- Understand fundamental concepts of computer architectures.
- Understand machine level data representation.
- Gain exposure to arithmetic and logic operations.
- Understand memory hierarchy and addressing.
- Gain exposure to input / output operations.

**Textbook:** Patterson and Hennessy (2017). Computer Organization and Design: The Hardware / Software Interface, ARM® Edition. Morgan Kaufmann (Elsevier). ISBN: 978-0-12-801733-3. Available in the UVM Bookstore.

Each week's instructional material will include textbook readings, lecture, and occasional supplemental reading posted on Brightspace.

**Computer:** For this course, you should have a reliable computer on which you can write, run, and debug code. Windows $\geq$ 10 and macOS $\geq$ 14.0 are supported. If you have a Linux machine, that's fine (lovely in fact), but you're on your own for support (simply on account of the diversity of Linux distros).

**Software:** You will be writing programs in Python and C, and accordingly you should have a reasonably current version of Python installed on your computer (*e.g.*, Python $\geq$ 3.12), and a reasonably current C compiler (*e.g.*, GCC $\geq$ 13, LLVM clang or Apple clang $\geq$ 16, MSVC $\geq$ 14). **If you don't meet these requirements, please address them promptly.** If you need help, come to office hours or help desk. Don't delay.

**Important websites:**

- Brightspace, for course materials, announcements, homework submission *etc.*: https://brightspace.uvm.edu.
- Gradescope, for homework submission (TBD): https://www.gradescope.com/.

**Correspondence:** Please use email for electronic correspondence (and not MS Teams). As I teach multiple courses please indicate the course and section in which you are enrolled in the subject line. Please use your UVM email for all correspondence.

**Weekly schedule of topics**
**(tentative and subject to change):**

| Week | Topic | Readings |
|---|---|---|
| 1 | Introduction; history; overview of organization; binary numbers | Chapter 1 |
| 2 | Semiconductor fabrication; Moore's law; current trends | Chapter 1 |
| 3 | Basics of architecture | See Brightspace |
| 4 | More on architecture; von Neumann, Harvard; logic gates | Appendix A |
| 5 | Bits, bytes, words; signed & unsigned; two's complement | Chapter 2 |
| 6 | Floating point: IEEE 754; arithmetic; bitwise ops | Chapter 3 |
| 7 | Review and midterm | |
| 8 | CPU; clock; datapath | Chapter 4 |
| 9 | Instruction sets; assembly; MIPS, ARM | Chapter 2 (revisited) |
| 10 | Pipelining and parallelism | Chapter 3 |
| 11 | Memory hierarchy and addressing | Chapter 5 |
| 12 | Non-volatile storage | See Brightspace |
| 13 | Guided project | See Brightspace |
| 14 | Guided project; review | See Brightspace |

**Grading:**

| Weight | Assessment |
|---|---|
| 10.0% | in-class quizzes; 11 @ 1.0% each; drop one |
| 15.0% | active learning / lab; 8 @ 2.5% each; drop two |
| 15.0% | programming homework; 5 @ 3.0% each |
| 20.0% | midterm exam |
| 20.0% | final exam |
| 20.0% | project |
| 100.0% | TOTAL |

Assignment of letter grades will be on a conventional scale. Any grade appeal (assignment, quiz, lab, exam, *etc.*) must be directed to your grader within one week of the grade being posted. If grading is done on Gradescope (*e.g.*, for homework), there's a *regrade request* feature which should be used for grade appeals.

**Exams:** There will be a midterm exam in week 07 (before fall recess). The Office of the Registrar schedules final exam dates. Final exams will be administered on 08 December (section A) and 11 December (section B).

**Programming homework:** Programming homework is intended to deepen and reinforce your understanding of material presented in the course.

Programming homework may be done individually or in teams of two (absolutely no more than two). Programming homework is submitted via Gradescope. If you work with someone on homework you must make a note of who you collaborated with as part of your submitted work. All students must type up and submit their own work, regardless of collaboration.

**Active learning / labs:** Active learning will give you an opportunity to engage with course material in a low-stakes, supervised environment. Most active learning exercises will be conducted in small groups (*i.e.,* 3–5 students) Labs may involve pencil-and-paper exercises or team programming.

**Quizzes:** In most weeks there will be a very brief quiz administered in class. More details will be presented in class.

**Final projects:** At the appropriate time, you'll be presented with a list of final project options (perhaps three or four). Final projects are to be completed in teams of two or three.

Final project elections are due in late October. Final projects are due on the last Friday of classes (5 December). Late projects will *not* be accepted. Final projects account for 20% of your grade. See additional instructions, guidelines, and suggestions posted on Brightspace.

**Academic integrity:** The Department of Computer Science enforces UVM's Code of Academic Integrity. Any suspected violation of this policy will be referred immediately to UVM's Center for Student Conduct (https://www.uvm.edu/sconduct). Sanctions for a violation may include a grade of XF in the course. Additional violations can result in dismissal from the university. In a word: *Don't*. All students should read and understand this policy. See: https://go.uvm.edu/cai.

Collaboration on quizzes and exams is strictly prohibited. Use of online services as a source of solutions is strictly prohibited. Using generative AI such as ChatGPT or Claude, or websites such as Chegg or Course Hero to complete coursework is a form of academic dishonesty. Work you submit for an individual grade must be your own. Any work not produced by you must be cited. For certain assignments, students may collaborate on homework (typically limited to teams of two or three). If you collaborate with another student on an assignment, be sure to indicate team members as specified. If you have any questions, ask!

Any attempt to tamper with or defeat any autograder is a form of academic dishonesty. This applies wherever autograders are in use, for example on Brightspace or Gradescope.

*All code submitted by students is subject to code similarity review*.

Exams, quizzes, homework assignments, answer keys and solutions, presentations or lecture notes, specifications and rubrics are copyright protected works, unless clearly and explicitly indicated otherwise. Any unauthorized copying or distribution of protected works is a violation of federal law and may result in disciplinary action. This includes submission of protected works as prompts to generative AI. Sharing of course materials without the specific, express approval of the instructor may be a violation of the University's Code of Academic Integrity and an act of academic dishonesty, which could result in disciplinary action. Violations will be handled under UVM's Intellectual Property Policy and Code of Academic Integrity, as appropriate. See: https://go.uvm.edu/ipp and https://go.uvm.edu/cai.

**Policy regarding AI:** Use of generative AI (ChatGPT, Claude, CoPilot, Llama, DeepSeek, Gemini, *etc.*) is strictly prohibited as a means of researching, producing, or verifying answers in exams and quizzes. No exceptions.

Most IDEs have some kind of AI assistant built-in or available as a plug-in (*e.g.*, GitHub CoPilot in VS Code, JetBrains AI Assistant, *etc.*) and there are many other tools for assisted coding (Replit, Cursor, *etc.*). These have their uses, but for your own learning, it's often best to disable them when writing code to avoid cognitive off-loading. Please avoid the use of Replit, Cursor, and other such tools. It's OK if you use built-in IDE assistants but use them wisely, and you must indicate whether or not you've used them by including a comment in your code. *You should be able to read, understand, and explain in detail the workings of any code you may submit for this course. Do not submit anything you don't completely understand.* I reserve the right to ask you questions about code you submit and you should be prepared to answer on the spot.

Use of generative AI for producing prose—reflections, essays, or similar writing—is prohibited. Feel free to use spell checkers and grammar checkers. UVM has a site license for CoPilot, which is integrated into UVM-supplied instances of Microsoft Word. This is very much preferred to outside, third-party tools. If you do use something other than UVM's CoPilot instance you must make a note of it in a comment, footnote, or end note.

If you have a documented disability (*e.g.*, dysgraphia) or English is not your native tongue, please contact me about an accommodation if you think certain AI tools would be of legitimate benefit in your writing.

Any unauthorized use of generative AI, or uncited use where permitted, constitutes a violation of UVM's Code of Academic Integrity and Code of Student Conduct. Violations or suspected violations will be referred to the Office of Student Conduct.

There are many ethical issues surrounding the use of generative AI. If you are uncomfortable about using generative AI, you are in no way obliged to use it.

If you have questions about generative AI or this policy, please do not hesitate to ask.

**Attendance:** The UVM attendance policy is available at `https://go.uvm.edu/srr`. There will be no make-ups for in-class active learning exercises if you did not attend class without prior notification and approval. While your attendance is ungraded, we will have frequent in-class assessments, and a good attendance record may be taken into consideration when handling exceptions if they arise.

If you are not able to attend in-person classes please notify the instructor via email as soon as possible. Depending on the nature of your absence, it may be appropriate for you to contact UVM Student Health Services (`https://www.uvm.edu/health/SHS`), CEMS Student Services (`https://www.uvm.edu/cems/student-services`), or the Dean's Office for your college. In many cases, these can provide an official request for flexibility on your behalf. While reasonable accommodations will be granted in the event of documented illness or emergencies, you are responsible for making up any work you have missed.

**Class participation:** You are expected to be an active participant in class. The more engaged you are, the more you will learn—and the more fun you'll have. This includes being prepared and attentive, responding when called on, participating in group discussion, and asking questions as appropriate. When it comes to asking questions, *please don't be shy!* There's no such thing as a "dumb" or "silly" question. If there's something you don't understand—*ask*! Asking questions helps you understand the material presented in the course. Asking questions is good for your classmates. It's almost certain that if you need clarification on some point, that there's at least one other student in the class with the same question. So help each other out—*ask*! Finally, when you ask a question you help the instructor to do a better job of explaining. If someone explains something, and you still don't quite grasp it, it's not unlikely that the explanation could be improved or clarified.

**Late policy / extensions:** Each homework assignment has a specific due date / time. You may submit work up to 24 hours after the due date / time, however, late submissions will be penalized 20%. Submissions that are more than 24 hours late will not be accepted unless an extension has been granted. We will consider reasonable requests for extensions when extenuating circumstances arise. (It can't hurt to ask.) However, extensions will not be granted if the request for extension is made within 24 hours of the time an assignment is due, except in the most extraordinary circumstances. So if you wish to request an extension, *do so early*! If an extension is granted, you must submit your work by the agreed-upon extension date.

**Student course evaluations:** Students are warmly encouraged to complete an evaluation of the course at its conclusion. Evaluations are anonymous and confidential, and the information gained, including constructive criticisms, will be used to improve the course.

**Defects / bonus points:** As you might expect, we will deduct points on assignments, quizzes, or exams where you've made an error. It's only fair that instructors should be held to a similar standard. Accordingly, bonus points are awarded for reporting and correcting defects in instructor-written course materials.

- 1.0 point: Material defect. This includes any error whatsoever in code or solutions, or any error in writing that changes materially the sense of what is written. This also includes incorrect due dates for posted assessments.
- Up to 0.5 point: Minor defect. This includes typos, misspellings, or minor errors which do not affect materially the readability or sense of what is written. Determination of points for minor defects is at the instructor's sole discretion.

Due to the unfortunate behavior of some students who have favored the practice of "bonus point mining" over proper study, no student may earn more than three bonus points in this course.

Due to the fact that we are still writing and revising autograders, autograder defects are not fair game for defect bonus points (but by all means, please report, and perhaps we will award a discretionary point here and there).

Bonus points for any given defect are only awarded to the first student (across all sections) who correctly identifies the error *and provides a valid correction*. Bonus points are not available for any materials which are clearly marked as drafts. Bonus points are added to your final grade before assigning letter grades—a point or two may make a big difference. Happy hunting.

The secret word is "timer."

**Diversity, equity, and inclusion:** UVM is a place where you should be treated with respect and kindness. We welcome individuals of all ages, backgrounds, beliefs, interests, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability, and other visible and non-visible differences. All students are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the community. If you ever feel that you have been unfairly treated or judged by an instructor, a mentor, another student, or another member of the community, please let someone know. Your instructors and advisors in the CEMS Office of Student Services are available to discuss any concerns, or you can report an incident of bias through the bias report program (https://go.uvm.edu/brp).

**Conduct:** Be kind to one another and to yourself. Be respectful of yourself, others, and the institution. Please arrive on time. Please, no food in class. Please, no cell phones in class. You may use a laptop or tablet, but only for active learning sessions, pair programming, taking notes, or assistive technologies.

For other policies on classroom conduct, please see: https://go.uvm.edu/srr and https://go.uvm.edu/csc.

**Accommodations:** In keeping with UVM policy, if you have a documented disability and are interested in utilizing ADA accommodations, you should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter.

Contact SAS: A170 Living/Learning Center; +1 802 656 7753; access@uvm.edu; or visit https://www.uvm.edu/access.

If you are entitled to use the Exam Proctoring Center, please book reservations at least four days in advance.

**Promoting health and safety:** If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (+1 802 656 3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at https://www.uvm.edu/deanofstudents.

**Wellbeing resources:**

- Center for Health and Wellbeing: https://www.uvm.edu/health/services
- Counseling and Psychiatry Services (CAPS): +1 802 656 3340
- Food Insecurity Assistance: https://www.uvm.edu/health/food-insecurity-uvm

**Student advocacy:** https://www.uvm.edu/deanofstudents/student_advocacy

**Your identity at UVM:** Students at UVM can specify the first name and pronoun they want used on campus. For information on how to update your preferred name and personal pronouns as well as keeping your legal name private, and UVM policy on lived name and pronouns, see: https://go.uvm.edu/lnpr.

**Religious holidays:** Students have the right to practice the religion of their choice. In order to receive extensions or excused absences, you should submit via email your documented religious holiday schedule within the first week of the course. Reasonable extensions will be granted where assignment deadlines conflict with religious holidays.

**Student athletes:** In order to receive extensions or excused absences, you should submit via email appropriate documentation as soon as possible, preferably within the first week of the course. Reasonable extensions will be granted where assignment deadlines conflict with team events or team travel.

**Statement on alcohol and other drugs:** We want you to get the most you can out of this course. Therefore, you are expected to familiarize yourself and abide by the University's policies with regard to alcohol, cannabis, tobacco, and other drug use. See: https://go.uvm.edu/actd. Please do everything you can to optimize your learning and to participate fully in this course.

**Class format changes:** The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

**Changes to this document:** This document is subject to change. Any such change will be communicated via an announcement on Brightspace. The latest version of the syllabus will always be available on Brightspace.