SYLLABUS CSC 505 SECTIONS 001/002/601 FALL 2021 (3 CREDIT HOURS)
DESIGN AND ANALYSIS OF ALGORITHMS

<table>
<thead>
<tr>
<th>Section</th>
<th>When?</th>
<th>Where?</th>
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</thead>
<tbody>
<tr>
<td>001</td>
<td>TuTh 4:30-5:45 PM</td>
<td>01231 EB2</td>
</tr>
<tr>
<td>002</td>
<td>TuTh 6:00-7:15 PM</td>
<td>02124 EB2</td>
</tr>
<tr>
<td>601</td>
<td></td>
<td>DE-Online</td>
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</tbody>
</table>

When? Where?

COURSE DESCRIPTION
This course covers

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

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 common 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.

TEXTBOOK (REQUIRED)

Introduction to Algorithms by TH Cormen, CE Leiserson, RL Rivest, and C Stein.
Web Link: https://mitpress.mit.edu/books/introduction-algorithms

The textbook is required.

INSTRUCTOR

Steffen Heber
Email: sheber@ncsu.edu
Phone: 919-513-1118
Office Location: 2260 EB2
Office Hours: Wednesday 2:00PM-3:00PM, or by appointment
Online Office Hours: Monday 4:30PM-5:30PM, or by appointment
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.
- 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 lecture videos and zoom meetings.
- Readings will generally be taken from our textbook with possible supplements from the literature.
- We will have multiple announced online quizzes, two midterms, 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 four homework assignments. All homework assignments are intended to be individual work.
- We will monitor your participation in class activities and post participation tasks.

Electronically-hosted Components: Moodle Web site, contains information about syllabus, and tentative timeline. We will be using Piazza for class discussion. Find our class signup link at: https://piazza.com/ncsu/fall2021/csc505. Rather than emailing questions to the teaching staff, I encourage you to 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 as 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 exam</td>
<td>35%</td>
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<tr>
<td>two in class midterm exams (equal weights)</td>
<td>35%</td>
</tr>
<tr>
<td>multiple announced online quizzes</td>
<td>10%</td>
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<tr>
<td>four homework assignments (equal weights)</td>
<td>18%</td>
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<tr>
<td>Participation</td>
<td>2%</td>
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This Course uses Standard NCSU Letter Grading.

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<th>Grade Range</th>
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<tr>
<td>97 ≤ A+ ≤ 100</td>
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<tr>
<td>93 ≤ A &lt; 97</td>
</tr>
<tr>
<td>90 ≤ A- &lt; 93</td>
</tr>
<tr>
<td>87 ≤ B+ &lt; 90</td>
</tr>
<tr>
<td>83 ≤ B &lt; 87</td>
</tr>
<tr>
<td>80 ≤ B- &lt; 83</td>
</tr>
<tr>
<td>77 ≤ C+ &lt; 80</td>
</tr>
<tr>
<td>73 ≤ C &lt; 77</td>
</tr>
<tr>
<td>70 ≤ C- &lt; 73</td>
</tr>
<tr>
<td>67 ≤ D+ &lt; 70</td>
</tr>
<tr>
<td>63 ≤ D &lt; 67</td>
</tr>
<tr>
<td>60 ≤ D- &lt; 63</td>
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<tr>
<td>0 ≤ F &lt; 60</td>
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- Bad Quiz Forgiveness: your lowest two quiz score will be dropped.
- There is a one-week time limit for submission of disputes for quizzes, and assignments. The entire quiz, 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 need to 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 homework assignments, quizzes, 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. To avoid reduced marks, please do NOT submit scanned writing or pictures in pdf format. Scanned writing is hard to read, takes longer to grade, and produces gigantic files. Use "UnityID_HW#" as a name of pdf file, where # should be replaced by 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 make sure that it works for you.

• Late Policy: All assignments are due on 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.); these are described on the web site. Arrangements for turning in late homework must be made by the day preceding the due date if possible. 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 that are 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 located at http://policies.ncsu.edu/regulation/reg-02-50-03. Additional information relative to 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/.

REQUIREMENTS FOR AUDITORS

This class cannot be audited.
ACADEMIC INTEGRITY

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01.

ACADEMIC HONESTY

See http://policies.ncsu.edu/policy/pol-11-35-01 for a detailed explanation of academic honesty.

HONOR PLEDGE

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

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 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.