Course Information

Course Number:	CSCE-620/VIZA-670
Course Title:	Computational Geometry
Section:	600
Time:	MWF 1:50 pm – 2:40 pm
Location:	HRBB 126
Credit Hours:	3

Instructor Details

Instructor:	Jianer Chen
Office:	PETR 428
Phone:	(979) 845-4259
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Office Hours:	MWF 2:40 pm – 3:40 pm

Course Description

Computational Geometry has become a very active research field whose fundamental task is to identify concepts, properties, and techniques that lead to efficient geometric algorithms and effective evaluation of their algorithmic complexity. The filed has seen great success by the beauty of the problems studied and the solutions obtained, and by its many applications in computer graphics, GIS, robotics, and other application areas. This course will be focused on the study of algorithms and complexity for geometric problems including geometric searching, convex hull construction and related problems, proximity, and intersection. We will solve these geometric problems by a variety of techniques developed in the field, among them are geometric sweeping, divide and conquer, refinement, reduction, geometric transformation, probabilistic methods, and parallel algorithms.

Course Prerequisites

Design and analysis of algorithms, basic background in and familiarity with elementary geometry, discrete mathematics, and probability theory, or approval of instructor.

Course Learning Outcomes

A student upon completing this course will:

- Master basic theories and techniques in the current research in computational geometry.
- Use appropriate technologies to communicate and conduct research in related research areas.
- Be able to apply theories and techniques studied in the course to solve real-world problems in application areas where geometric structures, algorithms, and complexity play important roles.

Textbook and/or Resource Materials

- M. de Berg, O. Cheong, M. van Kreveld, and M. Overmars, *Computational Geometry: Algorithms and Applications*, 3rd edition, Springer, 2008., and

- Jianer Chen, *Computational Geometry: Methods and Applications*, Lecture Notes, Department of Computer Science and Engineering, Texas A&M University.

Grading Policy

- Grading Scale: A = 90-100%, B = 70-89%, C = 60-70%, F = 0-59%
- Homework assignment: 30%, Course project: 30%, Final exam 40%
- There are 3 homework assignments, used to test students' understanding of the course lectures.
- The course research project will provide students with opportunities to read recent published papers in the area and do research on problems currently interesting in the area
- The final exam will be comprehensive.

Late Work Policy

The assignments are due on the designated due dates at the **beginning** of class. No late submissions will be accepted. Discuss unusual circumstances in advance with the instructor.

Course Schedule

- Week 1: Computational geometry: preliminaries and data structures
- Week 2: Geometric sweeping: line segment intersections
- Week 3: Geometric sweeping: convex hulls (Graham and Javis algorithms)
- Week 4: Geometric sweeping: farthest pair and triangulation
- Week 5: Divide and conquer: convex hulls (mergehull and quickhull)
- Week 6: Voronoi diagram: definition and structures, homework #1 due
- Week 7: Divide and conquer: Voronoi diagram construction
- Week 8: Prune and search: convex hulls (Kirkpatrick-Seidel's algorithm)
- Week 9: Prune and search: point location (slab method)
- Week 10: Divide and reduce: point location (Kirkpatrick algorithm), homework #2 due
- Week 11: Geometric algorithms via linear-time reductions
- Week 12: Computational lower bounds: Ben-Or's Theorem
- Week 13: Computational lower bounds via linear-time reductions
- Week 14: NP-hard geometric problems: ETSP, homework #3 due
- Week 15: NP-hard geometric problems: Line-Cover, course project due.
- Week 16: Course summary, and student presentations
- December 15, 3:30 pm – 5:30 pm: Final exam

Optional Course Information Items

- The course webpage can be accessed by the following link:

  https://people.engr.tamu.edu/j-chen3/courses/620/2025/courseweb.html, or

  You can go to the instructor's home page then click the course link. The course webpage publishes course syllabus, lecture notes, homework assignments, exams, and other course handouts.

- This course is using Canvas learning management system. Students submit their homework and projects via Canvas.

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."

This course assumes that all work submitted by students will be generated by the students themselves. Students should not have another person/entity do the writing of any substantive portion of an assignment for them, which includes hiring a person or a company to write assignments and using artificial intelligence tools like ChatGPT.

"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.

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.

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, you 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.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors influencing a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care practices by utilizing the resources and services available through University Health Services. The TELUS Health Student Support app provides access to professional counseling in multiple languages anytime, anywhere by phone or chat, and the 988 Suicide & Crisis Lifeline offers 24-hour emergency support at 988 or 988lifeline.orgLinks to an external site.

Texas A&M College Station

Students needing a listening ear can contact University Health Services (979.458.4584). 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.orgLinks to an external site.