

Course Information

Course Number: CSCE-669
Course Title: Computational Optimization
Section: 601
Time: MWF 10:20 am – 11:10 am
Location: HRBB 113
Credit Hours: 3

Instructor Details

Instructor: Jianer Chen
Office: PETR 428
Phone: (979) 845-4259
E-Mail: chen@cse.tamu.edu
Office Hours: MW 11:30 am – 1:00 pm

Course Description

Study of algorithmic techniques and complexity for computational optimization problems, with focus on dealing with infeasible optimization problems (e.g., NP-hard problems). Different approaches will be discussed, including polynomial-time approximation algorithms, parameterized algorithms, and faster exponential time algorithms. We will introduce classical results known since early 1980's, but emphasize on most recent results and approaches developed in the last few years.

Course Prerequisites

Design and analysis of algorithms, some background in 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 optimization.
- Be able to apply theories and techniques studied in the course to solve real-world problems in computational optimization.
- Use appropriate technologies to communicate, collaborate, and conduct research in the area of computational optimization.
- Gain a solid background and preparation for advanced research in computational optimization, operations research, and other related research areas.

Textbook and/or Resource Materials

- Jianer Chen, *Introduction to Tractability and Approximability of Optimization Problems*. Lecture Notes, Dept. Computer Science and Engineering, TAMU.

The following book provides helpful supplementary reading for the study:

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- D. Williamson and D. Shmoys, *The Design of Approximation Algorithms*, Cambridge University Press, New York, 2011.

Other supplementary course notes will also be provided.

Grading Policy

- Grading Scale: A = 90-100%, B = 70-89%, C = 60-70%, F = 0-59%
- Homework assignment: 30%, Course project: 35%, Final exam 35%.
- There are 3 homework assignments, used to test students' understanding of the course lectures. The final exam will be comprehensive. 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.

Late Work Policy

The assignments and project 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: Algorithmic background review
- Week 2: Maximum flow and graph matching
- Week 3: Linear programming
- Week 4: NP-completeness theory and approximation algorithms
- Week 5: Approximation algorithms: FPTAS algorithms, homework #1 due
- Week 6: Approximation algorithms: PTAS algorithms
- Week 7: Approximation algorithms: PTAS algorithms (continued)
- Week 8: Approximation algorithms: APX algorithms
- Week 9: Spring break
- Week 10: Approximation algorithms: APX algorithms (continued), homework #2 due
- Week 11: Inapproximability results, PCP theorem
- Week 12: Parameterized algorithms
- Week 13: Parameterized algorithms (continued), homework #3 due
- Week 14: ETH and Computational lower bounds
- Week 15: Exact algorithms for NP-hard problems
- Week 16: Exact algorithms for NP-hard problems (continued), course project due
- May 6, Final exam (8:00 am – 10:00 am)

Optional Course Information Items

- The course webpage can be accessed by the following link:
<https://people.engr.tamu.edu/j-chen3/courses/669/2024/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, 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 that influence a student's academic success and overall wellbeing. Students are encouraged to engage in proper 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.