

Course Information

Course Number: CSCE 411
Course Title: **Design and Analysis of Algorithms**
Section: 502
Time: T-Tr 3:55-5:10pm
Location: ZACH 244
Credit Hours: 3

Instructor Details

Instructor: Juan A. Garay
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Office Hours (Virtual): M-W 4:00-5:00pm, <https://tamu.zoom.us/j/95939079156>

Course Description

Study of computer algorithms for numeric and non-numeric problems; design paradigms; analysis of time and space requirements of algorithms; correctness of algorithms; NP-completeness and undecidability of problems.

Course Prerequisites

Grade of C or better in [CSCE 221](#) and [CSCE 222/ECEN 222](#); junior or senior classification or approval of instructor.

Course Learning Outcomes

At the end of the semester, you should be able to:

- Describe and use standard algorithms and techniques
- Design algorithms to solve specific problems
- Analyze algorithms' running times and space complexity
- Prove impossibility results for lower bounds on running time and space complexity
- Clearly and articulately state proofs and intuitions for algorithms
- Analyze existing data structures
- Choose an appropriate data structure for a problem and give a pseudocode implementation
- Prove a problem is NP-complete using reduction and understand the implications
- Understand the notion of undecidability, know that some problems are undecidable and the implications thereof

Textbook and/or Resource Materials

Introduction to Algorithms, **THIRD EDITION**, Cormen, Leiserson, Rivest, and Stein, MIT Press, 2009.
ISBN 9978-0-262-03384-8/978-0-262-53305-8

Grading Policy

Problem sets will have a variety of algorithmic design and analysis questions, and will be **proof-focused**. We will have two midterms and one final. These will be in the style of the problem sets, but shorter, so that they can be completed in one sitting. Tentatively, we will also have a programming project. Late assignments will lose 10%, plus 10% for every 24 hours that pass after the due date. If we discuss the assignment in class, or I provide solutions, no further late submissions will be accepted.

It is assumed that you will attend every class and participate in discussion. Questions are encouraged, especially if you do not understand something. Frequent and consistent unexcused absences will result in lost participation points. See <http://student-rules.tamu.edu/rule07> for a list of reasons absences will be excused. For all other absences, contact the instructor to ask for permission.

The tentative weights will be as follows:

- **Assignments:** 35%
- **Midterm I, Midterm II, Final:** 20% each
- **Participation:** 5%

Letter grades will be assigned per 10% interval: [90%,100%) = A, [80%,90%) = B, etc. I reserve the right to curve grades up for any assignment or for the course.

Cooperation: For the assignments in this class, discussion of concepts with others is allowed, but all assignments must be done on your own, unless otherwise instructed. If you use any source other than the text, reference it, whether it be a person, a book, a solution set, a web page or whatever. You **MUST** write up the solutions in your own words. Copying is strictly forbidden. Every assignment must be turned in with a cover page, which lists all sources you used.

Late Work Policy: Late assignments will lose **10%** of the maximum score, plus **10%** for every 24 hours that pass after the due date. If we discuss the assignment in class, or I provide solutions, no further late submissions will be accepted.

Course Topics

Topics are listed below. This is subject to change.

1. Introduction and Algorithmic Analysis

- Chapter 1: Role of algorithms
- Chapter 2: Getting started

- Chapter 3: Growth of functions
- 2. Divide and Conquer and Recurrences
 - Chapter 4; not 4.6
- 3. Sorting
 - Chapters 4-8
- 4. Advanced Design and Analysis Techniques
 - Chapter 15: Dynamic programming
 - Chapter 16: Greedy algorithms
 - Chapter 17: Amortized analysis
- 5. Randomized Algorithms
 - Chapter 5
- 6. Data Structures
 - Chapter 10: Elementary data structures
 - Chapter 11: Hash tables
 - Chapter 12: Binary search trees
 - Chapter 13: Red-Black trees
 - Chapter 18: B-trees
 - Chapter 19: Fibonacci heaps
 - Chapter 21: Disjoint sets
- 7. Graph Algorithms
 - Chapter 22: Elementary graph algorithms
 - Chapter 23: Minimum spanning trees
 - Chapter 24: Single-source shortest paths
 - Chapter 25: All-pairs shortest paths
 - Chapter 26: Max flow
- 8. NP-Completeness
 - Chapter 34: NP-Completeness
- 9. Selected Topics
 - Chapter 32: String matching
 - Chapter 34: NP-completeness

- Chapter 35: Approximation algorithms
- Other sources: Undecidability

University Policies

COVID-19 Policy

To help protect Aggieland and stop the spread of COVID-19, Texas A&M University urges students to be vaccinated and to wear masks in classrooms and all other academic facilities on campus, including labs. Doing so exemplifies the Aggie Core Values of respect, leadership, integrity, and selfless service by putting community concerns above individual preferences. COVID-19 vaccines and masking — regardless of vaccination status — have been shown to be safe and effective at reducing spread to others, infection, hospitalization, and death.

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to [Student Rule 7](#) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to [Student Rule 7](#) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" ([Student Rule 7, Section 7.4.1](#)).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" ([Student Rule 7, Section 7.4.2](#)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See [Student Rule 24](#).)

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

“Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one’s work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case” ([Section 20.1.2.3, Student Rule 20](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

NOTE: Faculty associated with the main campus in College Station should use this Academic Integrity Statement and Policy. Faculty not on the main campus should use the appropriate language and location at their site.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu. Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

NOTE: Faculty associated with the main campus in College Station should use this Americans with Disabilities Act Policy statement. Faculty not on the main campus should use the appropriate language and location at their site.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most

instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services](#) (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's [Title IX webpage](#).

NOTE: *Faculty associated with the main campus in College Station should use this Title IX and Statement on Limits of Liability. Faculty not on the main campus should use the appropriate language and location at their site.*

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing the resources and services available from Counseling & Psychological Services (CAPS). Students who need someone to talk to can call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at suicidepreventionlifeline.org.