

# CSE3666: Introduction to Computer Architecture

## Fall 2024

### Course information

Course Number and Title: CSE 3666 Introduction to Computer Architecture

Credits: 3

Prerequisites: CSE 2050 or 2100; open only to students in the School of Engineering and declared Computer Science minors. Not open for credit after passing CSE 2304, 4302, or 4950.

### Course description

Structure and operation of digital systems and computers. Instruction sets and assembly language. Integer and floating-point arithmetic. Machine organization, control and data paths, pipeline, and the memory hierarchy.

### Textbook

David A. Patterson and John L. Hennessy. Computer Organization and Design **RISC-V Edition: The Hardware Software Interface** (The Morgan Kaufmann Series in Computer Architecture and Design) **2nd Edition**, Morgan Kaufmann. Dec 2020. ISBN-13: 978-0128203316.

### Course Goals and Objectives

1. Represent data (e.g., integers, floating-point numbers, instructions.) with bits.
2. Program with RISC-V instructions (computing with instructions).
3. Design an instruction set architecture (ISA). For example, describe types of instructions, encode/decode instructions, and identify and apply good design principles.
4. Design digital circuit (e.g., arithmetic-logic unit) with logic gates.
5. Design a processor that supports a specified ISA.
6. Design a processor pipeline and handle data and control hazards.
7. Design memory cache in a computer system.
8. Evaluate the performance of a computer system.

The course schedule will be posted online separately.

Syllabus information may be subject to change, with the exception of materials for purchase.

## Instructors and TAs

Muhammad Ikram, [muhammad.ikram@uconn.edu](mailto:muhammad.ikram@uconn.edu)

Z. Jerry Shi, [zshi@uconn.edu](mailto:zshi@uconn.edu)

TAs

They can be found on Discord.

Office Hours:

TBD. The times will be posted in an announcement in HuskyCT.

Discord Q&A:

TAs will be monitoring questions on Discord and try their best to have all questions answered promptly.

## Lectures and labs

Lecture Section 010, Tue and Thur, 3:30PM - 4:45PM, Muhammad Ikram

Lab 011L, Wed 2:30PM - 3:20PM, ITE 134

Lab 012L, Wed 3:35PM - 4:25PM, ITE 134

Lab 013L, Wed 4:40PM - 5:30PM, ITE 134

Lab 014L, Wed 1:25PM - 2:15PM, ITE C27

Lab 015L, Wed 5:40PM - 6:30PM, ITE 134

Lecture Section 021: BUSN 127, Tue and Thur, 12:30PM - 1:45PM, Jerry Shi

Lectures, labs, and exams are in person.

Lab 021L, Wed 12:20PM - 1:10PM, ITE 134

Lab 024L, Wed 3:35PM - 4:25PM, ITE C27

Lab 025L, Wed 4:40PM - 5:30PM, ITE C27

## Grade

Students' final grade is based on the following components:

- Labs: 11%.
- Homework: 16%.
- Participation (labs and homework): 3%. Students who receive at least 70% on ALL mandatory assignments/questions receive three points on the weighted total. Mandatory assignments/questions will be clearly marked and may have separate submission links.
- Exams: 70%. There are two midterm exams and the final exam. The lower of the midterm exam: 15%. The higher of the midterm exams: 20%. The final exam: 30%. The highest of the three exams: 5%.

The final grade is based on the weighted total of components in the course. Students can **estimate** their grade using the following table. The instructors reserve the right to adjust the thresholds and apply + or – to grades near thresholds.

Level of Mastery	Letter Grade	Expected floor
Excellent	A	93
Good	B	83
Average	C	73
Passing	D	63

## Extra credit

Students who participate in lectures can earn up to 2 points. Students earn 2 points if they have participated in at least 75% of the lectures, and earn 1 point if they participated in 60% or more, but less than 75% of the sessions. **There is no makeup for missing a lecture.**

## Attendance

Although attendance is not required to pass the course, students are strongly encouraged to attend lectures and labs. Students who miss lectures/labs should study provided materials themselves and get help through office hours or discussions on Discord.

## Lab and homework assignments

Lab and homework assignments are submitted on HuskyCT or on Gradescope. In general, students must justify their answers, write concise comments in code, and make handwriting legible.

Some questions/assignments are graded automatically. The grades students receive are available shortly after submission. **We do not adjust the grades from the auto grader.** Students are advised to make attempts early and correct mistakes.

For manually graded questions, we will make every effort to provide grades in one or two weeks. We may need more time for some assignments. If you have questions regarding the grading, you **MUST** contact either instructors or TAs within **ONE WEEK** after the graded work is returned to you (or to the class). Please check your grades often in HuskyCT.

## Late Policy

Students should check HuskyCT frequently for open assignments and due dates. We have a lab and a homework assignment almost every week.

**All due dates are specified in the assignments.** The actual deadline is 11:55 PM Eastern Time on due dates. The deadline time set on submission pages is 11:59 PM. If the deadline on the submission page is not set accurately, we will correct them promptly.

The instructors reserve the right to change deadlines accordingly as the semester progresses. All changes will be communicated in an appropriate manner.

Occasionally some students may need an extension. We allow an automatic extension of two days on some lab and homework assignments. Deadlines without automatic extension will be marked as **firm deadline** on an assignment. There is no limit on how many times a student uses the “automatic extension” and there is no penalty on using “automatic extension”. The submission page is closed after the deadline (firm deadline or deadline plus automatic extension). **All lab tests deadlines are firm deadlines.**

Late submissions are not accepted, unless students have university accepted reasons, e.g., medical emergency, and provide evidence. Students must contact the instructor or TA before the deadline, or as soon as they can if they have an emergency. There may be a penalty for late submissions, for example, 10% of the maximum points for each additional day. There may be additional requirements, for example, presenting their work to instructors.

Please note that late submissions cannot be arranged sometimes, especially when doing so would slow down the progress of the class.

No submissions are accepted if solutions to the assignment have been posted.

## Midterm exams

Two midterm exams are scheduled in the evening hours. Students who cannot take the exam at the scheduled time should contact instructors and TAs early to make arrangements.

**In Fall 2024, Exam 1 is scheduled on Wed, 10/2/2024 and Exam 2 is on Wed, 11/13/2024.**

Both exams start at **6:45pm**. We may adjust the starting time slightly. Please mark your calendar.

Students who miss a midterm exam due to medical emergency should provide strong evidence or get approval from the Dean of Students Office (DOS) for makeup exams. The makeup exam is arranged only after students are fully recovered. It is not guaranteed that the makeup exam takes place before the semester ends. The assessment form may also change.

## Important Information on Final Exams

**Final exams are scheduled by the registrar's office, not by instructors.** The final exam dates are posted in the student administration system around October 1 for the fall semester and around March 1 for the spring semester. Please check the dates when they are available.

Students are required to be available for exams during the scheduled time. Students must submit requests to the DOS Office before the deadlines if they need to reschedule their final exams. The DOS office will provide instructions thereafter.

According to the University policy, vacations, previously purchased tickets or reservations, weddings (unless part of the wedding party), and other large or small scale social events, are not viable excuses for missing a final exam. Contact the DOS office with any questions.

## Weekly Time Commitment

Students should expect to dedicate at least six hours a week to this course, in addition to lectures and labs. This expectation is based on the various course activities, assignments, and assessments and the University of Connecticut's policy regarding credit hours. (More information related to hours per week per credit can be accessed at the Online Student website).

## Students with Disabilities

The University of Connecticut is committed to protecting the rights of individuals with disabilities and assuring that the learning environment is accessible. Students who require accommodations should contact the Center for Students with Disabilities, Wilbur Cross Building Room 204, (860) 486-2020 or <http://csd.uconn.edu/>.

**Students are strongly encouraged to contact CSD in the first three weeks of the semester.**

## Software/Hardware/Technical Requirements

The software/Hardware/technical requirements for this course include:

- HuskyCT/Blackboard
- Gradescope
- Github
- Discord
- Adobe Acrobat Reader (or other PDF readers)
- Microsoft Office (free to UConn students through [uconn.onthehub.com](https://uconn.onthehub.com))
- RARS (RISC-V Assembler and Runtime Simulator)
- Python 3.6+ and packages, for example, MyHDL
- A calculator
- A cell phone or other devices that can scan documents into PDF files
- iClicker in some sections for participating in lectures

NOTE: This course has NOT been designed for use with mobile devices.

For information on managing your privacy at the University of Connecticut, visit the [University's Privacy page](#).

## Student Responsibilities and Resources

As a member of the University of Connecticut student community, you are held to certain standards and academic policies. In addition, there are numerous resources available to help you succeed in your academic work. Review these important [standards, policies and resources](#), which include:

- The Student Code, including academic integrity and resources on avoiding cheating and plagiarism
- Copyrighted Materials
- Credit Hours and Workload
- Netiquette and Communication
- Adding or Dropping a Course
- Academic Calendar
- Policy Against Discrimination, Harassment and Inappropriate Romantic Relationships
- Sexual Assault Reporting Policy

## Academic Integrity

*Academic integrity* is a fundamental expectation of all students in this course. Cheating, plagiarism, and other forms of academic misconduct are not allowed in this course. The consequences of violating academic integrity include receiving a reduced/failing grade for the assignment and receiving a reduced/failing grade for the class.

Below is a list of common misconducts. Please notice that this is **not** a complete list. It is your responsibility to be familiar with the Student Code of Conduct and conduct yourself according to the standards that are described in the code.

- Represent the work from other people or the work generated by computers as your own. For example, copy answers from another student's work (e.g., examination sheet, homework, quiz, etc.), obtain solutions from other people, or submit code generated by generative AI.
- Make use of notes during a closed book/closed notebook examination.
- Make use of electronic devices, e.g., cell phones, which are not allowed in an examination.
- Allow another student to take an examination in your place.
- Assist another student to violate academic integrity. For example, allow other students to copy your work, or share your answers with other students.

You may discuss the homework with anyone and use any reference material, provided you do not copy any other person's work or solutions from any sources. Appropriate reference or credit must be acknowledged if you use the results from other people.

For the programming questions, it is expected that you write every line of code that you submit (with the exception of code given out in class and simple online examples, typically a few lines, that demonstrate the usage of library functions or system calls). The following are examples of activities that are prohibited:

- Posting assignments in the course on the Internet and then copying answers.
- Giving code to another student (via email, printouts, photos, voice, etc.).
- Posting code in a publicly accessible location.

## Evaluation of Course Experience

Students will be given an opportunity to provide feedback on their course experience and instruction using the University's standard procedures, which are administered by the [Office of Institutional Research and Effectiveness](#) (OIRE).

The University of Connecticut is dedicated to supporting and enhancing teaching effectiveness and student learning using a variety of methods. The Student Evaluation of Teaching (SET) is just one tool used to help faculty enhance their teaching. The SET is used for both formative (self-improvement) and summative (evaluation) purposes.

Additional informal formative surveys and other feedback instruments may be administered within the course.

## Copyright

The following is the standard copyright language provided by UConn to instructors.

My lectures, notes, handouts, and displays are protected by state common law and federal copyright law. They are my own original expression and I have recorded them prior or during my lecture in order to ensure that I obtain copyright protection. Students are authorized to take notes in my class; however, this authorization extends only to making one set of notes for your own personal use and no other use. I will inform you as to whether you are authorized to record my lectures at the beginning of each semester. If you are so authorized to record my lectures, you may not copy this recording or any other material, provide copies of either to anyone else, or make a commercial use of them without prior permission from me.

Students should be aware that instructors' materials are protected by copyright regardless of whether such a statement appears in the syllabus.

More information is available at [Copyright and Teaching | UConn Library](#).

## Success

UConn has many resources to help students succeed. Success in this course and in your major program depends heavily on your personal health and well-being. Recognize that stress is an expected part of the college experience, and it often can be compounded by unexpected setbacks or life changes outside the classroom. Your teaching assistants and instructors strongly encourage you to reframe challenges as an unavoidable pathway to success. Reflect on your role in taking care of yourself throughout the semester, before the demands of exams and projects reach their peak. Please feel free to reach out to us about any difficulty you may be having that may impact your performance in your courses or campus life as soon as it occurs and before it becomes too overwhelming. In addition to your academic advisor, we strongly encourage you to contact the many other support services on campus that stand ready to assist you.

- [Dean of Students Office](#)
- [Academic Achievement Center](#)
- [Student Health and Wellness](#)

Week	DateStart	DateEnd	Topics	HW	Lab
1	08/26/24	08/30/24	Introduction Control flow		Lab0
2	09/02/24	09/06/24	Binary numbers Logical operations	HW1	Lab1
3	09/09/24	09/13/24	Memory Instruction Encoding - 1	HW2	Lab2
4	09/16/24	09/20/24	Function Encoding - 2	HW3	Lab3
5	09/23/24	09/27/24	Misc Topics Combinational circuit		Lab4
6	09/30/24	10/04/24	Exam 1 (Wed, 10/2) Combinational/Sequential circuit	HW4	
7	10/07/24	10/11/24	Sequential circuit Multiplication/division		Lab5
8	10/14/24	10/18/24	Floating-point numbers Performance	HW5	Lab6
9	10/21/24	10/25/24	Single-cycle Processor	HW6	Lab7
10	10/28/24	11/01/24	Pipeline Data hazards	HW7	Lab8
11	11/04/24	11/08/24	Data hazards (2) Control hazards	HW8	
12	11/11/24	11/15/24	Exam 2 (Wed, 11/13) Introduction to cache		
13	11/18/24	11/22/24	Direct-mapped cache. Cache performance.	HW9	Lab9
	11/25/24	11/29/24	Fall break		
14	12/02/24	12/06/24	Misc. Discussion/Review		