CSDS 410 Analysis of Algorithms (3 credit hours)

Case Western Reserve University

Fall 2023 Syllabus

Professor	Prof. Dianne Foreback, PhD **e-mail:** drf68@case.edu (**best contact method**) **office:** Olin 609 **phone:** 216-368-4466 (email is a better contact method)
Lectures	CSDS 410-100 (4682) Building and Room: Olin 313 Monday and Wednesday, 12:45 – 2:00 p.m.
Professor's Office Hours	Mon & Wed, 5:00 p.m. – 6:00 p.m. (to be assured a time slot, please schedule with this **calendar link**). If your classes coincide with these office hours, please, send me an email and we will schedule another time to meet. See **more info** in the section "Office Hours" within this document.
TA's Office Hours	To be posted in Canvas.
Prerequisites	Computer Science Major or Data Science and Analytics Major CSDS 302/ECSE 302/Math 304 Discrete Math (minimum grade of C) CSDS 233/ECSE 233 Introduction to Data Structures (minimum grade of C)
Required Text	Goodrich, Michael T., and Tamassia, Roberto. *Algorithm Design and Applications*. Wiley, 2015. 978-1-118-33591-8. The textbook is available at the publisher's website, at other sites, and in bookstores.
Final Exam	All students are required to take the final exam on **Wednesday, December 20th from 12:00 – 3:00 p.m.**

Course Description and Objectives

This course covers fundamental topics in algorithm design and analysis in depth: amortized analysis, NP-completeness and reductions, dynamic programming, advanced graph algorithms, string algorithms, geometric algorithms, and local search heuristics.

Upon successful completion of this course, you will be able to:

- Develop a comprehensive understanding of major algorithmic techniques and state-of-the-art algorithms for common problems.
- Become fluent in analyzing algorithms in terms of correctness and required computational resources.
- Become comfortable with formalism and doing proofs.
- Develop a vision towards using computational thinking effectively to solve challenging problems in a broad range of practical applications.
- Demonstrate familiarity with major algorithm design techniques.
- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Determine which algorithm technique to use for a problem.

- Synthesize efficient algorithms in common design situations.

Tentative Course Material

Material from the course that may be derived from sections within the following chapters of our main course textbook by Goodrich and Tamassia and potentially online sources.

Introduction to Algorithms
Merge-Sort and Quick-Sort (Ch 8)
Fast Sorting and Selection (Ch 9)
Union Find (Ch 7)
Graphs and Traversals (Ch 13)
Shortest Paths (Ch 14)
Minimum Spanning Trees (Ch 15)
Greedy Method (Ch 10)
Divide-and-Conquer (Ch 11)
Dynamic Programming (Ch 12)
NP-Completeness (Ch 17)
String Algorithms (Ch 23)
Network Flow and Matching (Ch 16)

Tentative Due Dates/Schedule for Exams, Quizzes, Assignments and Project (please note, the project has many portions and the due dates for preliminary project work will be scheduled later). The actual due dates will be posted in Canvas.

Week 3: Sunday, Sept 17 (Assign 1)
Week 4: Wednesday, Sept 20 (Quiz 1)
Week 5: Sunday, Oct 1 (Assign 2)
Week 6: Wednesday, Oct 4 (Quiz 2)
Week 7: Sunday, Oct 15 (Assign 3)
Week 8: Monday, Oct 16 (Midterm Exam)
Week 10: Sunday, Nov 5 (Assign 4)
Week 11: Wednesday, Nov 8 (Quiz 3)
Week 12: Sunday, Nov 19 (Assign 5)
Week 13: Monday, Nov 20 (Quiz 4)
Week 14: Sunday, Dec 3 (Assign 6)
Final Exam: Wednesday, December 20th from 12:00 – 3:00 p.m. all students are required to take the exam this day/time

Grades

Your final course grade will be calculated as follows:

- quizzes (approx. 4, lowest score dropped) 10%
- assignments (approx. 6, lowest score dropped) 40%
- midterm exam 20%
- final exam (cumulative) 30%

To assess your final course grade, all point values assigned on graded materials are considered. Your final course grade will be determined as follows: 100-90% A, 89-80 B, 79-70 C, 69-60 D, and 59-0 F. This scale may be adjusted downward for the entire class, i.e. there may be a curve at the end but do not plan for this. However, to ensure a particular grade, the preceding scale is used. Note that grades assigned on previous work will not be altered at the end of the semester. It is your responsibility to discuss any grade discrepancies the day your graded work is returned; please notify your TA via email of a discrepancy.

Contact Info and Writing Emails

Email Correspondence – my email address is drf68@case.edu

To protect your own privacy, you must use your university provided email account. Include a meaningful subject in the subject section of the email. Place a salutation at the top of your email, e.g., "Hello Prof. Foreback". Introduce yourself, e.g. **"I am Jane Doe from your analysis of algorithms class"**. Please include the class that you are taking. End your email with a closing and signature, e.g., "Thank you, Jane Doe". Write using proper English conventions, including spelling and grammar, such that you are sure I can understand your question. Aside: When corresponding with potential employers, it is a good idea to use a similar format.

Professor's Office Hours

To guarantee a meeting, please schedule a timeslot to meet with me during office hours with the link at the top of the syllabus in the "Office Hours" section. You are welcome to stop in during office hours even if you do not schedule an appointment. However, if somebody did schedule one, this person is given priority. Note, you can request up to two 15-minute timeslots for a total of 30 minutes if necessary. Please only do this if you believe our conversation will last this long since others may wish to meet. Of course, if you need more time and others are not scheduled and our time permits, you may have more time.

If your classes coincide with office hours, please, send me an email and we will schedule another time to meet.

Providing we are not discussing grades, if you want to meet via Zoom during office hours, please send me an email after scheduling your time. I will send you a link before our meeting.

Teaching Assistants' Office Hours

To be determined.

Lectures, Attendance and Class Participation

Class attendance is required. Students are expected to prepare and **attend each meeting** and to participate in class. If a student is unable to attend class, they must let the instructor know in advance or as soon as possible. Note that active participation during a lecture will help you learn the material and succeed in class. For complete information, please go to the School of Graduate Studies Policies & Procedures site. Some presentations are posted on the course website, but these are not all inclusive. That is, some material covered in lectures is not available in these presentations, but you are responsible for this information even if you cannot attend class. If you miss a class, I recommend obtaining notes from a fellow student.

Exams

There will be a total of two exams: one midterm exam (held during class) and a final exam (held during finals week). Both exams, unless otherwise noted, are closed book, closed notes, no electronic devices, and must be the student's individual work unless otherwise noted. It is expected that you take each exam at the scheduled time. You will be tested on the material we cover in class, from the book, from additional resources, in the presentations, homework assignments and quizzes. The textbook or the slides alone may not be sufficient for adequate preparation for the exams; please attend lectures. There are no make-up exams.

Quizzes

There will be several quizzes. The quizzes are equally weighted. The lowest score of your quizzes is dropped. If you do not take a quiz, a score of zero is assigned as your score. Any grading discrepancies must be noted on the day your quiz is returned. There are no make-up quizzes.

Assignments and Late Policy

Several assignments are given throughout the semester. Each assignment consists of problems relating to the course material. Any grading discrepancies should be reported to your TA within 24 hours the day your work is returned; please send your TA an email.

Homework assignments are to be turned in by 11:59 p.m. on the due date. No late homework will be accepted, but the lowest homework grade will be dropped. (In other words, turn in what you have by the start of class. If your schedule is too busy, just drop the homework. However, try your best to save the dropped homework for the latter half of the semester when you may really need it. In exceptional circumstances, such as an illness, extensions may be granted providing appropriate documentation is submitted. However, all extensions must be approved by the instructor **before** the due date and appropriate documentation is required.

As a courtesy to the grader, homework should be written neatly. Poorly written work will not be graded. When writing algorithms be sure not only that your solution is correct, but also that it is easy for the grader to understand why your solution is correct. Part of your grade will be based not only on correctness, but also on the clarity, simplicity, and elegance of your solution.

Academic Integrity Policy

All students in this course are expected to adhere to University standards of academic integrity. Cheating, plagiarism, misrepresentation, and other forms of academic dishonesty will not be tolerated. This includes, but is not limited to, consulting with another person during an exam, turning in written work that was prepared by someone other than you, making minor modifications to the work of someone else and turning it in as your own, or engaging in misrepresentation in seeking a postponement or extension.

A zero-tolerance policy on plagiarism and academic integrity is enforced. The enforcement will result, at minimum, a score of zero for the entire assignment, quiz or exam. Additionally, an F may be assigned for your overall course grade and appropriate disciplinary action, independent of the extent of plagiarism, will be taken.

Ignorance of the policy will not be accepted as an excuse. If you are not sure whether something you plan to submit would be considered either cheating or plagiarism, it is your responsibility to ask for clarification.

For complete information, please go to the School of Graduate Studies Policies & Procedures site.

Use of Electronic Devices

Unless specifically been given permission, you are not allowed to record or video tape lectures. However, and on an occasional basis, if I write a complex drawing on the board, and you ask me during the lecture if you can take a picture, I may permit this (after I get out of the way).

Out of consideration of your colleagues, all phones and electronic devices should be silenced during class.

Classroom and University Code of Conduct

Please be courteous to your classmates. Arrive on time in class. Do not bring food to eat in class. Silence cell

phones. Follow the University Code of Conduct https://case.edu/studentlife/conduct/university-code-conduct.

Registration
All students attending the class must register. Students who fail to register are not permitted to participate or attend lectures.

Accessibility
Any student who feels that they may need an accommodation based on the impact of a disability should contact and register with the Coordinator of Disability Services at 216-368-5230. I welcome meeting with those who are registered and need special assistance as well. More information about Disability Services is available at https://case.edu/studentlife/disability/.

Subject to Change Statement
The syllabus and course schedule may be subject to change. Changes will be communicated via email, via the course website or in class.