

Course Information

Course Number: CSCE 689
Course Title: Special Topics in Modern Algorithms for Data Science
Section: 608
Time: MWF 1:50-2:40 PM CT
Location: [HRBB](#) 126
Credit Hours: 3

Instructor Details

Instructor: Samson Zhou
Office: PETR 424
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Office Hours: Wednesdays 3-4 PM CT, or by appointment

Course Description

Algorithms for data science; sublinear algorithms; models of computation for big data; differential privacy.

Course Prerequisites

Graduate classification; CSCE 629 or equivalent or approval of instructor.

Special Course Designation

N/A

Course Learning Outcomes

Upon finishing this class, students should be able to:

- Describe the motivation and statement of central data science problems, measured by the midterm presentation
- Work in various big data models of computation, leading toward the final project
- Understand the fundamentals of private data analysis
- Demonstrate awareness of common algorithmic techniques, through scribe notes

Textbook and/or Resource Materials

No textbook required or recommended. LaTeX template for scribe notes will be provided.

Online resource:

- Class webpage for disseminating relevant course materials.

Grading Policy

Scribe notes (succinct LaTeX summary of lectures) 20%, midterm presentation 35%, final project 45%

Late Work Policy

With exception of excused absences allowed by student rule 7, no late work will be accepted.

Work submitted by a student as makeup work for an excused absence is not considered late work and is exempted from the late work policy ([Student Rule 7](#)).

Course Schedule

Course schedule, subject to change. See additional optional topics at the bottom.

| Week | Topic | Assignment |
|-------------|--|---------------------------------------|
| 1 | Probability basics (hashing, birthday paradox, coupon-collector, balls-in-bins, power-of-two choices) | <i>Scribe notes</i> |
| 2 | Probability basics continued, concentration inequalities (Markov, Chebyshev, Chernoff) | <i>Scribe notes</i> |
| 3 | Dimensionality reduction (Johnson-Lindenstrauss) | <i>Scribe notes</i> |
| 4 | Streaming model (reservoir sampling, norm estimation, heavy-hitters, distinct elements) | <i>Scribe notes, MIDTERM UPDATES</i> |
| 5 | Sliding window model, adversarial robustness | <i>Scribe notes</i> |
| 6 | Differential privacy | <i>Scribe notes</i> |
| 7 | Reading paper presentations | <i>MIDTERM PRESENTATION</i> |
| 8 | Clustering in the streaming model, coresets | <i>Scribe notes</i> |
| 9 | Numerical linear algebra in the streaming model (Linear regression, subspace embeddings, low-rank approximation) | <i>Scribe notes, PROJECT PROPOSAL</i> |
| 10 | Online learning, linear programming, semi-definite programming | <i>Scribe notes</i> |

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|----|-------------------------------|--------------------------------------|
| 11 | Learning-augmented algorithms | <i>Scribe notes</i> |
| 12 | Optional topics | <i>Scribe notes, PROJECT UPDATES</i> |
| 13 | Optional topics | <i>Scribe notes</i> |
| 14 | Optional topics | <i>Scribe notes</i> |
| 15 | Project presentations | <i>FINAL PROJECT</i> |

List of optional topics include: lower bounds (information theory, communication complexity) for the streaming model, distributed model, L_p norm estimation, L_p regression, local and shuffle models for differential privacy, sparse vector technique for differential privacy, adaptive data analysis and differential privacy

Learning Resources

Texas A&M at Galveston

On-campus learning resources to support students in achieving excellence are available through The Commons (tamug.edu/commons).

University Policies

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](#)).

Texas A&M at College Station

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

Texas A&M at Galveston

You can learn more about the Honor Council Rules and Procedures as well as your rights and responsibilities at tamug.edu/HonorSystem.

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 the Disability Resources office on your campus (resources listed below) 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.

Texas A&M at College Station

Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu.

Texas A&M at Galveston

Disability Resources is located in the Student Services Building or at (409) 740-4587 or visit tamug.edu/counsel/Disabilities.

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.

Texas A&M at College Station

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](#).

Texas A&M at Galveston

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with the Counseling Office in the Seibel Student Center, or call (409)740-4587. For additional information, visit tamug.edu/counsel.

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

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 available resources and services on your campus

Texas A&M College Station

Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or 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.

Texas A&M at Galveston

Students who need someone to talk to can call (409) 740-4736 from 8:00 a.m. to 5:00 p.m. weekdays or visit tamug.edu/counsel for more information. For 24-hour emergency assistance during nights and weekends, contact the TAMUG Police Dept at (409) 740-4545. 24-hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at suicidepreventionlifeline.org.

Campus-Specific Policies**Texas A&M at Galveston**

Classroom Access and Inclusion Statement

Texas A&M University is committed to engaged student participation in all of its programs and courses and provides an accessible academic environment for all students. This means that our classrooms, our virtual spaces, our practices and our interactions are as inclusive as possible and we work to provide a welcoming instructional climate and equal learning opportunities for everyone. If you have an instructional need, please notify me as soon as possible.

The Aggie Core values of respect, excellence, leadership, loyalty, integrity and selfless service in addition to civility, and the ability to listen and to observe others are the foundation of a welcoming instructional climate. Active, thoughtful and respectful participation in all aspects of the course supports a more inclusive classroom environment as well as [our mutual](#) responsibilities to the campus community.