

## Course Information

Course Number: CSCE 689  
Course Title: Algorithmic Game Theory  
Section: 607  
Time: T/Th: 9:35-10:50 am  
Location: HRBB 126  
Credit Hours: 3

## Instructor Details

Instructor: Alan Kuhnle  
Office: PETR421  
E-Mail: kuhnle@tamu.edu  
Office Hours: M: 9--10 am; Th: 11am-12pm

## Course Description

Algorithmic Game Theory is an interdisciplinary field that combines the study of algorithms, computer science, and game theory to analyze strategic interactions among rational agents. In this course, we will cover the fundamental concepts and techniques used in Algorithmic Game Theory, including Nash equilibria, social choice theory, mechanism design, and computational complexity.

## Course Prerequisites

CSCE 629 or permission of the instructor.

## Special Course Designation

None

## Course Learning Outcomes

Upon completion of the Algorithmic Game Theory course, students should be able to:

- Understand the fundamental concepts and techniques used in Algorithmic Game Theory, including Nash equilibria, social choice theory, mechanism design, and computational complexity.
- Analyze strategic interactions among rational agents in diverse settings such as auctions, voting systems, and resource allocation.
- Design algorithms that optimize outcomes in strategic environments and account for the incentives and motivations of rational agents.

- Evaluate the efficiency and fairness of different mechanisms and understand how to apply them to real-world problems.
- Develop critical thinking and problem-solving skills in Algorithmic Game Theory, which can be applied to other fields and disciplines.
- Communicate effectively about Algorithmic Game Theory concepts and ideas to other students and professionals.
- Apply concepts learned in class to model and analyze strategic situations in diverse contexts, including economics, political science, and computer science.

### Textbook and/or Resource Materials

**Textbooks:**    Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations. Yoav Shoham, Kevin Leyton-Brown. ISBN: 0521899435

Algorithmic Game Theory. Noam Nisan, Tim Roughgarden, Eva Tardos, and Vijay V. Vazirani. ISBN: 978-9-521-87282-9

Twenty Lectures on Algorithmic Game Theory. Tim Roughgarden. ISBN: 131662479X

### Grading Policy

**Homework Assignments.** There are four homework problem sets. Your assignments **must be submitted in LaTeX**. Submit assignments to Canvas.

**Exams.** There will be one mid-term exam and one final exam.

#### Grading Distribution.

Exams, 50%.

Class Participation: 10%.

Homework Assignments, 40%.

**The grading scale will be: A  $\geq$  90%, B  $\geq$  80%, C  $\geq$  70%, D  $\geq$  60% > F.**

### Late Work Policy

Assignments are due at the beginning of class. No late work is accepted unless it is because of a documented, excused absence. Please refer to [Student Rule 7](#) for information about excused absences.

### Course Schedule

Week 1	Introduction to Algorithmic Game Theory, Games in Normal Form
2	Games in Normal Form

---

3	Complexity of Finding Nash Equilibria
4	Equilibrium Computation for Two-Player Games in Strategic and Extensive Form <b>Homework 1 Due</b>
5	Combinatorial Algorithms for Market Equilibria
6	Introduction to Mechanism Design
7	Combinatorial Auctions <b>Homework 2 Due</b>
8	Profit Maximization in Mechanism Design
9	Online Mechanisms <b>Midterm Exam</b>
10	Introduction to the Inefficiency of Equilibria
11	Routing Games <b>Homework 3 Due</b>
12	Network Formation Games
13	The Price of Anarchy and the Design of Scalable Resource Allocation Mechanisms
14	Cascading Behavior in Networks <b>Homework 4 Due</b>
15	Computational Aspects of Prediction Markets
	<b>Final Exam</b>

## 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](http://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](http://tamug.edu/HonorSystem).*

#### **Texas A&M at Qatar**

*You can learn more about academic integrity and your rights and responsibilities at Texas A&M University at Qatar by visiting the [Aggie Honor System](#) website.*

### **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](http://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](http://tamug.edu/counsel/Disabilities).*

**Texas A&M at Qatar**

*Disability Services is located in the Engineering Building, room 318C or at +974.4423.0316 or visit <https://www.qatar.tamu.edu/students/student-affairs/disability-services>.*

## **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](http://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](#).*

**Texas A&M at Qatar**

*Texas A&M University at Qatar students wishing to discuss concerns in a confidential setting are encouraged to visit the [Health and Wellness](#) website for more information.*

*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 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 988 Suicide & Crisis Lifeline (988) or at [988lifeline.org](http://988lifeline.org) [Links to an external site.](#)*

**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](http://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 988 Suicide & Crisis Lifeline (988) or at [988lifeline.org](http://988lifeline.org) [Links to an external site.](#)*

**Texas A&M at Qatar**

*Texas A&M University at Qatar students wishing to discuss concerns in a confidential setting are encouraged to visit the [Health and Wellness](#) website for more information.*

**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.