

## Syllabus – Fall 2024

Excluding materials for purchase, syllabus information may be subject to change. The most up-to-date syllabus is located within the course in HuskyCT.

### Course and Instructor Information

**Course Title:** CSE 5050: Algorithms and Complexity

**Credits:** 3

**Format:** Asynchronous; except for midterm and final exams.

**Prerequisites:** Open to grad students in CSE, others with consent. Recommended prep: Discrete mathematics; fluency in a high-level programming language; data structures and algorithms at the level of CSE 2050. Students cannot receive credit for both CSE 3500 and 5050.

**Professor:** Mukul S. Bansal

**Email:** [mukul.bansal@uconn.edu](mailto:mukul.bansal@uconn.edu) (this is the preferred method for communicating with the instructor)

**Telephone:** 860-486-2572

**Link to connect to any Webex meetings:** <https://uconn-cmr.webex.com/meet/mub13001>

**Office Hours/Availability:** By appointment; through Webex. Please feel free to email the instructor to set up a Webex meeting if you have any course-related questions. Questions can also be sent via email. Students can expect to receive a response within 24 hours

**Teaching assistant:** Samson Weiner

**Teaching assistant email address:** [samson.weiner@uconn.edu](mailto:samson.weiner@uconn.edu)

**Teaching assistant office hours:** Samson: TBD, via Webex.

**Teaching assistant Webex link:** Samson: <https://uconn-cmr.webex.com/meet/sdw14004>

### Course Materials

**Required course materials should be obtained before the first day of class.**

Required textbooks are available for purchase through the [UConn Bookstore](#) (or use the Purchase Textbooks tool in HuskyCT). Textbooks can be shipped ([fees apply](#)).

**Required textbook:** "Algorithm Design" by Kleinberg and Tardos (Pearson/Addison-Wesley; 1st edition; 2005).

Note that the University also has minimum [device requirements for all students](#).

*Additional course readings and media are available within HuskyCT, through either an Internet link or Library Resources*

### Course Description

This course is designed to introduce students to the fundamentals of algorithm design and analysis. Topics covered in this course include complexity analysis, basic graph algorithms, and fundamental algorithm design techniques such as greedy algorithms, divide and conquer, and dynamic programming. The course will also cover polynomial-time reductions and NP-completeness.

### Course Objectives

By the end of the semester, students should be able to:

1. Apply standard algorithm design techniques, including divide-and-conquer, greedy, and dynamic programming.
2. Write precise descriptions of algorithms.
3. Design provably correct and efficient algorithmic solutions for many new computational problems.

4. Prove correctness or optimality of algorithms designed using the studied techniques.
5. Analyze worst-case time complexity of most algorithms.
6. Interpret complexity classes P and NP and use polynomial-time reductions to reason about NP-hardness of new problems.

## Choosing between CSE 5050 and CSE 5500

The CSE department offers two main algorithms courses at the beginning graduate level: *CSE 5050 Algorithms and Complexity* and *CSE 5500 Algorithms*. CSE 5050 is appropriate for those graduate students who have not previously had a chance to take a rigorous, standalone algorithms course. However, if a student has already taken a rigorous algorithms course before (CSE 3500 or equivalent; covering basic algorithm design techniques, complexity analysis, and rigorous proofs) then CSE 5500 may be a more appropriate course to take. CSE 5500 generally covers more advanced algorithm design techniques, such as approximation algorithms and randomized algorithms, and would likely be more fun and more beneficial for such students. Please feel free to get in touch with the instructor if you are unsure about which of these courses to sign up for.

## Course Outline & Schedule

### [Course Schedule](#)

Module 1: Basics of algorithmic thinking (Week 1)  
 Module 2: Complexity analysis (Week 2)  
 Module 3: Graph algorithms (Weeks 3 and 4)  
 Module 4: Greedy algorithms (Weeks 5, 6 and 7)  
 Module 5: Divide and conquer (Weeks 8 and 9)  
 Module 6: Dynamic programming (Weeks 10 and 11)  
 Module 7: NP-completeness (Weeks 12, 13 and 14)

## Course Requirements and Grading

### Summary of Course Grading:

Course Components	Weight
Weekly Quizzes	10%
Problem Sets	15%
Perusall Video Lecture Assignments	10%
Midterm Exam 1	17.5%
Midterm Exam 2	17.5%
Final Exam	30%

### Weekly Quizzes

There will be a multiple-choice quiz due each Saturday during each of the 14 weeks of the course. These 14 quizzes will be worth a total of 10% of the weight.

These quizzes are open-book/open-notes, but collaboration/discussion with other students or individuals is prohibited. Students will have 30 minutes to complete each quiz.

### Problem Sets

There will be a total of 11 problem sets during the course. The lowest scoring problem set score will be dropped and the remaining 10 problem sets will count for a total of 15% of the weight.

Problem Sets must be submitted as a **single pdf file** and must be either typed (preferably using LaTeX) or neatly written and clearly scanned (clear photos are fine too). Students are permitted to discuss general concepts and solution ideas concerning the homework assignments but sharing written solutions with others or using solutions provided by others (including solutions found on the internet), in part or in whole, is prohibited. All collaborators with whom you have discussed ideas for homework solutions must be identified on your homework. Similarly, if you consult any sources other than the textbook or course notes, you are required to cite the source in your homework. You are also encouraged to seek help from the instructor or TA, if needed.

### Perusall Video Lecture Assignments

Students will have two Perusall assignments each week where students must view and annotate the video lectures posted for that week. These video annotation assignments count for a total of 10% of the weight.

The purpose of using Perusall for viewing and discussing video lectures is to try and recreate the benefits of a classroom learning environment, where students can interrupt the instructor to ask questions or make comments or observations, and where students can engage in discussion during the lecture and help answer each other's questions. As you view each video on Perusall, you are expected to create at least *one* thoughtful annotation (usually questions or comments) or replies to your classmates' annotations (at least 2 per assignment, where each assignment consists of two videos). These posted comments/questions/replies should be substantially different from those already posted by other students and should contribute in some way to the overall discussion. Please also "upvote" some of your classmates' comments or questions if you find them helpful or have similar questions. Grading in these Perusall assignments will be based on the number and quality of your annotations or replies, your actual watching of the video, any upvotes received for your annotations/comments, and your upvotes of other's comments or questions. It is worth noting that, even though only one annotation is required per video (2 per assignment), the *best* annotations are used for grading; as a result, creating more than one annotation per video often helps to improve the overall grade.

*Perusall best practices:* It is generally a good idea to watch the video lectures and create annotations/questions earlier in the week (say Monday or Tuesday) and to then return to Perusall later in the week (say on Thursday or Friday) to look at responses to your annotations, respond to other students' questions/comments, and, generally, to benefit fully from all of the other annotations/responses. During most weeks, the instructor will respond to students' questions on Perusall at least twice each week: on Tuesday afternoons and Friday afternoons/evenings.

### Midterm Exams 1 and 2

There will be two midterm exams in this course, each worth 17.5% of the weight. Tentative dates for these exams are Wednesday, September 25, 2024 and Wednesday, October 30, 2024. Each exam will be 75 minutes long. Students enrolled in Section 1 (fully online version) of this course must begin the exam between 5 PM and 6 PM on these days. Students enrolled in Section 2 (in-person exams version) of this course must take the exam at **5 PM in room MCHU 302**.

The syllabus for Midterm Exam 1 will be the content of Modules 1, 2, and 3. The syllabus for Midterm Exam 2 will be the content of Modules 4 and 5 (but will also assume an understanding of the content of all previous modules).

### Final Exam

Final exam week for Fall 2024 extends from Monday, December 9, through Sunday, December 15, 2024. The final exam will be comprehensive and will be 2 hours long. It will carry 30% of the total weight. Students are required to be available for their final exam during the assigned time (as assigned by the registrar). Please note that travel plans, social events, misreading the exam schedule, or over-sleeping are not viable excuses for missing a final exam. Thank you in advance for your cooperation. Final grades will be curved, i.e., grading will be relative, but without a predetermined distribution of grades. We will follow the following grading scale.

### Grading Scale (per the Registrar):

Explanation	Letter Grade
Distinction	A
	A-
Good Quality	B+
	B
	B-
Below Expected Standard	C+
	C
	C-
Unsatisfactory Quality	D+
	D
	D-
Failure	F

### Instructions for Midterm and Final Exams

All exams are closed-book and closed-notes and the use of any online or offline resource is prohibited. Collaboration with others or sharing your solutions with anyone else is also strictly prohibited. However, *students are allowed to use a single letter-size review sheet, hand-written or typed on both sides, during the exam.*

Students can prepare such a review sheet prior to the exam, containing any information they wish, for unrestricted use during the exam. Students are also allowed to use scratch paper during the exam.

*Additional instructions for Section 1 (fully online) students:* There will be space (i.e., a text box) below each question where you can type out the solution for that question. If you need to draw and include figures/graphs or include equations that are difficult to write out in the text boxes, you can write/draw them on paper and then email the instructor (mukul.bansal@uconn.edu) a clear scan or photo within 10 minutes after submitting the exam. Please note that solutions *must* be typed out in the text boxes and that only figures, graphs, or equations may be submitted using the scan/photo.

Both midterm exams and the final exam will require the use of LockDown Browser and Respondus Monitor (see below).

*Additional instructions for Section 2 (in-person exams) students:* Section 2 students will be taking a traditional paper exam and will be hand writing their solutions. All exams will be in person and will begin at the specified time.

### **Due Dates and Late Policy**

All course due dates are identified in the [Course Schedule](#). Deadlines are based on Eastern Time; if you are in a different time zone, please adjust your submittal times accordingly. *The instructor reserves the right to change dates accordingly as the semester progresses. All changes will be communicated in an appropriate manner.*

Problem sets may be submitted up to 24 hours late but with a 20% penalty. Late submissions are not allowed for Quizzes and Perusall assignments, and any quizzes or Perusall assignments submitted after the due date will not be graded. Likewise, Problem sets submitted after the 24-hour late submission deadline will not be graded. If you feel you have a legitimate reason for seeking an extension on a quiz or Perusall assignment, you can get in touch with the instructor (a few days before the relevant submission deadline) to discuss possible options.

There will be no make-ups for any missed exams.

### **Grading Rubric**

Unless otherwise stated, all problem set and exam questions that ask students to provide an algorithm also require students to provide proof of correctness and to analyze the worst-case time complexity of their algorithm. For such questions, points will be assigned to each of these three different components of the solution. The exact assignment of points may vary from question to question, depending on the relative difficulties of the three components, but will be similar to the following: 50% for algorithm description, 30% for proof of correctness, and 20% for complexity analysis.

We will follow a holistic grading rubric where more points will be awarded for solutions that hit upon more of the key ideas. For example, a student may expect full points if they clearly demonstrate they understand how to solve the problem and do not make any conceptual mistakes. On the other hand, if a student's work shows that they did not understand the problem or if their attempt is largely incorrect and does not solve the problem (i.e., goes in the wrong direction and/or does not hit upon key ideas) then they may lose all or most of the points, even if they provide a lengthy solution consisting of a complete algorithm description, proof, and complexity analysis.

### **Feedback and Grades**

The course instructor(s) will make every effort to provide feedback and grades for problem sets and exams within one week of the due date. To keep track of your performance in the course, refer to My Grades in HuskyCT.

### **Weekly Time Commitment**

You should expect to dedicate 9 to 12 hours a week to this course. 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](#).

### **Student Authentication and Verification**

The University of Connecticut is required to verify the identity of students who participate in online courses and to establish that students who register in an online course are the same students who participate in and complete the course activities and assessments and receive academic credit. Verification and authentication of student identity in this course will include:

1. Secure access to the learning management system using your unique UConn NetID and password.
2. ID check through webcam or in-person before any exams.

### **Assessment/Exam Proctoring for Students in Section 1 (Fully Online Version) of the Course**

This course requires the use of [Respondus Lockdown Browser with Monitor](#) for all online exams. This requires a webcam and microphone. See [Introduction to Respondus LockDown Browser for Students](#) for more information. This course may also, in some exceptional instances, require exam proctoring via webcam through Webex.

Note that, in the interest of maintaining academic integrity, students are required to provide a full 360 degree view of their surroundings, along with a full, clear view of their workspace (e.g., desk) during the “Environment Check” phase of the Respondus Monitor startup sequence. If the student is using a review sheet then this review sheet must also be clearly shown on camera during the environment check. An improper or incomplete environment check will result in an automatic score of 0 for the associated exam. Students will have an opportunity, prior to the first midterm exam, to practice using Respondus LockDown Browser and Monitor, perform the environment check, and receive feedback on their environment check from the instructor upon request.

Failure to properly use Respondus LockDown Browser and Monitor during any exam, e.g., no video or disconnecting from Lockdown Browser during the exam, will result in a penalty up to and including being assigned a score of 0 for that exam. Please also note that the use of earphones or headphones is not allowed while using Respondus LockDown Browser and Monitor to take an exam.

## Academic Honesty

Students are expected to adhere to the highest standards of academic honesty. All submitted material (which includes quiz answers, Perusall assignment text, problem set solutions, and midterm/final exam question solutions) must be your own work. Plagiarism and other violations will be reviewed and sanctioned according to UConn’s Policy on Academic Integrity. You can read more about this policy at <https://community.uconn.edu/academic-misconduct/>

Academic consequences of academic misconduct may vary based on the severity of the infringement and can include assigning a score of 0 for a specific quiz/assignment/problem-set/exam, assigning a score of 0 for an entire assessment category (e.g., for all quizzes or problem sets, etc.), or assigning a failing grade for the entire course.

## Guidelines for Asynchronous Course

In order to maintain a supportive and welcoming learning environment for everyone, it is necessary that all students use respectful, professional language when posting comments or questions or otherwise engaging in discussions on Perusall or in discussion forums.

### Copyright

*The instructor’s lectures, notes, handouts, and displays are protected by state common law and federal copyright law. Students are authorized to take notes in this class; however, this authorization extends only to making one set of notes for your own personal use and no other use. The posted video lectures and the web-based video delivery of each class in this course is for sole use of the students enrolled in this course. Any other use of these videos without the written consent of the course’s instructor is prohibited. You may not copy any videos or any other material, provide copies of either to anyone else, or make any commercial use of them without prior written permission from the course’s instructor.*

## 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
  - Academic Integrity
  - 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

## 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/>.

Blackboard measures and evaluates accessibility using two sets of standards: the WCAG 2.0 standards issued by the World Wide Web Consortium (W3C) and Section 508 of the Rehabilitation Act issued in the United States federal government.” (Retrieved March 24, 2013 from [Blackboard's website](#))

## Software/Technical Requirements (with Accessibility and Privacy Information)

The software/technical requirements for this course include:

- HuskyCT/Blackboard ([HuskyCT/ Blackboard Accessibility Statement](#), [HuskyCT/ Blackboard Privacy Policy](#))
- Adobe Acrobat Reader ([Adobe Reader Accessibility Statement](#), [Adobe Reader Privacy Policy](#))
- Google Apps ([Google Apps Accessibility](#), [Google for Education Privacy Policy](#))
- Microsoft Office (free to UConn students through [uconn.onthehub.com](http://uconn.onthehub.com)) ([Microsoft Accessibility Statement](#), [Microsoft Privacy Statement](#))
- Dedicated access to high-speed internet with a minimum speed of 1.5 Mbps (4 Mbps or higher is recommended).
- WebCam and microphone
- LockDown Browser and Respondus Monitor

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

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

## Help

This course is facilitated online using the learning management platform, [HuskyCT](#). The [IT Knowledge Base](#) provides students with support, troubleshooting, and how-to information about HuskyCT. The [IT Knowledge Base](#) includes a video tour of HuskyCT.

For technical help with HuskyCT, you have access to the in-person/live person support options available during regular business hours through the [Technology Support Center](#). You also have [24x7 Course Support](#) outside of business hours, including access to live chat, phone, and support documents.

[Technical and Academic Help](#) provides a guide to frequently asked questions for online students.

## Study Groups

Are you interested in forming a study group with other students in the class? There is a [study group application](#) in Nexus that can help you get started. View this [video](#) for more information.

## Minimum Technical Skills

To be successful in this course, you will need the following technical skills:

- Use electronic mail with attachments.
- Save files in commonly used word processing program formats.
- Copy and paste text, graphics or hyperlinks.
- Work within two or more browser windows simultaneously.
- Open and access PDF files.
- The ability to create PDF files for homework submission (either using Microsoft Office, LaTeX, or scanning handwritten work to PDF)

## Evaluation of the Course

Students will be provided an opportunity to evaluate instruction in this course using the University's standard procedures, which are administered by the [Office of Institutional Research and Effectiveness](#) (OIRE).

Additional informal formative surveys may also be administered within the course as an optional evaluation tool.