SYLLABUS CSC 505 SECTIONS 001/002/601 FALL 2022 (3 CREDIT HOURS)
DESIGN AND ANALYSIS OF ALGORITHMS

<table>
<thead>
<tr>
<th>When?</th>
<th>Where?</th>
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<tbody>
<tr>
<td>Section 001</td>
<td>MW 4:30-5:45 PM, 01025 EB2</td>
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<tr>
<td>Section 002</td>
<td>MW 6:00-7:15 PM, 01230 EB2</td>
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<tr>
<td>Section 601</td>
<td>DE-Online</td>
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COURSE DESCRIPTION

This course covers

- Complexity and analysis of algorithms: asymptotic analysis, worst case and average case, recurrences, lower bounds, NP-completeness
- Algorithm design techniques, for example, use of data structures, recurrence, divide and conquer, dynamic programming, greedy choice, local and global search, and approximation.
- Algorithms for classical problems, including sorting, searching, and graph problems (connectivity, shortest paths, minimum spanning trees).

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,
- compute 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,
• describe algorithms and their characteristics, such as worst-case running time, space requirements, etc., in textual form,
• solve problems using common algorithm design techniques: greedy, divide and conquer, dynamic programming, graph searching, and the use of data structures,
• solve recurrence relations related to divide and conquer algorithms,
• reduce an instance of a problem to a smaller instance of the same problem,
• 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,
• identify properties of problems that lead to efficient algorithms or make them intractable.

**TEXTBOOK (REQUIRED)**

Web Link: https://mitpress.mit.edu/9780262046305/introduction-to-algorithms/

The textbook is required.

**INSTRUCTOR**

Steffen Heber  
Email: sheber@ncsu.edu  
Phone: 919-513-1118  
Office Location: 2260 EB2  
Office Hours:
  • on campus: Tuesday 4:00 PM-5:00 PM  
  • via zoom PMI 694 362 4188: Thursday 4:00 PM-5:00 PM  
  • by appointment

Teaching Assistants: TBA
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).
- Class attendance is mandatory. For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03.
- No laptops or cell phones are allowed during class.
- Readings will generally be taken from our textbook with possible supplements from the literature.
- We will have announced online quizzes, two midterms, and a final exam.
- All 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 four homework assignments. All homework assignments are intended to be individual work.

**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, where relevant to the course. 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:** Moodle Web site, contains information about the syllabus, and a tentative timeline. We will be using Piazza for class discussion. Find our class signup link at: https://piazza.com/ncsu/fall2022/csc505.

**Communication:** Please post your questions on Piazza. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. If you have any problems or feedback for the developers, email team@piazza.com. Disclaimer: **Do not post solutions to assignments or exams before they have been returned - this will be considered cheating.** For questions about personal grades or requests for meetings please contact the instructor, or the TAs via private post.
Grades will be computed with a weighted average using the weights shown below.

<table>
<thead>
<tr>
<th>Section</th>
<th>001, 002, 601</th>
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<tbody>
<tr>
<td>final in-class/proctored exam</td>
<td>35%</td>
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<tr>
<td>two in-class/proctored midterm exams (equal weights)</td>
<td>40%</td>
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<tr>
<td>multiple open books, not proctored online quizzes (equal weights)</td>
<td>5%</td>
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<tr>
<td>four homework assignments (equal weights)</td>
<td>20%</td>
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This Course uses Standard NCSU Letter Grading.

<table>
<thead>
<tr>
<th>Grade Range</th>
<th>Description</th>
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<tbody>
<tr>
<td>97 ≤ A+ ≤ 100</td>
<td>A+</td>
</tr>
<tr>
<td>93 ≤ A &lt; 97</td>
<td>A</td>
</tr>
<tr>
<td>90 ≤ A- &lt; 93</td>
<td>A-</td>
</tr>
<tr>
<td>87 ≤ B+ &lt; 90</td>
<td>B+</td>
</tr>
<tr>
<td>83 ≤ B &lt; 87</td>
<td>B</td>
</tr>
<tr>
<td>80 ≤ B- &lt; 83</td>
<td>B-</td>
</tr>
<tr>
<td>77 ≤ C+ &lt; 80</td>
<td>C+</td>
</tr>
<tr>
<td>73 ≤ C &lt; 77</td>
<td>C</td>
</tr>
<tr>
<td>70 ≤ C- &lt; 73</td>
<td>C-</td>
</tr>
<tr>
<td>67 ≤ D+ &lt; 70</td>
<td>D+</td>
</tr>
<tr>
<td>63 ≤ D &lt; 67</td>
<td>D</td>
</tr>
<tr>
<td>60 ≤ D- &lt; 63</td>
<td>D-</td>
</tr>
<tr>
<td>0 ≤ F &lt; 60</td>
<td>F</td>
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- The final exam score will replace the lowest midterm score if this improves your grade.
- 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 submission of disputes for exams and assignments.** The entire exam or homework may be regraded, and 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 excuse is accepted, the score of your final exam will be used to replace the grade of the missed assignment or exam.
- Course grades may be curved up, but they will never be curved down.
- Extra credit: there might be extra points in assignments and exams. The bonus points earned in a specific assignment or exam cannot be transferred to other assignments or exams.
- At the end of the class, every student will obtain an increase of x percentage points (x will be announced by the instructor) in the final grade point average. The purpose of these bonus points is to protect students that cannot double-check their final exam from grading mistakes. The bonus will be removed if a regrade request is submitted.
HOMEWORK POLICIES

• All homework assignments are intended to be individual work. Turning in an exam or assignment which is not the student’s own work is cheating. Copying of text, code, or other content from the Internet (or other sources) is plagiarism. Write all homework solutions from scratch using your own words; paraphrases of solutions from other sources are unacceptable even if you cite those sources.

• If an academic integrity violation occurs, the offending student(s) will be assessed a penalty that is at least as severe as getting a 0 for the whole homework for which the violation occurred. The case will always be reported to the Office of Student Conduct.

• Any tool/resource must be approved in advance 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.

• 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. Use "UnityID_HW#" as the name of the pdf file, where # should be replaced by the current homework number; write your name and unity ID at the top of your homework on page one. 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, 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.

POLICIES ON INCOMPLETE GRADES

If an extended deadline is not authorized by the Graduate School, 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 described at http://policies.ncsu.edu/regulation/reg-02-50-03; additional information 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/.

REQUIREMENTS FOR AUDITORS

This class cannot be audited.
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).

ACADEMIC INTEGRITY

See http://policies.ncsu.edu/policy/pol-11-35-01 for a detailed explanation of academic honesty. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02).

PACK PLEDGE

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

ACCOMMODATIONS FOR DISABILITIES

Reasonable accommodations will be made for students with verifiable disabilities. In order 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/).

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.

This syllabus is subject to change.