

**SYLLABUS CSC 505 SECTION 651 SUMMER SESSION I 2025 (3 CREDIT HOURS)**  
**DESIGN AND ANALYSIS OF ALGORITHMS**

When?	Where?
Section 651	DE-Online

**COURSE DESCRIPTION**

This course covers

- algorithms and data structures for classical problems such as sorting, searching, graph problems, etc.
- algorithm design techniques, for example, recurrence, divide and conquer, dynamic programming, greedy choice, and approximation
- performance analysis: asymptotic bounds for worst-case, best-case, and average-case
- NP-completeness

**PREREQUISITES**

The class has the following prerequisites:

- calculus and lower-level math,
- discrete mathematics, for example, CSC 224/226, or a comparable course,
- data structures, for example, CSC 314/316, or a comparable course, and
- basic programming skills in python or java.

**LEARNING OUTCOMES**

You will learn how to solve computational problems using concepts of algorithms and discrete mathematics, e.g.

- prove the correctness of sorting, selection, graph, and other algorithms,
- reduce an instance of a problem to a smaller instance of the same problem,
- give big-oh, big-omega, big-theta, little-oh, and little-omega bounds for functions,
- analyze the worst- and average-case running time of algorithms described in pseudocode,
- prove a lower bound on comparison-based sorting algorithms and distinguish between lower bounds for algorithms and lower bounds for problems,
- solve recurrence relations related to divide and conquer algorithms,
- identify properties of problems that lead to efficient algorithms or make them intractable,

- solve problems using algorithm design techniques: greedy, divide and conquer, dynamic programming, graph searching, and the use of efficient data structures,
- describe algorithms and their characteristics, such as worst-case running time, space requirements, etc., in textual form,
- identify problem domains in which theoretical results in algorithm design and analysis have practical applications and derive appropriate models for the practical problems,
- define NP-completeness and outline a proof of NP-completeness of a given decision problem.

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## TEXTBOOK

*Introduction to Algorithms* by TH Cormen, CE Leiserson, RL Rivest, and C Stein.

Edition: 4th. ISBN: 9780262046305.

Web Link: <https://mitpress.mit.edu/books/introduction-algorithms-fourth-edition>

The textbook is required.

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## INSTRUCTOR

Steffen Heber

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Phone: 919-513-1118

Office Location: 2306 EB2

Office Hours: **Tuesday 4:00 PM-4:45 PM via Zoom Meeting ID: 925 2759 8471 or by appointment**

TA: Avleen Singh Mehal, [asmehal@ncsu.edu](mailto:asmehal@ncsu.edu). Office hours: TBA

## COURSE STRUCTURE AND POLICIES

The coursework consists of lectures, readings, homework assignments, and exams.

- Lectures (videos) might depart from our textbook. Some of the material presented might not be available through the lecture notes or textbook. You are responsible for all material presented or discussed in class (videos).
- Readings will generally be taken from our textbook with possible supplements from the literature.
- We will have multiple announced online quizzes, one midterm, and a final exam.
- All quizzes and exams are closed-book exams. However, calculators (not programmable!) are permitted. Sorry, no cell phones are allowed. Exams might include material from lectures, assignments, and readings
- There will be three homework assignments. All homework assignments are intended to be individual work.

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## ELECTRONICALLY HOSTED COURSE COMPONENTS

Students may be required to disclose personally identifiable information to other students in the course via electronic tools like email or web postings. Examples include online discussions of class topics and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

**Electronically hosted components:** Online course components include Moodle, Zoom, Panopto, and Piazza. Our Moodle Web site contains information about the syllabus and a tentative timeline. **We will be using Piazza for class discussion.**

- Find our **Piazza signup link** at: <https://piazza.com/ncsu/summer2025/csc505651>
- **Rather than emailing questions to the teaching staff, please post your questions on Piazza.** The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself.
- **For questions about personal grades or meeting requests, please contact the instructor or the TA via private piazza post.**
- **Do not post solutions to assignments or exams before they have been returned** - this will be considered cheating.
- If you have any problems or feedback for the developers, email [team@piazza.com](mailto:team@piazza.com).

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## GRADING

Grades will be computed with a weighted average using the weights shown below.

Section	651
final exam (proctored)	40%
one midterm exam (proctored)	30%
multiple announced online quizzes (NOT proctored)	10%
three homework assignments (equal weights)	20%

This Course uses Standard NCSU Letter Grading.

$97 \leq A+ \leq 100$
$93 \leq A < 97$
$90 \leq A- < 93$
$87 \leq B+ < 90$
$83 \leq B < 87$
$80 \leq B- < 83$
$77 \leq C+ < 80$
$73 \leq C < 77$
$70 \leq C- < 73$
$67 \leq D+ < 70$
$63 \leq D < 67$
$60 \leq D- < 63$
$0 \leq F < 60$

- **The final exam score will replace a lower midterm score and all lower quiz scores.**
- **Half of your quiz grade will be awarded for participation; you will receive the other half if you answer more than 50% of the questions.**
- **There is a one-week time limit for submitting disputes for exams and assignments.** The entire exam or homework may be regraded, not just the disputed question.
- **There are no makeup assignments or exams.** If you are forced to miss an assignment or exam, you must contact the instructor before the deadline, and a university-accepted excuse must be presented. If the reason is accepted, your final exam score will replace the missed assignment or exam grade.
- Course grades may be curved up, but they will never be curved down.
- Extra credit: there might be extra points in homework assignments and exams. Bonus points earned in a specific task will be counted towards achieving 100% and cannot be transferred to other tasks.
- At the end of the class, every student will obtain an increase of x percentage points (the instructor will announce x) in the final grade point average. The purpose of these bonus points is to protect students who cannot double-check their final exam from grading mistakes. The bonus will be removed if a regrade request is submitted.

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## HOMEWORK POLICIES

- **All homework assignments are intended to be individual work. Turning in an exam or assignment that is not the student's work is cheating. Copying text, code, or other content from the Internet (or other sources) is plagiarism.** Write all homework solutions from scratch using your own words; paraphrasing answers from other sources is unacceptable even if you cite those sources.
- Any tool/resource must be approved by the instructor and identified and acknowledged clearly in any work turned in; anything else is plagiarism. For more information, please consult the university's Code of Student Conduct.
- We may use plagiarism-detection software tools like iThenticate and MOSS to review your deliverables.
- **If an academic integrity violation occurs, the offending student(s) will be assessed a penalty at least as severe as getting a 0 for the whole assignment for which the violation occurred. The case will always be reported to the Office of Student Conduct.**
- Homework assignments must be submitted in printed form via Moodle before the announced deadline. Please do NOT submit scanned writing or pictures in PDF format to avoid reduced marks. Scanned writing is hard to read, takes longer to grade, and produces gigantic files. **Please try this out well before the due date to ensure it works.**
- Late Policy: All assignments are due at 9 PM of the due date. Late homework will be accepted only in circumstances that are grounds for excused absence under university policy ([policies.ncsu.edu/regulation/reg-02-20-03](http://policies.ncsu.edu/regulation/reg-02-20-03), item 3). The university provides mechanisms for documenting such reasons (severe illness, death in the family, etc.) described on the website. If possible, arrangements for turning in late homework must be made the day preceding the due date. Unexcused late submissions will result in a 10%/40% point reduction on the first/second day after the due date. No credit will be given for submissions three or more days late.

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## POLICIES ON INCOMPLETE GRADES

If the Graduate School does not authorize an extended deadline, an unfinished, incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions) or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-03>. Additional information about incomplete grades for graduate students can be found in the Graduate Administrative Handbook in Section 3.18.F at [http://www.fis.ncsu.edu/grad\\_publicns/handbook/](http://www.fis.ncsu.edu/grad_publicns/handbook/).

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## REQUIREMENTS FOR AUDITORS

This class cannot be audited.

## N.C. STATE UNIVERSITY POLICIES, REGULATIONS, AND RULES

Students are responsible for reviewing the PRRs which pertain to their course rights and responsibilities. These include <http://policies.ncsu.edu/policy/pol-04-25-05> (Equal Opportunity and Non-Discrimination Policy Statement), <http://oied.ncsu.edu/oied/policies.php> (Office for Institutional Equity and Diversity), <http://policies.ncsu.edu/policy/pol-11-35-01> (Code of Student Conduct), and <http://policies.ncsu.edu/regulation/reg-02-50-03> (Grades and Grade Point Average).

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### ACADEMIC INTEGRITY

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct. For a detailed explanation of academic honesty, see <http://policies.ncsu.edu/policy/pol-11-35-01>.

- Review the Code of Student Conduct and the Pack Pledge.
- Every piece of work should be performed by you without the help of others.
- Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02).

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### PACK PLEDGE

Your signature on any test or assignment indicates, "I have neither given nor received unauthorized aid on this test or assignment."

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### ACCOMMODATIONS FOR DISABILITIES

*Reasonable accommodations will be made for students with verifiable disabilities. To take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01) (<https://policies.ncsu.edu/regulation/reg-02-20-01/>).*

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### NON-DISCRIMINATION POLICY

*NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or <https://oied.ncsu.edu/divweb/>. Any person who*

*feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.*

## COURSE SCHEDULE

**Schedule CSC 505 section 651 Summer 2025;** the schedule is subject to change.

Week	topics	assignments	exams	videos
5/14-18	introduction, growth of functions, asymptotic notation, divide and conquer	read the syllabus read chapters 1,2,3,4(1-3)		8/19/24 8/21/24 8/26/24
5/19-25	recurrences, heap sort, quick sort	read chapters 4(4-5),6,7	quiz 1 5/21-5/25	8/28/24 9/04/24 9/09/24
5/26-6/1	lower bounds for sorting, linear sorting algorithms, selection, and medians	read chapters 8,9	quiz 2 5/28-6/1	9/11/24 9/16/24 9/18/24
May 26, Memorial Day (no classes)				
6/2-8	dynamic programming	read chapter 14 submit homework 1 on Monday, June 2	quiz 3 6/4-6/8	9/23/24 9/30/24
6/9-15	greedy algorithms, dynamic sets	read chapters 15,19	quiz 4 6/11-6/15	10/02/24 10/07/24 10/09/24
6/16-22	graph search	read chapters 20(1-3)	midterm June 17-18	10/16/24 10/21/24
June 19, Juneteenth (no classes)				
6/23-29	topological sort, strongly connected components, minimum spanning tree	read chapters 20(4-5),21 submit homework 2 on Monday, June 23	quiz 5 6/25-6/29	10/23/24 10/28/24 11/04/24
6/30-7/6	single-source shortest path, all pairs shortest path algorithms	read chapters 22,23	quiz 6 7/2-7/6	11/06/24 11/11/24
July 4, Independence Day (no classes)				
7/7-13	P, NP, NPC	read chapters 34(1-3) submit homework 3 on Friday, July 11	quiz 7 7/9-7/13	11/13/24 11/18/24

7/14-20	NP-complete problems, reductions	read chapter 34(4-5)	quiz 8 7/16-7/20	11/20/24 11/25/24
7/21-27	Final preview & approximation algorithms	read chapter 35	quiz 9 available 7/21-7/25	12/02/24
<b>7/28-29 final exam</b> 7/31 grades due by 5 PM				

All but the last quiz will be available from Wednesday to Sunday at midnight of the corresponding week.  
Quiz #9 will be available 7/21/25-7/25/25.